

A Century of
FARMING IN IOWA
1846--1946

A Century of
**FARMING
IN IOWA**

1846--1946

By Members of the Staff of the
Iowa State College
and the
Iowa Agricultural
Experiment Station

*Published in Commemoration of the
One Hundredth Anniversary of
Iowa's Statehood*

M. R. A. LIBRARY



M. R. A. LIBRARY

THE IOWA STATE COLLEGE PRESS

Ames, Iowa, 1946

COPYRIGHT, DECEMBER 28, 1946,
The 100th Anniversary of Iowa's Statehood
by
THE IOWA STATE COLLEGE PRESS

PRINTED AT THE IOWA STATE COLLEGE PRESS
AMES, IOWA, U. S. A.

An Overview

EARLE D. ROSS, *History*

THE STORY OF THE ORIGINS AND GROWTH OF THE LEADING farm practices in Iowa traces the essential steps in general diversified agriculture in its fullest attainment to the present time. The period involved, extending from the beginnings of modern systematized applications of scientific principles to the practices and business of cultivation and husbandry down to the latest achievements of the scientist, the technician, and the manager, is long enough to present a balanced perspective, but sufficiently recent to provide adequate records for verifiable conclusions and pertinent comparisons.

While such a history is of direct appeal and substantial value for the occupation whose background is traced, it has far wider implications. The experiences of this agricultural commonwealth illustrate environmental adaptation; the achievements and limitations of technology on the farm; the emergence of the business of farming and its relations to other enterprises; the underlying influences and the typical features of voluntary association from the crude, timorous ventures of the early agrarian crusade to the present highly organized and confident commodity co-operatives and the federated organizations of nation-wide interest groups; and finally, the successive stages in the extension of governmental policies of aid, regulation, and direction. Such a record of what a century ago was held to be the state's "leading interest" is of prime importance to Iowa, but hardly less so to the region of which the state is an outstanding unit, and to the nation as a whole to which the state's resources are so essential and its counsels so influential.

Nature herself has provided the basic factors in Iowa's agricultural pre-eminence. As the late Raymond A. Pearson observed, "Providence has been good to us." The economic geographer assigns the Prairie Plains to a most favored area of productivity and dependability. Drainage systems, soil, and climate have combined to concentrate the

growing of corn and the raising of livestock—the typical Cornbelt economy—in this region. Iowa is situated in the “core” or “inner” Corn Belt, with over seven-eighths of its area true prairie and with a full quarter of the grade A land of the nation within its borders.

Its location on the most direct line of movement west of the Alleghenies and between the great interior rivers attracted and facilitated settlement and provided unusual advantages for marketing. The early population was well fitted to take advantage of such opportunities.

Settlers in the formative years were predominately natives, representing a secondary migration from the old Southwest and the old Northwest. The typical Hawkeyes were true pioneers whose forebears had ventured on earlier frontiers. Later immigrant elements, from the British Isles, the German states, Holland, and the Scandinavian countries, readily adjusted themselves to the prevailing economy and society. Certain groups contributed particular skills, especially in livestock management, dairying, and horticulture.

Iowa was the last of the states to be settled under traditional pioneer conditions; the railroad and other utilities were to modify later movements. The state was thus born in a transition stage in transportation and industry. Iowa grew up with the railroad, the factory, the steel plow, the reaper, new forage plants, and improved breeds of livestock. These attainments in production and transportation were coming in a period of, and largely as a result of a regional specialization which made possible a regular and growing home market and an expanding export trade in grain and meat.

In spite of early limitations upon marketing facilities and the natural abundance of resources, efforts for the improvement of breeds of animals, varieties of plants, and the techniques of cultivation and husbandry were undertaken in the early years. Pioneer stockmen and dairymen introduced blooded animals. Machinery and usable roads led to the importation of the leading breeds of draft and driving horses. The expanse of fertile land encouraged an early trial of new and promising varieties of corn and small grains. Horticulturists sought to acclimate the leading fruits and vegetables.

During the first decade of statehood agricultural societies—state and local—were flourishing, and two agricultural papers were launched. A state horticultural association, livestock organizations, general and special, and a dairy association soon followed.

An Agricultural College and Farm were chartered in 1858 and the farm secured. In the years before the College was established the office

of the secretary of the board provided a rudimentary state department for the collection of statistics and the distribution of seeds and plants for trial. Following the opening of the College in 1869, the first professors of the agricultural department conducted simple experiments in crop improvement and livestock breeding and nutrition. With the establishment of a federally aided experiment station in 1888, systematic programs of experimentation and research involving all branches of the state's agricultural interests were conducted in co-operation with regional and federal agencies. These efforts were both promotive and protective, for along with the improvements in breeds, varieties, and techniques, high and specialized cultivation and in some cases foreign importations have brought devastating pests and animal and plant diseases which have been combated with relative effectiveness, although, in varying forms and degrees, they constitute a continuing menace and challenge.

Along with scientific applications to increase and improve production has come an introduction and adaptation of machinery to accelerate and standardize the processes. With its peculiarly favorable conditions for mechanical appliance, the state has pioneered and achieved until most essential operations of the farm and an increasing number in the home commonly are carried on by mechanical, power-driven devices.

Such improvements and equipment, along with rising prices for land, necessitated an increasingly large investment. By the seventies, Iowa farming was commercialized and the farmer was a business man, confronted with the combined problems of credit, investment, management, and marketing. The typical unit has been the medium-sized livestock enterprise characteristic of the Corn Belt. The great staple crop and the subordinate crops of oats and clover, to which soybeans have more recently been added, have constituted a rotation that, under proper management, has made for a relatively permanent and stabilized economy. Cash grain production, dairying, fruit and vegetable cultivation, and beekeeping have been supplemental undertakings and in certain areas, the main specialties. To be sure, like all farming ventures, this one has been subjected to natural risks, and like all business ones, to the fluctuations of the market.

Periodical depressions, usually connected with unfavorable climatic conditions, unbalanced production, overextended investment, and wars, have been the most trying and disorganizing influences. The six major depressions since territorial days have had a progressive intensity with a corresponding degree of disaster. Wars, home and foreign,

have been direct or attending factors in all of these convulsions. The Civil War demands led to production "crazes" and deflated values in the youthful state, and the abnormal stimulus of the first world struggle accumulated unprecedented debts for an unimagined collapse. Among the most hopeful tendencies in the present global involvement have been the widespread evidences of fearful awareness of past experiences. From such financial disasters, as well as from the oppressive disparities with other interests, relief has been sought both by voluntary association and governmental activities.

From the beginning of the class-conscious farmer movements in the Granger days, Iowa has been conspicuous in all of the main organizations, general and special, but with the persisting pioneer traditions of individual property rights, the more extreme and uncompromising economic and political proposals have secured no substantial support. The rare resorts to direct action have been in defense of property rights which were held to be unfairly invaded and endangered. The movements at different stages and with changing special objectives have varied in their effectiveness. In general, however, there is conclusive evidence that the agricultural interest of the state has been strengthened in its relative economic power and that the conditions and standards of rural living have been markedly bettered through collective efforts. But with all the attainments through voluntary effort, there has been an increasing need for the functioning of government—state and national.

The tradition of a rugged individualism that had no need or desire for governmental aid and regulation is a pure myth so far as the Midwest is concerned. From the Louisiana Purchase, which was negotiated to give the farmer an accessible market for his surplus, to the latest regulatory act and grant-in-aid, government has "been in the business" of farming at every turn. The settler in the Black Hawk and later purchases wanted land from the public domain in price, amount, quality, and situation adjusted to his desires and resources. He wanted credit to finance his undertaking; highways and railroads to transport his produce; tariffs to stabilize his market; state and federal departments to be supplemented in recent years by a state-federal extension service, to keep him informed of the latest developments in his occupation; and schools and colleges, general and special, to educate his children.

For all these services the pioneer looked to benevolent and generally accommodating, if not always provident, governments. Later, when the eagerly-sought utilities seemed oppressive and domineering, and

high interest rates and low prices were felt to be the result of the machinations of the "money power," the regulatory services of government were invoked. Still later in a new financial age, special credit agencies were sought as the equivalent of the federal reserve provision for other interests. Temporary relief and permanent solution have been sought from time to time in dealing with special problems of production and marketing. However, all previous policies were subordinated by the inclusive and advanced program of recovery acts in the 1930's, which had their leadership and initiation in the Corn Belt, with Iowa as the focal area.

Iowans have been especially prominent in agricultural administration. The early movement for a federal fact-finding, co-ordinating bureau was supported by Iowa farm leaders in memoranda of societies, in agricultural journals, and by the state's representatives at the meetings of the United States Agricultural Society, which was the main organ of agitation. During the patent office period of administration, one of the most able commissioners was Charles Mason, a large landowner and progressive farmer of the state. During his term from 1853 to 1857, he gave particular and understanding attention to the agricultural branch of the bureau. During the years of the independent department before executive status was secured (1862-1889), several Iowans including William Duane Wilson and C. C. Parry were connected with it and "Father" Coker Clarkson, the agricultural editor of the *State Register*, declined the headship offered both by Grant and Garfield. Since the raising of the department to cabinet status in 1889, four Iowa farmers and farm journalists have served as Secretary of Agriculture under seven presidents. Scores of experts trained in the state have worked in the bureaus at Washington or "in the field."

The transformations that modern science has brought to every branch and phase of the farming enterprise in this state present a record that, except for its familiarity, would be astounding. As always, social and political changes have trailed those in the physical realm, but here, too, advance is marked and accelerating at a rate that promises within measurable time to become more nearly commensurate. For the state as a whole the most significant result of the achievements of a century is that they have not led to new types and organizations of the farming enterprise, but rather that they have tended to perpetuate and strengthen the particular system that emerged through regional adaptation in the formative years—the family-sized diversified farm as an economic and social unit.

Table of Contents

An Overview	v
EARLE D. ROSS	
1. Struggle for Land Ownership	1
W. G. MURRAY	
2. The Soil That Grows the Crops	18
J. B. PETERSON and A. J. ENGLEHORN	
3. Growing the Bumper Corn Crop	32
G. F. SPRAGUE and J. C. CUNNINGHAM	
4. The Fields of Waving Grain	45
H. D. HUGHES	
5. Forage Crops That Feed the Livestock and Save the Soil	54
H. D. HUGHES and MAURICE E. HEATH	
6. Winning the Fight Against Plant Diseases	66
J. C. GILMAN and MILDRED HEMMINGSEN	
7. Man and Nature Battle Injurious Insects	76
CARL J. DRAKE	
8. Weeds That Challenge Iowa Crops	89
A. L. BAKKE, R. H. PORTER, and E. P. SYLWESTER	
9. Hog Raising—A Big Business	97
W. A. CRAFT and ARTHUR L. ANDERSON	
10. Iowans Feed Beef Cattle for Market	112
P. S. SHEARER	
11. The Development of Iowa's High-Producing Dairy Cattle	120
C. Y. CANNON	
12. Sheep Production in the Livestock Enterprises	128
W. F. LA GRANGE	
13. Horses Pull Iowa Into Prominence	141
A. B. CAINE	
14. Eggs and Meat From Iowa Poultry	154
GEORGE F. STEWART	
15. Combating Animal Diseases—and Winning	167
CHARLES MURRAY	

16.	Growing Fruits, Vegetables, and Flowers	185
	B. S. PICKETT, A. T. ERWIN, E. S. HABER, H. L. LANTZ, H. E. NICHOLS, and E. C. VOLZ	
17.	Trees of Our Times—and Pioneer Times	200
	G. B. MAC DONALD	
18.	Bees—The Beneficial Insect	206
	F. B. PADDOCK	
19.	Dairy Product Output From Iowa Farms	214
	M. MORTENSEN	
20.	The Marketing Phase of Iowa Farm Living	228
	SAM H. THOMPSON	
21.	The Role of Machinery in Iowa Farming	241
	J. B. DAVIDSON	
22.	Trends in Farm Structures	250
	HENRY GIESE	
23.	Agricultural Journalism in Iowa	262
	K. R. MARVIN	
24.	The Farm Standard of Living in Iowa	287
	ELIZABETH E. HOYT	
25.	Schools for the Farm Boy and Farm Girl	303
	M. L. CUSHMAN	
26.	Farmers' Organizations	319
	LOUIS BERNARD SCHMIDT	
27.	The Pattern of Farm Management	336
	JOHN HOPKINS	
	Index	355

Index to Illustrative Sections

Section One Following Page 82

- I. Present-Day Iowa From the Air
- II. Productive Land
Contour Farming
- III. Hybrid Seed-Production Field
Root and Stalk Strength of Different Hybrids
- IV. "Uncle" Asa Turner
- V. Outstanding Developers of Superior Oat Breeds
- VI. Ida Fischer
Bluegrass Palace
- VII. Hot Formaldehyde Treatment of Seed Potatoes
- VIII. Comparative Resistance of Oats

Section Two Following Page 130

- IX. European Corn Borer Attack
- X. Locust Invasion
Effectiveness of Chinch Bug Barriers
- XI. Power Sprayer in Weed Control
- XII. Hog Production
- XIII. Concrete Floors in Hog Lot
Alfalfa Pasture for Hogs
- XIV. Commercial Beef Production
1856 Type of Cow
- XV. Farm Family Milking
1919 State Fair Cow-Testing Association Exhibit
- XVI. Model Dairy Barn Milking Set-up

Section Three Following Page 210

- XVII. Sheep Pasture at the Turn of the Century
Western Lambs in Feed Lot
- XVIII. Iowa Draft Horses and Mules at Farm Work
- XIX. Farceur 7,332, Outstanding Belgian Stallion

- XX. Farm Poultry Flock
Commercial Hatchery
- XXI. Hog Cholera Vaccination
- XXII. 1921 Vineyard Scene in Southwestern Iowa
Pleasant Valley Onion Production
- XXIII. Forestry Project to Stop Sheet Erosion
- XXIV. Modern Farm Beekeeping
- Section Four Following Page 290*
- XXV. First Creamery in Iowa, Spring Branch
Central Print Room for Iowa State Brand Butter
- XXVI. Livestock Delivery by Team
Highway Before Days of Hard Surfacing
- XXVII. 1867 Model Threshing Machine
Modern Corn Picker in Action.
- XXVIII. Early Corn Planter
Pioneer Plow
- XXIX. Self-Rake, Reaper, and Mower Combined
- XXX. Most Popular Barn Design—the “Gothic Roof”
- XXXI. Promoters of Agricultural Journalism, 1905
- XXXII. Interior, One-Room Rural School
Exterior, Crawfordsville Consolidated School

The typical Iowa farmer and his family have a strong, continuing desire to own a farm that belongs to them alone. The family-sized farm grew up here, and won its popularity as the most practical unit for this region.

1. Struggle For Land Ownership

W. G. MURRAY, *Economics and Sociology*

AN AIRPLANE TRIP OVER IOWA IN 1833—IF SUCH A TRIP had been possible—would have given the passengers an excellent view of a native prairie of unmatched fertility, with scarcely a sign of civilization. A few Indians and some settlements along the Mississippi River would have been about the only signs of human activity. The same air view of Iowa today—as we near the midpoint of the Twentieth Century—presents a remarkable transformation. The Iowa prairie has been made into 213,000 farms enclosing 95 per cent of the state's area into productive fields, pastures, and farmsteads.

Those who have seen present-day Iowa from the air are impressed by the regular pattern of straight roads which cut the landscape into square mile areas of productive farm land. They sense the strength and independence of Iowa as they see the individual farmsteads which dot this landscape as far as the eye can reach. Each farmstead is usually set off by itself with a white house, red barn, windmill, and distinctive grove of trees. How this Iowa was settled by hardy pioneers and how these same pioneers, their sons, and their grandsons succeeded and failed in the struggle for ownership of the state's fertile acres is recorded in three significant phases.

The first was the rush of settlers into the unsurveyed territory beginning in 1833. The second was the rectangular land survey which was started in 1836. The third was the system of land sales and auctions which began in 1838, and was accompanied by extensive gifts of land by the United States government to the state, to railroads, and to military veterans. Following this early settlement period, three features highlighted the farmers' 100-year struggle for farms of their own. These features are the contest between large-scale and family-sized farms, the rise in tenancy, and the rise in mortgaged ownership.

SETTLEMENT WITHOUT LEGAL SANCTION

The western movement of settlers across the Mississippi River into Iowa territory did not wait for legal sanction. The movement started on a large scale in 1833 after the Black Hawk Purchase transferred a fifty mile strip of land from the Indians to the United States; a strip just west of the Mississippi River extending from the Missouri border to a point in northeastern Iowa. Settlers were not permitted by federal law to stake out claims until townships had been surveyed and the land offered for sale. But the pressure by farmers to obtain land in the frontier areas was too great to be held back by a federal enactment which had little support in this new area, even from the courts.

Two thousand persons, according to one authority, came into Iowa territory in 1833 and staked out claims to land. Not all were farmers, however, because trading centers were set up early to serve the settlers. When the general land survey started in 1836, the first census revealed 10,564 persons in the Iowa territory. In 1838 when the first land sales occurred—the earliest date provided for legal entry—more than 23,000 persons were living in Iowa territory.

A strong testimonial to the spirit of fair play of these early pioneers is the pattern of frontier law and regulation which they created and enforced. Most important in this extra-legal system was the claim association developed to protect the settlers or squatters recognized as having first claim to the land they staked out. This protection prevented trespassers from coming in to claim land already staked out, and prevented would-be outside purchasers from buying land claimed by members of the association.

These claim associations with their effective means of dispensing frontier justice were of special importance in the struggle for farm ownership. The settlers who claimed land and improved it before the land was surveyed had a great deal to lose if they were unable to get title to "their" land when it was put up for sale. Since there was no way to make the claims coincide with the legal boundaries of the survey when it was eventually made, countless disputes and difficulties naturally arose between settlers in matching their claims with regularly surveyed tracts. The claim association provided an outstanding service in the frontier community in adjustment of these difficulties. An association would elect an official bidder and set up a "court" to arbitrate disputes among settlers. If a speculator or outside person tried to out-bid the association bidder, the squatters were prepared to deal with him. It is reported, for example, that when a Mahaska County delegation went to a land office sale "every man carried a stout hickory club to defend himself and neighbors against over-bidders."

The territorial legislature in 1839 declared that agreements involving lands owned by the United States government were fully valid, and approved an act to prevent trespass on the possessions of settlers on the public domain and to uphold squatter claims when established by a claim association. The territorial Supreme Court in 1840 upheld the state law legalizing squatters' claims, even though the federal law prohibited such settlement on public lands.

The claim association was chiefly a product of settlement prior to official survey. Consequently, when the survey caught up with settlement, as it did in Iowa in the early fifties, the need for the association vanished. For this reason the claim association was common only in eastern Iowa where settlement was ahead of the survey.

THE RECTANGULAR SURVEY IN IOWA

Every farm purchased in Iowa during the first one hundred years of the state's history has been legally described in the deed transferring the land title from the seller to the buyer. These legal descriptions are based on the original United States rectangular land survey started in Iowa in 1836 and practically completed in 1858. This land description system is chiefly responsible for the physical farm boundaries in Iowa and figures in every land transaction.

A legal description of an Iowa farm will illustrate the important features of the rectangular survey. The farm chosen is:

"The NW $\frac{1}{4}$ of Section 12, Township 80 North, Range 2 West of the 5th Principal Meridian."

Location of the land from a legal description is accomplished readily by reading backward. The "5th Principal Meridian" which appears on all complete land descriptions in Iowa refers to a north and south line running through the eastern tip of Iowa. The location of this line was the first task of William A. Burt, the surveyor who started the Iowa land survey in 1836. Every farm in Iowa is designated as a certain number of ranges east or west of the line, a range being six miles wide—the width of a township.

A base line which runs east and west through Arkansas is also used in designating the location of all land in Iowa. The farm in our example is 80 townships or approximately 480 miles north of this base line. Given the meridian and base line, it is possible to locate the exact survey township in which any farm is situated. The farm described, as a map with township and range numbers will show, is situated in southeastern Cedar County.

Each surveyed township—a six-mile square—is divided into thirty-six sections. Each full section—one mile square—is divided into four equal quarters. Each full section measures 640 acres including the road; consequently each quarter section measures 160 acres including the road. The farm in the example is easily identified as 160 acres in the northwest quarter of section 12. Farms located along the north and west boundaries of a township are designated as “fractional” because they are likely to have more or less than the regulation acreage. Errors in measurement and corrections caused by curvature of the earth were carried to these twelve boundary sections: sections 1–6 along the north, and sections 6, 7, 18, 19, 30, and 31 along the west boundary of each township.

The uniform survey of land into sections of 640 acres and the division of these sections into quarter sections of 160 acres each has had a significant effect on the pattern of settlement in Iowa. The first settlers frequently staked out a claim to a half section of 320 acres, but when they came to purchase their farms from the government they found the amount of land they could farm was more nearly 160 than 320 acres. Despite all the changes in agricultural techniques in the last one hundred years, the quarter section—160 acres—is still today the most common farm size.

PRIVATE LAND SALES AND AUCTIONS

The first private sales and auctions of Iowa land occurred in 1838 at the two land offices established for this purpose, one at Dubuque and the other at Burlington. Strangely enough, many of the settlers were not at all enthusiastic over President Van Buren's order placing the first Iowa townships on sale. These settlers were short of cash, like most frontier farmers who had found the task of developing and improving a farm an expensive one. And cash at the time of sale was required. Even \$1.25 an acre, which seems like a low price, amounted to \$200 for a quarter section, and many of the settlers just did not have this sum. Consequently, lenders and speculators were drawn to the region by black-market interest rates as high as 35 per cent and higher. Even though the rates were terribly high, the settler had to have the money in order to gain ownership to the claim on which he may have expended several years of hard work. The struggle for farm ownership was not an easy one in spite of the abundance of land available at \$1.25 an acre. The struggle included not only the saving of the necessary money, but also the hard, tough job of making a farm and a farm home out of a bare piece of unbroken prairie.

Private sales were arranged in 1838 for settlers with pre-emption claims while public sales were held later that year for those who did not have these claims. Settlers who had staked out claims and were living on them were able to take advantage of certain federal pre-emption laws which legalized claims made prior to the passage of the laws. Such measures of particular importance in the Iowa territory were those of 1838 and 1840. The pre-emption was limited to 160 acres, the price was set at \$1.25 an acre, and the claimant had to be living on the land. Finally in 1841 a permanent federal pre-emption act was passed which not only legalized previous settlement but also gave settlers the right to settle on surveyed land.

The sales, both private and public, at the two land offices for the first three years show a heavy preponderance of activity in southeastern Iowa. The figures are as follows:

	Dubuque	Burlington	Total
	(acres)	(acres)	(acres)
1838	26,000	248,000	274,000
1839	26,000	271,000	297,000
1840	126,000	443,000	569,000

Total sales for this three year period were more than a million acres for an average price of \$1.25 an acre, the minimum price. As long as the supply of good land to the west held out there was no need to pay more.

As settlers poured into Iowa and as the frontier and land surveys were pushed farther west, land offices were opened at convenient points for the farmers to buy the land. Offices in Fairfield, Marion, and Iowa City were opened in the forties. Chariton, Des Moines, Council Bluffs, Fort Dodge, Decorah, Osage, and Sioux City had land offices in the fifties. Land sales reached a peak in 1855 when 3,708,000 acres or 11 per cent of the land area in the state was sold for cash and military warrants.

DISPOSAL BY GIFT

Less than one-third of Iowa was sold by the United States government for cash; the rest was given away chiefly by means of warrants for military service (Table 1). Over fourteen million acres, about 40 per cent of the state, was disposed of by military warrants. A federal act in 1847 providing a land warrant to those who served in the war with Mexico was the main source of the warrants used to obtain land in Iowa. Each warrant entitled the holder to 160 acres of land. In 1852, when these warrants were made transferable, they were bought

and sold like bonds, with published quotations in Boston and New York. Many of them were used by capitalists and land companies in this purchase of land. While only a few military warrants were used in Iowa previous to 1847, the number increased rapidly after that date until in 1851 almost as much land was obtained by warrants as by cash.

Actual settlement did not keep pace with the sale of land for cash or its disposition in exchange for military warrants. The result was ownership of undeveloped tracts by land investors, speculators, military veterans, and corporations—all of whom were holding for a rise and eventual sale to settlers interested in making farms out of the raw land. The farmers who came into the state later had to buy the land they wanted at from \$2.50 to \$10 an acre, not from the government but more likely from some individual who had bought it several years

TABLE 1
DISPOSAL OF PUBLIC LAND IN IOWA *
(acres)

A. Cash sale by U. S. Government.		11,900,000
B. Gifts by U. S. Government for:		
Military service (warrants)	14,100,000	
Education	2,100,000	
Internal improvements:		
Railroads	4,400,000	
Other	2,300,000	
Homesteads	900,000	
Miscellaneous	100,000	
		23,900,000
Approximate total area of Iowa		35,800,000

* Based on figures in Lokken, *Iowa Public Land Disposal*, State Historical Society of Iowa, Iowa City, 1942, p. 267.

earlier at \$1.25 an acre. The difference was not all gain to the investor, however, because considerable time frequently elapsed between sale by the government and purchase by a *bona fide* farmer. But there would have been less speculation and more assistance given the pioneer farmer in Iowa if the Homestead Act of 1862 had been passed twenty-five years earlier and if at the same time the United States government had given cash instead of land warrants to the military veterans, railroads, and educational institutions.

LARGE-SCALE VS. FAMILY-SIZED FARMS

A question which appears puzzling at first is why the family-sized farm has become the leading type in Iowa instead of the large-scale or

corporate farm. Actually, several factors in the early period favored the large-scale unit.

First, capital was important and scarce in the frontier area. Moreover, it was the corporation or individual capitalist which had the needed funds. True, land was cheap, but it cost almost \$2.50 an acre or twice the minimum price of the land to get the prairie sod broken when the breaking was done on a custom basis. Then there were buildings and a long period of waiting between the breaking of the prairie and the first real crop, which usually did not come until the second year. All this required capital which favored the operator or corporation with financial backing.

Second, large tracts of open prairie in central and western Iowa were surveyed and made available for purchase before individual settlers with limited funds came on the scene in great numbers. These extensive areas could be purchased by corporations, land companies, and individual capitalists. Although these lands could not always be bought in solid tracts, it was usually not difficult to obtain a large block of land if one had the desire and the capital. Purchase of large holdings was not always possible in eastern Iowa because the settlers had come in ahead of the survey and sale of land. In central and western Iowa, on the other hand, the survey and sale of land took place for the most part before the settlers arrived. This explains the claim associations in eastern Iowa, and it also explains the accumulation of large land holdings by certain individuals and companies in the rest of the state after 1845.

The large land holdings acquired in Iowa during the fifties might have been the beginnings of extensive large scale farming. A list of those purchasing more than 75,000 acres during the decade of the fifties follows:

	(acres)
Horatio W. Sanford, Dubuque	250,000
William J. Barney	191,000
Cook, Sargent, and Downey, Davenport	180,000
Easley and Willingham, Halifax County, Virginia..	146,000
E. Temple, Lucas County	90,000
Henn, Williams and Company, Fairfield	84,500
Culbertson and Reno, Iowa City	82,000
Brown and Ives, Providence, Rhode Island	78,000

Later in northwestern Iowa large tracts of land were bought by the Close Brothers and the Iowa Land Company which they managed.

During 1880 this firm bought 97,000 acres and in 1882 was advertising 500,000 acres for sale in northwestern Iowa and southeastern Minnesota.

For the most part these large land holdings were not held for a long period and only in a few instances are there records of the owners developing their lands into farms. If we assume 1,000 acres or more as a large-scale farm, we find from the Federal Census that the number of such farms in Iowa rose rapidly to a peak of 428 in 1880 but declined after this point. The total of such farms was only 201 in 1940. Of these 201, only two were reported as being 5,000 acres or more in size.

One of the large-scale purchases which developed into farms was the Pella Colony, started by a group of immigrants from Holland which settled in northeastern Marion County in 1847. (See *The Hollanders in Iowa*, by Jacob Van Der Zee.) The Hollanders were able to buy out the few settlers who had already started farming in the area and also to buy out the absentee owners who held isolated undeveloped tracts. As a result the Hollanders acquired practically a solid tract of 18,000 acres. This group, which numbered almost 600, proceeded to lay out the town of Pella and to dispose of the farm land among individuals in the group who developed family-sized farms of their own.

Another large-scale purchase was that made by the Amana Colony in 1855 in northeastern Iowa County. This was different from the Pella settlement in that the Amana colonists held their 18,000 acres of land in common. They went out to farm their land from the small villages where they lived in true communal fashion. This method of living and ownership persisted until 1932, when the group was organized as a stock company with the members receiving shares of stock to represent their ownership in the corporation. The farming operations, however, still are carried on as one enterprise with the people who farm the land still living in the villages.

By 1870, land had become relatively high priced around Pella although there still were large areas of undeveloped land to the west, where there were opportunities for homesteading, as provided for under the Homestead Act of 1862. Another group of Hollanders, many of them from Pella, settled on a tract of about 25,000 acres in Sioux County in 1869 and 1870. They laid out the town of Orange City, which became the center of their settlement.

Still another example, also in northwestern Iowa, was the unique development around Le Mars by the British during the late seventies and the early eighties. The movement was started by William B. Close,

a graduate of Cambridge University, England, and his brother Frederick. These are the same Close Brothers referred to previously in connection with large land purchases in northwestern Iowa. Unlike most real estate operators, they actually made improved farms out of some of their land and rented these farms out to tenants or sold them to settlers who wanted an improved farm. These operations of the Close Brothers which started in 1878 in Crawford County have been described in *The British in Iowa*, by J. Van Der Zee, as follows:

The Close system did not consist merely of holding virgin land on the chance of a rise in value: on the contrary, they built houses, ploughed the sod, and improved their property so as to make it productive of income, wherein they conceived lay the distinction between legitimate business and speculation in land. Tenants met the rent for wheat lands in kind on the half-share principle; and they paid an average of \$2 per acre for Indian corn lands, owing to the difficulty of collecting it in kind.

In 1879 the Close Brothers moved north to Plymouth County where there was more virgin land waiting to be developed. With the aid of British bank connections and wealthy friends, including the Duke of Sutherland, they obtained enough capital to buy large areas of Northwest Iowa land. A third brother, James, joined the other two in their land operations.

The Close Brothers put on an active campaign to get well-to-do British farmers to settle on their lands in Northwest Iowa. With an effective campaign of literature they succeeded in getting several hundred British settlers to come. The fame of the Le Mars colony spread far and wide because many of these British settlers proceeded to establish large farms in the English manner, with a social life which went along with it. What with cricket, hunting, horse racing, and a social organization called "The Prairie Club," the group was fast developing the area into a pattern similar to that in England. We might soon have had large estates owned by wealthy families with the land farmed by tenants.

But this British colony in northwestern Iowa was short-lived. Their passing is summed up in these words:

Of the Britishers who were induced to come to the counties of northwestern Iowa during the eighties, not many can be found living there today. The farm life that promised wealth and happiness to the immigrants ended in disappointment and even failure for most of the young unmarried men. (*The British in Iowa.*)

The failure of the wealthy British settlers to stick to their Iowa farms brings out the strength of the pioneer farm family which developed the state of Iowa. The back-breaking job of making a farm out of virgin prairie was accomplished most successfully as a family task.

No corporation or capitalist could compete with the individual farmer and his family in developing a farm. Hired labor was too expensive and was almost nonexistent because any laborer soon saw it was to his best interest to develop a farm of his own.

The competition for land, labor, and capital on the Iowa frontier resulted in a clear-cut division between the laborer or farmer and the capitalist. Although both the farmer-settler and the capitalist acquired land in the new state (the capitalist acquiring huge areas in some instances), the capitalist soon found it was more profitable to lend his funds to the farmer than it was to hire labor to develop his land holdings. Consequently the number of large farms declined. On the other hand, settlers were willing to pay high interest rates, up to 35 per cent in the early days, in order to get the necessary funds to develop farms of their own. In the sixties and seventies it was common for farmers to pay a 10 per cent premium for the privilege of borrowing at the legal maximum interest rate of 10 per cent—an excellent example of a “black market” before the days of OPA.

This willingness of farmers to pay high interest was an indication of the sacrifice they were ready to make in their struggle to own a farm. The natural result was the establishment of loan offices throughout Iowa, many of them with bank connections or other financial backing in the East. They made a business of lending to farmers on farm mortgages for the purchase of land, and on chattel security for funds to carry on farming operations. For example, the Close Brothers organization, which reached its peak in land operation about 1884, eventually changed from a land company to a farm loan business.

The individual farm family, even though it did have to pay high interest rates, was successful in developing Iowa into a state of 160-acre family-sized farms. Low prices of farm products and depression at various times, as we will see later, caused many losses and foreclosures. But even then the owner was only temporarily displaced by a tenant. The pattern of family-sized farms was firmly established.

Only very slight changes have occurred in the average size of Iowa farms during the past one hundred years (Table 2). The high figure of 185 acres in 1850 was a result of the large number of farmers who settled and bought 320 acres, only to find out later that they could not operate such a large unit. The average dropped to 134 acres in 1870. What happened during this 1850–70 period was that the number of 320-acre farms declined and the number of 80- and 120-acre farms increased. All during this period, however, the 160-acre unit was the most common size. As machinery came in, the number of acres a

family could operate increased. By 1890 the present pattern was clearly evident, and only slight changes have occurred since that time. It should be pointed out, however, that although the average has remained relatively stable since 1890, there has been a slight increase both in the number of small farms under 10 acres and in the number of large farms, especially 240- and 320-acre farms.

TABLE 2
NUMBER OF FARMS, AVERAGE ACRE PER FARM AND PERCENTAGE OF TOTAL
AREA OF IOWA FARM LAND
(Federal Census, 1850-1940)

Year	Number of Farms	Average Acres per Farm	Farm Land Percentage of Total Area of State
1850.....	14,805	185	7.6
1860.....	61,163	165	28.1
1870.....	116,202	134	43.4
1880.....	185,351	134	69.1
1890.....	201,903	151	85.1
1900.....	228,622	151	96.5
1910.....	217,044	156	94.7
1920.....	213,439	157	93.4
1930.....	214,928	158	94.9
1940.....	213,318	160	95.3

In reality, Iowa farms are much larger now than in 1850 or 1900—not in acres but in total production. This is the result of higher yields, more profitable crops such as alfalfa and soybeans, and larger livestock production per farm. The story of hybrid corn which plays an important part in this increase is discussed elsewhere, as is also the improvement and introduction of machinery, tractors, and electricity which have made it possible for one man to do what previously it took many men to do. This increased production per farm has been accomplished without much change in the average number of acres per farm and without displacing the family as the typical operating unit on the farm. In short, scientific developments have enabled the farm family of today with fewer children to produce much more than the farm family of twenty-five or fifty years ago.

It is clear that the family-sized farm has won a clean-cut victory over the large-scale unit. The chief reasons for this victory were the willingness of the farm family to work if necessary for a low return, and to endure almost endless hardships to possess a farm of its own.

RISE IN TENANCY

Tenancy followed close on the heels of the frontier as it moved across Iowa. Strange as it may seem, landlords and tenants made their appearance in parts of the state while virgin prairie was to be had for a nominal sum in other parts. As the years passed the percentage of tenants increased steadily until in 1935 the figure almost hit the 50 per cent mark. Throughout this period the trend in Iowa has been similar to that in the country as a whole, except that the rise has been higher in Iowa. (Table 3). In 1880 the percentage of tenants in the United States was 25.6. It reached a peak of 42.4 per cent in 1930 and dropped in 1940 to 38.7 per cent for the country as a whole.

TABLE 3
TENANTS AS A PERCENTAGE OF ALL FARM OPERATORS IN IOWA
(Federal Census 1880-1940)

Percentage		Percentage	
1880.....	23.8	1925.....	44.7
1890.....	28.1	1930.....	47.3
1900.....	34.9	1935.....	49.6
1910.....	37.8	1940.....	47.6
1920.....	41.7	1945.....	

Tenant-operated farms were common in the early years, particularly in western Iowa. The records of the Iowa Land Company and the Close Brothers, for example, give minute details of leasing practices—including the crop share division between landlord and tenant which is prevalent today. Although it was not until 1880 that the Federal Census reported tenancy figures, the report at that time showed 23.8 per cent or almost one tenant for every three owner operators. In 1880, it should be remembered, only 70 per cent of the land area in the state was in farms.

The question naturally arises as to why any farmer remained a tenant when land was so plentiful. The answer, it happens, is not hard to find. The land which was so plentiful and cheap was undeveloped and far from transportation facilities. And there were some farmers who preferred to be tenants on well-improved farms rather than owner-operators of farms in the process of development.

But some farmers who had little money or equipment pushed out into the newest frontier areas to develop farms of their own out of unimproved land. Although farming there required much labor, relatively little capital was needed. At the other extreme were the

farmers with capital. They were in a position to buy improved land back some distance from the frontier. Such farms frequently sold for from five to ten times as much as the unimproved frontier land.

In between these two extremes were younger men who lacked the capital needed to buy farms of their own but preferred to rent an improved farm as against developing a new farm out of virgin prairie.

Improved farms of the type just described could be purchased often from frontier farmers who made it their business to keep in the front lines of settlement. They profited from the increased value of the land which they transformed from virgin prairie into an improved farm. As soon as the country around was settled and the railroads arrived, they sold their farm at a substantial increase over the price they had paid, then moved farther west to land which was undeveloped and cheap.

During the eighties, the nineties, and the early 1900's the process of land improvement continued and the percentage of tenancy climbed. Drainage, service buildings, farm dwellings, fences, and other improvements increased the cost of the farm to the incoming settler.

With the passage of time a new generation came on the scene. Sons and sons-in-law were not ready to buy the parental farms until they accumulated a sizable down payment or until the farm had to be sold in the settlement of an estate. The logical solution was for younger men to rent. This enabled the older folks to retire and the young folks to start farming with a small amount of capital. It was natural, therefore, to expect an increase of tenancy as a result of this transformation of Iowa from a land of farms operated by the original settlers to a land of farms operated by sons and grandsons of these original settlers.

A final reason for the increase of tenancy was the pinch of depressions with their tragic aftermath of farm mortgage foreclosures. Those farmers who bought their farms in good times and mortgaged them heavily found themselves loaded with an impossible burden in the years of low prices which followed. The usual sequence was the foreclosure of the mortgage by the lender and the change of the previous owner into a tenant.

MORTGAGED OWNERSHIP

Throughout Iowa's first one hundred years, the farmers of the state have made frequent use of the mortgage in their struggle for farm ownership. Even during the early years when land sold for as little as \$1.25 an acre, mortgages were common because farmers were desperately short of capital.

How the farm mortgage has been used in Iowa is indicated by an analysis made of farm mortgages recorded in Story County. (Although Story County, which is located in the center of the state, is somewhat above the state average in land values, it is typical of the state so far as mortgage practices are concerned.)

A total of thirteen farm mortgages were recorded in Story County in 1854, the year following the organization of the county. In 1857, which was the first boom year in the area, 126 farm mortgages were given to lenders as security for loans. By 1860 there were 471 farms in the county, 212 outstanding mortgages totalling \$86,000, and an average debt of \$3.83 on each acre mortgaged.

The number of farm mortgages outstanding in Story County continued to rise until 1880 when the total reached 1,822. At this time the settlement of the county was about complete, with three-fourths of the land included in farms. Although the dollar volume of mortgages continued to increase from 1880 until 1920, the number of mortgages did not change appreciably except for an increase to more than 2,400 in 1920-21. More than half the owner-operators in Iowa in 1920 reported mortgages on their farms, according to the Federal Census.

Rising land values up to 1920 forced many farm purchasers to use mortgage credit with a continuously rising debt per acre. After land values reached \$20 an acre in 1870, they rose at a slower pace until 1900. From 1900 to 1920, land values rose rapidly at first and then boomed to an all-time high in 1920 of \$227 an acre (Table 4). The cause of this increase was a rise in farm income plus speculative activity which became particularly noticeable in 1919-20. Iowa's total farm mortgage debt, estimated by the United States Department of Agriculture at 430 million dollars in 1910, reached 1,187 million dollars in 1920 and 1,503 millions dollars in 1921.

TABLE 4
AVERAGE VALUE PER ACRE OF FARM LAND AND BUILDINGS
(Federal Census 1850-1940)

1850.....	\$ 6.09	1900.....	\$ 43.31
1860.....	11.91	1910.....	96.00
1870.....	20.21	1920.....	227.09
1880.....	22.92	1930.....	124.18
1890.....	28.13	1940.....	78.79

With the fall of farm product prices in 1921, the land boom collapsed and farmers found it increasingly difficult to meet the interest

on their huge mortgage debt. Foreclosures were the tragic consequence.

Periods of low prices for farm products and numerous foreclosures of farm mortgages have occurred several times in the state's history. In Story County there were six depression periods of low prices and foreclosures: 1858-60, 1871-72, 1876-79, 1894-98, 1921-25, and 1931-35. In every period the depression was preceded by a period of prosperity, ranging from mild to excessive, when farms were bought at rapidly rising prices and mortgaged at progressively higher amounts. The boom of 1919-20 outdid all the others in the buying and mortgaging of land and was followed by two serious depressions.

It is difficult to comprehend the extent of the 1919-20 boom and its tragic aftermath. A huge acreage of land was sold at peak prices and mortgaged heavily. Approximately 10 per cent of the farm land in the state was sold during the year ending March 1, 1920. In Story County the total number of farm sales was 516, which was more than twice the number sold in any one of the preceding ten years. Furthermore, the average sale price at which this record breaking number of farms changed hands was \$289 per acre—highest in the history of the county. The fuel which produced this inflationary flame was the mortgage money represented by 787 mortgages totaling \$10,330,000, of which one-third was second, third, and fourth mortgage money. Many of the junior mortgages were foreclosed in the next five years when farm prices declined. This resulted in the designation of the 1921-25 period as the "second mortgage" depression. Later, in 1931 and after, farm prices declined to a still lower level and many of the first mortgages were foreclosed in the 1931-35 period which was designated as the "first mortgage" depression.

The seriousness of the 1931-35 depression is indicated by the amount of farm land acquired by insurance companies and other lending agencies through foreclosures and voluntary deeding of land by debt-burdened farm owners. A survey in 1933 revealed 8 per cent of the farm land in the state owned by corporations, with 10 per cent in 1935 and a peak of 12 per cent in 1939. Insurance companies, the leading first-mortgage lenders in the state, held the largest share of the land. In 1933 they owned 3.9 per cent of the land in the state and in 1939 they had 8.1 per cent or an area equal roughly to eight out of the ninety-nine counties in the state.

By 1946 virtually all of the corporate acreage was back in the hands of individuals. High prices of farm products, high farm incomes, and rising land values during World War II made it possible for the lending agencies to sell their farms readily. In fact, several of the insurance

companies started selling their farms on contract as early as 1935. They sold chiefly to tenants, some of them former owners, with only a small down payment. Many of these farm owners have been able to clear their farms entirely of debt by 1946.

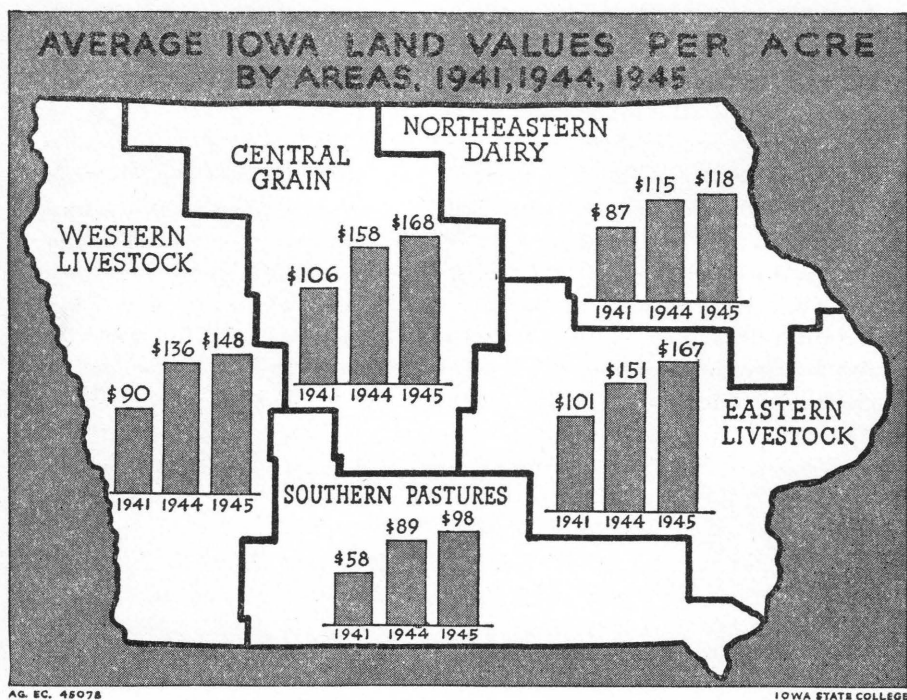


FIG. 1.—Rising land values during World War II showed a trend of the times. By areas, these were the values recorded for three of the years in the war period.

More ownership by operating farmers and less tenancy has been set forth as a worthy goal. A few qualifications, however, are in order. It is obviously unwise for tenants to buy farms during high price periods like 1919–20 because their ownership may be purchased at too high a cost or may end up in a mortgage foreclosure with the loss of the family's life savings. Furthermore, there are tenants who need to save additional money before buying and there are some tenants who may be better satisfied in the long run to remain tenants throughout their farming careers rather than take on the heavy risks of ownership. Yet in spite of these risks, the typical farmer and his family have a strong continuing desire to own a farm that belongs to them alone. And it

is a worthy desire when achieved without a heavy debt because it can provide independence, security, and a high standard of living for those who prefer a life on the farm.

It appears that the family-sized farm has become firmly established and that approximately one-half of our Iowa farms will continue to be operated by their owners and the other half by tenants. Depressions may increase the number of tenants because of farms that are lost through foreclosure. But good times will make it easy for tenants to step into ownership.

Although land values rose from an average of \$79 an acre in 1940 to approximately \$145 in 1946, there was much less buying and mortgaging than in the earlier period. The farm mortgage debt in Iowa in 1945 was estimated at 607 million dollars, which is less than at any time since 1913. World War II, unlike World War I, has not loaded farmers with a debt based on over-priced land. But large bank deposits, heavy demands for farm products, and an optimistic psychology at the end of Iowa's first one hundred years provided the possibility of ruinous land inflation.

In the first one hundred years of Iowa history, farmers learned that their soils were generally rich and productive. They also learned that the naturally high level of fertility of their soils could not be maintained without good, careful management.

2. The Soil That Grows the Crops

J. B. PETERSON AND A. J. ENGLEHORN, *Agronomy*

IOWA SOILS ARE PRODUCTIVE. THAT FACT IS PROVED BY the value of farm produce—a higher value than that of any other state in the Union. It's proved by a corn crop that excels that of any other state or any foreign country. It's proved by the livestock to which the corn is fed—no other state produces as many hogs and chickens as does Iowa. And it's proved by scientific study of the soils themselves. In 1934 it was estimated that one-fourth of all Grade A land in the country was contained within the state's borders.

Except for the drainage of wet lands, Iowans have had little responsibility for the original productiveness of their land. The soils of Iowa are the result of geological processes, which laid down powdered rock that was the parent material for soils, and of natural processes—such as chemical action, moving water, plant life—which turned this parent material into a true soil with characteristic layers.

Glaciers descended into Iowa five times. As they advanced from the north the glaciers picked up loose soil and ground or crushed into powder the rocks encountered on the way. Some of this accumulation remained where it was dropped by melting ice. Water flowing from melting ice washed other debris considerable distances. Winds picked up finer material from the river valleys and laid it down across the land. When the ice age ended, the state was buried under a deep covering of finely-divided rock flour, rich in the minerals that plants need. Its surface was a smooth and gently rolling plain. This topography, which makes possible the use of power machinery, is one of the state's greatest farming assets.

The glaciers treated Iowa well. Glaciers often scour and scrape away soil leaving only a thin covering of soil over the rock. This happened to the north, but not in Iowa. Glaciers also often leave great

areas of sand and gravel, but in Iowa usually sufficient clay and silt were mixed with the sand to make good soils. Unlike most other states,

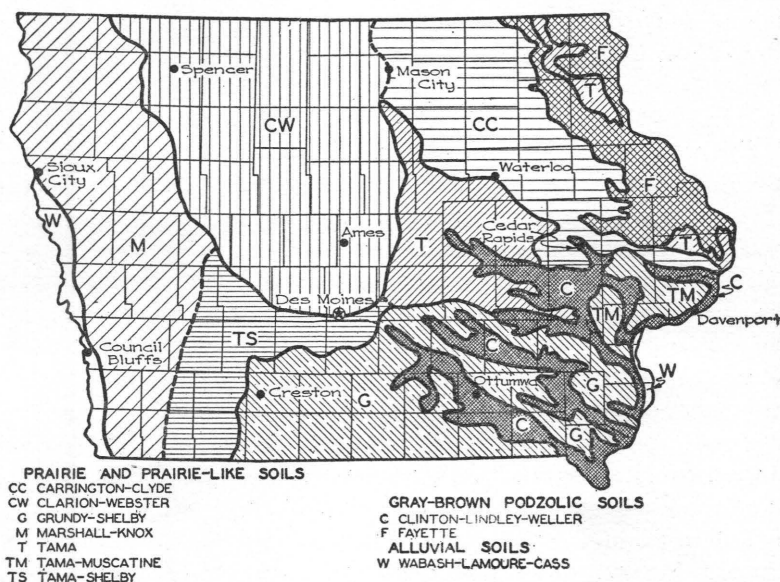


FIG. 2.—Iowa land may be divided into these principal soil associations.

Iowa was almost completely covered with deep deposits of finely-divided glacial and wind-blown material.

Next came conversion of this parent material into soil. As time passed, the action of plants increased the amount of organic matter in the surface layer. Clay and minerals moved downward and accumulated in the subsoil. Gradually the soil began to develop layers, called "horizons." These layers, taken together, constitute the soil profile—the nature of which determines the value of the soil.

In general, the best agricultural soils are those developed in climates just humid enough to grow luxuriant grass, but not humid enough to grow trees. Surface layers built up under trees are not as deep or as rich as under grasslands. Well-drained timbered soils are usually more leached than well-drained grass soils and their subsoils are heavier and tighter. Here again Iowa was fortunate.

The Cornbelt states lie in the transition zone between heavily timbered country and semi-arid grass lands. Their prairie soils, developed under grass, are among the most productive soils in the world. Until he reached Ohio, the pioneer farmer's first job was usually to cut

down enough trees to give him land to plow. He first met rich prairie soils in Ohio and Indiana. Not until he reached Illinois did he find more land in grass than in trees. The farther west he went, he found less rain and trees, and more grass. In Iowa, only 15 per cent of the soil area was under timber.

CHARACTERISTICS

The prairie soils have many fortunate characteristics. Their surface layer is deep, rich in organic matter and nitrogen. Minerals needed for plant growth, such as calcium, phosphorus, and potassium, are present in greater quantity than is true in soils of more humid climates. Prairie soils absorb and store water readily and they are easily tilled. The prairie soil profile is familiar to Iowans as they have seen it in road cuts and newly-dug post holes: a dark brown surface layer blending into a yellowish brown subsoil which at depths of twenty to forty inches blends into a still lighter parent material.

In addition to this rich soil, Iowa has a favorable climate. Iowa is in a fortunate position north and south, just as it is east and west. It is far enough north to have long days during the growing season, but not so far north that crop production is seriously limited by a short growing season. Iowa is far enough north that the ground freezes deeply in winter, locking up the soil's fertility and checking the excessive weathering and leaching which tends to impoverish soils in states where winters are warm and wet.

The first settlers in Iowa had little idea of the richness of the land. Indeed, most of Iowa's first farms were carved out of the forests! The pioneers lacked experience with grassland soils and lacked the knowledge of soil types and crop adaptation available today. They had to learn the best ways of using the new land largely by trial and error.

In eastern Iowa, trees were found on the uplands as well as along the streams. As the pioneer moved west across the state he found few trees. Even the timber along the streams was thin and meager along the western boundary of the state. Those pioneers who came a little later, settling on the prairie, found that once the sod had been broken they had more fertile soil than the farmers who had gotten to the state first and settled on timber land.

CROPPING PATTERN

The pioneer, unacquainted with prairie soils, had little idea as to what crops would grow best on them. In the early years, even if he had known the cropping patterns suited to Iowa soil and climate, he didn't

have much choice. There was little transportation available to bring in food and clothing. Trips to the nearest trading post were made on horseback or by wagon. As a result, the crops a farmer planted were those his family needed for food, and as feed for the few animals he raised. Horses and cattle were kept primarily to serve as draft animals. A few pigs and chickens were kept for meat, while sheep furnished wool to be woven into clothing. This type of subsistence farming was reflected in early crop patterns, in which garden crops like beans and pumpkins and orchard crops like apples and grapes had an important place. Certain other minor crops like tobacco and fiber flax were planted, not because they were suited to the soil and climate, but because the settler needed them. Wheat was an important crop, seldom taken to market, but instead hauled to the local mill to be ground into flour. If the farmer had more wheat than his family needed, the miller took a portion to pay for the cost of grinding. Corn furnished feed for livestock and food for humans. Only a small excess over the family's needs was grown to be sold or traded for sugar, coffee, tea, and thread. Since the farmer raised little to sell and most of his labor had to be done by hand, acreages were not large. Much of the land was left in grass and consequently the problem of soil management was of little importance.

Population increased, however, and pressure for land became greater. The coming of the railroads, the growth of county seat towns approximately twenty-four miles apart, and the improving of country roads helped bring in commercial farming. Now the farmer began to choose those combinations of crops and livestock which would give him the highest net income.

Although Iowans knew little about soil, they soon found that their soils had a lot to do with the combination of crops which was most profitable. By trial and error, the Iowa farmer discovered that his land was best suited to the growing of corn. Wheat, which had played such an important role in the pioneer economy, became less important.

Though corn is the major crop on Iowa farms today, it is by no means the state's only important crop. Not every acre is suited to corn, and even acres that are cannot be planted to corn year in and year out. Crop rotation is necessary to preserve soil fertility.

Livestock production is a major enterprise in all parts of the state, but the percentage of crops and pasture land, and the kinds of livestock raised differ from one part of the state to another. These variations arise from basic differences in soils. In the better soil areas of the state, percentage of crop acreage is highest, and hay and pasture

the lowest. For example, the Cash Grain Area is a section of rich soils, with little waste land. It coincides closely with the region covered by the more recent glacial invasion of the state—the so-called “Wisconsin Drift Area.” Furthermore, this area was nearly all formed under prairie grass rather than under forest.

DRAINAGE

All land which was better drained because of its topography was first cultivated, while the heavier, darker, more fertile lands remained unbroken. Large areas of wet land were also left unplowed in this section of the state in the early days. In most of the eastern two-thirds of the state there were large undrained flat lands. In Henry County, for instance, all the land in timber was under the plow by 1850, while the flat prairie areas in Canaan Township were not broken out until about 1900. This township today is one of the most productive in the county.

Tile drainage made possible the reclamation of thousands of acres of some of the most fertile land in the state. Poorly drained lands which had been purchased at a low price with a moderate investment in drainage could be sold at a good profit.

Tile drainage, however, came slowly. Many legal points had to be clarified first; enabling and other legislative acts were necessary. Drainage districts had to be legalized with power to tax. Laws with respect to the rights of the individual had to be passed and then clarified by the courts.

Legal obstacles, however, were not the only barriers to quick land drainage. How best to drain small areas of land, as well as large tracts, had not yet been found. Large ditches could be dug to drain lake beds, large sloughs, and other sizable wet areas. These cost a good deal and required drainage taxes to be levied on the land.

To drain all of the land adequately, to take the water from each small slough, pot hole, and duck pond, however, would have required elaborate ditch systems and would have created difficulty in farming operations. Some system of subsurface drainage was obviously necessary.

Methods used in Europe were tried first. Mole drainage, where an opening is forced through the soil similar to that formed by the common garden mole, was attempted, but did not work out satisfactorily on many soils. Early drainage systems sometimes consisted of flat tile or brick laid in the bottom of the trench to form a rectangular or triangular-shaped drain. Later, round tile drains were tried and found

suitable for tile. Tile factories were built and soon were able to supply the local demands.

Tile drainage of wet lands began about 1890 and reached its peak before 1910. A high proportion of the wet lands had been tiled by 1915. Unfortunately, many of the early systems were not adequate. Too often the tile were too small for the runoff which they had to carry. Many drainage patterns were not scientifically designed and many systems have not been maintained in proper order. As a result many fields once tiled are in need of drainage improvement. In general, though, the results were good and thousands of acres of fertile land were brought into cultivation. By the time of World War I, Iowa farmers had spent on tiling an amount equal to the cost of the Panama Canal.

TABLE 5
TYPE OF FARMING AREAS—PERCENTAGE
(1940 Census Data)

Land Use	State Total	North- east Dairy	Cash Grain	Western Livestock	Southern Pasture	Eastern Livestock
Permanent pasture.....	13	16	7	8	21	15
Corn.....	35	33	42	40	26	34
Small grains.....	20	21	27	23	12	16
Hay and rotation pasture..	32	30	24	29	41	35

We can see the slope and fertility of soil reflected in the crops men grow. (Table 5). Southern Iowa, for example, has only about half as much land in intertilled crops, but nearly three times as much land in pasture as has the Cash Grain Area. Hilly, humid Eastern Iowa most closely resembled Southern Iowa, while Western Iowa, hilly but less humid and more recently settled, closely resembles the Cash Grain Area in this respect. What is true for the state is true for the individual farm—poorer land remains in woodlot or pasture.

Outside the Cash Grain Area, topography has developed on older glacial or wind-deposited materials. Here streams have had time to develop, erosion has taken place, and there is a higher proportion of steep land best suited to permanent pasture. This is especially true in northeastern and southern Iowa. In northeastern Iowa, pastures permit the raising of dairy cattle. In the warmer southern counties, dairying gives way to beef cattle.

COMPOSITION

Soils in these southern counties are older than those in the rest of Iowa, for recent glaciers melted before they got so far south and did not bring in new soil material. Because they are older there has been more time for lime to leach out, leaving them more acid. Lands along the streams that developed under timber usually lack the deep surface soils common to the prairie. In the older soil areas some of the flat lands between streams, where soils have developed under grass, have been leached. Clays from the surface soils have moved downward into the subsoils to such a degree that drainage is often impeded. Under good management, however, these soils can be improved.

The farmer originally had little responsibility for the richness of Iowa soil. Indeed, often without his knowledge, the soils determined what crops he should raise. However, the farmer has had an influence on the land—all too often to the detriment of the soil and his own welfare. The very act of farming meant a loss in soil fertility. There were two reasons for this. One is that by breaking the thick, protective layer of prairie sod, the farmer opened the soil to the destructive influence of the wind and water. The other reason is that the plants man grew took elements out of the soil—elements that had been laid down by the glaciers, or carried in on wind of the glacial age thousands of years before.

This is true of any plant, of course, even the prairie grass itself. But prairie grass died where it grew and the elements stayed with the soil. When man grew plants he ate them or fed them to his animals. Whether the elements ever got back to the soil again depended, as we shall see, on a great number of things. Not all crops take the same quantity of elements out of the soil. Moreover, when corn is fed to livestock on the farm and the manure returned to the fields, the soil loses less than when the corn is shipped off and made into breakfast food. Iowa soils benefit greatly by the fact that Iowa farmers feed their corn to hogs and cattle.

NITROGEN

Suppose we see how this works by taking a little closer look at one element, nitrogen—one of the most important elements in the soil. As we do so, keep in mind that in 1846 no farmers anywhere knew the facts we know about soils today. The past one hundred years of the history of soils in Iowa is largely the story of how farmers learned facts like these about nitrogen and put them to work.

The amount of nitrogen that will remain in the soil depends on

another element—carbon. In most soils, it takes about twelve pounds of carbon to hold one pound of nitrogen. If the carbon goes, the nitrogen goes too. How is carbon kept in soil? Plants take carbon out of the air. The more plants or organic matter in the soil, the more carbon; the more carbon, the more nitrogen. So if a farmer wants to increase carbon in the soil, he can do so by plowing under green plants, by spreading manure which is full of plant residues, or by plowing under the unused residues of crops. At Ames it has been found that when land is planted to corn continuously for twenty years, the amount of organic matter in the soil drops 19 per cent. If two tons of manure per acre are added each year, only 6 per cent of the organic material is lost.

Cattle entered Iowa in the 1830's, on the heels of the hunters and trappers. They grazed on the open range of the prairies and were driven to Illinois for fattening. In any one community, grazing lasted only about ten to fifteen years before crops and fences came. As soon as livestock were penned up, the problem arose of spreading the manure over the fields. As early as 1864, B. H. Wilder remarked in the State Agricultural Society's report that though it was convenient to move feeding yards about the farm, it was not economical. Manure will lose most of its value if handled carelessly, so Wilder recommended that it be stacked to prevent leaching. At that time, he declared, labor was too dear and produce too low to permit storing manure in sheds, tanks, or compost heaps. But spreading manure from a farm wagon by pitchfork is hard, dirty work and on Iowa's fertile soils seemed rather unnecessary. The soil produced well and there were fresh, new lands farther west. Even if the pioneer had known all he knows today he might not have acted much differently. For though introduction of mechanical, horse-drawn manure spreaders after 1900 made the job easier, manure still is carelessly handled on many Iowa farms today.

We have pointed out that plants contain carbon which is needed to hold nitrogen in the soil. But plants also hold nitrogen itself. There is nitrogen not only in the ear of corn but in the stalks and corn cobs as well. Growing corn at the rate of 100 bushels to the acre will require 160 pounds of nitrogen from the soil. Even if everything but the shelled corn goes back to the soil the soil is still poorer by 100 pounds of nitrogen. All this is not lost, however. If the shelled corn is fed to livestock, the animals retain only about twenty pounds—the rest goes into manure. Even if the farmer used the very best methods of handling manure it would still lose probably half of its nitrogen

ALL ABOUT

content. Under poor methods the manure will lose practically all its nitrogen. Summing up, a 100 bushel corn crop takes about 160 pounds of nitrogen out of the soil. Of this about 100 pounds may get back, leaving a net loss of about 60 pounds—

Returned in cornstalks, etc.	60 pounds
Returned as manure	40 pounds
	<hr/> 100 pounds returned
Retained by the animal	20 pounds
Lost in the manure	40 pounds
	<hr/> 60 pounds lost

A loss of 60 pounds is certainly a lot better than one of 160 pounds—but it's still enough to cause eventually a serious loss in soil fertility.

This does not mean that Iowa soil is doomed to lose its fertility. As every farmer knows, there are ways of building up nitrogen in the soil by pulling it out of the air. Every farmer has nitrogen-producing factories on his own farm, except that he calls them "legumes." Legumes take nitrogen from the air. Roots that may go twenty feet or more into the ground build up nitrogen that remains after the plant is gone. And of course if the legume is plowed under, the nitrogen in its stem and leaves goes to the soil also.

The native wild grasses, which furnished satisfactory hay for horses, were not as rich as legumes in the proteins cattle need. Perhaps this, more than the unrealized effect on soil, may explain why farmers very early introduced such legumes as red clover. The pioneers knew clover was needed by livestock. Alfalfa is another legume grown primarily for hay. Alfalfa came rather late in Iowa's history, being limited in 1900 to only a few successful seedings. By 1910 total alfalfa acreage amounted to only 29,000 acres. By 1943 1.3 million acres were planted to alfalfa. The first legume to be adopted largely for its effect on the soil was sweet clover. It always has been grown primarily to be plowed under for green manure. Planted with small grain, it remains in the fall after the grain is harvested and is plowed under the next spring as the land is prepared for corn again. A few farmers in both eastern and western Iowa used sweet clover successfully before 1910, but it did not become important until about 1920. It is probable that something like two million acres of clover are planted with small grain each year. Figures are available only for second year plantings, clover grown by itself, for hay or pasture. Ordinarily 300,000 acres of such clover are found in the state.

To take nitrogen out of the air, certain bacteria must be present on the roots of legumes. Without these bacteria the legumes themselves won't grow well, nor will they return nitrogen to the soil.

Farmers didn't know about bacteria, but they did know clover would grow in some fields and not in others. When one early Iowan imported clover seed early in the state's history, he told friends in Illinois to send him two bags of soil from their clover field. He spread the soil on his fields, planted clover which flourished due to the bacteria in the soil from Illinois. This was a rather inefficient method, however, and successful growing of legumes waited until early in this century, when farmers began inoculating their seed by mixing it with bacteria cultures.

CALCIUM

Even if bacteria are present on legume roots, legumes won't flourish unless the soil has a certain amount of calcium. Lime, the common name for calcium, is lost by dissolving in water and leaching away, and by being taken away in crops. Consequently, the longer that land is farmed, the less and less calcium it has. As the amount of calcium decreases the soil becomes "acid." Some legumes, such as red clover, will grow fairly well on acid soils, but they are not very efficient in taking nitrogen from the air on such soils. Alfalfa and sweet clover almost always fail if the soil is very acid. Where soils are acid, lime much be added in order to grow legumes efficiently and raise the general level of fertility.

Lime has been used by farmers for a long time. The Romans used it two thousand years ago. Later it was used in Europe. Farmers in New England found it necessary on their acid soils early in the Nineteenth Century. Partly because they grew the acid-tolerant clovers and because many of the soils were much better supplied with lime than they are now, after years of cropping and exposure to leaching, the early Iowa farmer did not realize the need for lime.

Indeed, it has taken a good deal of talking and writing by leading farmers and soil experts to explain to farmers why they need lime. About 1900, scientists began testing soils for acidity with litmus paper, a not too accurate method. About the same time it began to be recognized that failure of clovers and other legumes was a sign of lime deficiency. Iowa State College publications began urging the use of lime about 1904 and a bulletin in 1914 reported tests for acidity of samples of soil taken from different sections of the state. Extension workers and vocational agriculture teachers in the high schools began stressing

the importance of liming. It has been estimated that Iowa's twenty-five million acres of crop and pasture land should receive six million tons of limestone a year for the ten years to 1956. In no year up to Iowa's centennial has the amount of limestone applied been sufficient.

The job of keeping nitrogen in the soil is a complex one—and sometimes the farmer starts too late. Where lime hasn't been used for many years, manure has been wasted, and surface soils have been permitted to wash away, organic matter, nitrogen, and other plant nutrients must be put back into the soil. Meanwhile the farmer must grow some small grain and corn. In such a case, commercial nitrogen fertilizer is probably the answer. Even with proper land use and good soil, small amounts of nitrogen fertilizer give crops a more vigorous start, especially in wet seasons. Moreover—and this is something we haven't mentioned before—nitrogen, although it is very important, is only one of fourteen elements plants need. Furthermore, nitrogen is the only one of the needed elements found in soil which can be added to the soil from the air. When any of the other thirteen are not present in usable form, they must be added. Next to nitrogen, elements most commonly lacking in sufficient amounts in the soil are phosphorus and potassium. Phosphorus concentrates in the kernel of corn and in the blood and bones of animals so that there is a steady drain of it from Iowa farms every year.

PHOSPHORUS AND POTASSIUM

Sending a thousand-pound steer to market, for example, will remove phosphorus equivalent to a 100-pound sack of superphosphate. Although low in phosphorus, Iowa soils are unusually high in potassium, which has not been used much as fertilizer except on sand, peat, and high lime soils. Lately, however, other soils have been found where potassium has increased yields, especially of corn. Even before World War I, Experiment Station work revealed the need of phosphate on many Iowa soils. Until recently farmers have been slow to apply phosphorus and potassium fertilizer to the land. All supplies of phosphorus and potassium had to be shipped into Iowa from other states, and there was no good quick method of telling which soils needed it. Some soils responded and some did not. In the last few years, however, chemical tests for estimating the fertilizer needs of soils have been developed and are being used more widely. Together with the information obtained from a large number of fertilizer experiments that have been carried on in the different soil areas of the state, they are a valuable guide to efficient fertilizer use. Today, Iowa farmers are using more than 150,000 tons of fertilizer annually.

It should be remembered that there are two principal ways in which soil loses fertility: Farm crops take elements out of the soil, and wind and water carry elements away.

TILLAGE

Before man came to Iowa, nature had reached a kind of balance. Trees and grass alike replaced as much organic material and nitrogen as rain and wind carried away. But once the land was cleared of trees and sod broken, erosion began to accelerate. Constant plowing and cultivating of the surface soil speeded the loss of organic matter. Once grass roots went deep into the earth to reach nutrients laid down by the glaciers and bring them up nearer the surface. Organic material accumulated and a good, granular structure built up so that the soil was porous and absorbed the rain. Tillage destroyed these qualities, breaking up the grains of earth into smaller particles which water could move about easily. Soils ran together more easily, becoming cloddy and more impervious to water.

The cast iron plow gave way to steel; two-bottom plows and the tractor made tillage even easier. For a time experts believed that water could be conserved by stirring up the soil frequently. Today experts believe land should be cultivated only often enough to keep down weeds. Although Iowa hills are not steep, half the land has an average slope of more than 5 per cent. On the Marshall soils of southwestern Iowa it has been found that even under rotation, land of 9 per cent slope can lose as much as ten tons of soil per acre in a single year. Iowa had an advantage over other states because most of its land was tillable. But it had two disadvantages that some farms in the East did not have. One was that so much of its land was in corn which had to be cultivated to keep down weeds, and frequent cultivation made it just that much easier for soil to wash away, wherever the land was sloping. Iowa also had an unusual amount of up and down hill plowing. In the East, farms were often laid out to follow the natural boundaries of the land. But in Iowa the land had been laid out in rectangular blocks, and when the farmer cut up his square farm into fields he naturally cut his fields out on a square pattern.

ROTATION

Even the best of land can't grow corn year after year without rest, however. Farmers in the old world had been rotating the land for years. Even back in the Dark Ages they used to let their fields "rest" periodically. Experiments in rotation had been tried in England before Iowa was settled, and farm journals strongly urged rotation in pioneer

days. The first Iowa Experiment Station bulletin, published in 1888, declared: "We will try to determine . . . what gains should result from the proper rotation of crops." Actual tests (with open-pollinated corn) on the rich black soils of central Iowa showed that when land is planted in corn continuously, yields averaged 49.3 bushels. Planted alternately to corn and oats the land yielded 59 bushels of corn, and in rotation of corn, corn, oats and mixed hay, yields reached 70.3 bushels.

The reasons for rotations are clear. Hay crops checked erosion and cultivation waste. Plant residues, highest when pasture crops were plowed under, returned valuable elements to the soil. Legumes in rotation returned nitrogen to the soil. Of course, actual rotations differed from one area to another, just as we have seen that the crops themselves differed.

Iowa farmers began to take a greater interest in soil conservation early in the thirties. Since that time, many have learned how to cut down losses caused by cultivating land on gentler slopes not steep enough to be retired to permanent grasses or trees. They have learned to use such practices as terracing, contouring, and strip cropping. They have learned where and how to use dams and how to protect waterways with grass and other forms of vegetation. They know that certain parts of their lands because of their steepness can be held only by grass or trees.

But today's systems of crop and soil management developed rather slowly. In 1905 the first publication systematically describing the soils of Iowa was published. In this the basic principle that different soils require different methods of farming was expressed. This report was soon followed by the beginning of soil surveys of the state.

Gradual expansion in research programs by Iowa and other states and by federal agencies since early in the century has yielded basic information on soils which is helping us to understand their peculiarities and to plan how to use them to best advantage.

The findings of such studies are helping to take the guess out of farming. How much our present systems of soil management have been developed from individual experiences through the years and how much from planned experimentation is hard to tell. Certainly experience was the chief guide in the early days. In the future the results of purposeful effort to secure and organize knowledge of Iowa soils will play an increasingly important part in land planning and soil management.

During World War II, as had happened twenty-five years before

in World War I, acreage in corn went up. And at the war's end, after forced production, farmers looked forward to sound land use. More steep land awaited return to timber or permanent pasture. Gullies needed fencing and planting, ponds and dams remained to be built, rolling fields called for more contoured cultivation and an end to "square farming on a round country." Old drainage systems needed renovation. Some areas were still in need of their first tile. Many acres needed lime, and organic matter, manure, and green manures. Some needed fertilizers.

Iowa's soils were no longer as rich, at the end of its first hundred years, as they had been at the beginning. But farmers were aware of the problem of soil depletion. Co-operative group action in the form of soil conservation districts, organizations of farmers for the purpose of combating erosion and building up and maintaining the fertility of their soils, was rapidly spreading. Research and educational programs were expanding to meet farmer demands. And knowledge was available, lacking in 1846, that would enable farmers to conserve their heritage. In greater and greater numbers they were doing just that.

This growing interest in the soil and its conservation has come none too soon, for rich lands can be ruined just as well as poor lands. Their's is even the greater danger because on better lands the processes of soil depletion are often not apparent until most of the damage has been done. With hard work and vigilance, but *only* with hard work and vigilance, can the fertility of Iowa soils be maintained and the state remain sure of her leadership in agricultural production.

Iowa produces nearly 20 per cent of the United States corn crop, and more than any foreign country. The average annual production for the years 1941-45 was 552,977,400 bushels.

3. Growing the Bumper Corn Crop

G. F. SPRAGUE, *United States Department of Agriculture*, and
J. C. CUNNINGHAM, *Iowa Agricultural Experiment Station*

ONE OF THE FIRST CROPS PLANTED BY THE WHITE SETTLER in Iowa was "sod corn." Already, in the period more than a hundred years ago, corn was a staple item in the diet of the Indians of the state. Their total production certainly must have been less than half a million bushels a year, but heralded the crop growths to come.

The "sod corn" of the white settler produced a crop of sorts the first year. Its main advantage was that it required no cultivation, leaving the settler free to clear land where necessary, build his house, and break more land for the next year's crop. Ground to be planted to corn was cross marked and planted by hand. Cultivation was done with a harrow, often homemade, and a double-shovel cultivator which cultivated only half a row for each trip across the field. In many cases this cultivation was supplemented by hand hoeing.

Under favorable conditions corn yields were obtained which compare well with those of today. A boys' one-acre corn-growing contest was sponsored by the Iowa State Agricultural Society. In 1857 this contest was won by Wilbert LaTourette. Sworn records state that the yield for this single acre was 95.5 bushels. His report follows:

The ground on which the following crop was raised is a black loam with a clay subsoil, and lies slightly rolling to the south. The location is four and a half miles west of Muscatine.

The ground was prepared about the 20th of May, by plowing six inches deep, with a common stubble ground plow. On the 26th day of May, it was marked in rows $3\frac{1}{2}$ feet apart, then planted with a hand corn planter, $1\frac{1}{2}$ feet apart in the row.

The seed was a large yellow corn (name unknown). The crop was cultivated by harrowing once with two horses and large harrow; once with a shovel plow, and layed by with a side corn plow.

Cost of cultivation as follows, viz.:

Breaking one acre.....	\$1.50
Marking off and planting .....	.75
Harrowing .....	.37
Two plowings and thriving	2.50
Whole cost of cultivation	<u>\$5.12</u>

The crop was gathered December 5, 1857. My age is 16 years and 6 months, and I am 6 feet $3\frac{1}{2}$ inches high.

By 1860, Iowa's annual corn production was more than forty-two million bushels. Many changes occurred during the next twenty years. First was the change in motive power as more horses and mules replaced oxen (Chapter 13). As the horse replaced the slow-moving ox, it became possible for a farmer to plant and harvest more acres of corn. By 1880, farmers were harvesting some 231 million bushels; nearly a sixfold increase in twenty years. Of course this was largely due to plowing up of more prairie into crop land as the state became settled. More corn meant more livestock. Numbers of livestock rose in roughly the same proportion as the amount of corn. In this same twenty-year period, Iowa farmers increased hog numbers from 935 thousand to more than 6 million, and cattle from a half million to two and a half million.

By 1880, too, Iowans had turned from hand planters to wire-operated checkrow planters. It has been estimated that one man could plant about four and one-half acres of corn a day with the hand planter. With a two-row check planter he could plant fourteen acres a day. As time went on, tractors, four-row planters, corn pickers and tractor-mounted cultivators continued to increase the acreage of corn that one farmer could raise.

Methods of planting corn are vastly different today from those of one hundred years ago. The types of corn planted vary even more.

TYPES IN OLDEN DAYS

Corn is native to the Americas. The first immigrants who settled the Atlantic coastal region knew nothing of corn, or "maize" as it was then commonly called. The only strains available were those being grown by the Indians. These may be divided into three general types: flint, flour, and gourd seed. Dent corn as known today was practically unknown to the Indians and the early settlers. The "gourd seed" was a very late, rough type. It is believed by some that the dent varieties arose from crosses between the gourd seed and flint types; or it may be that the dent types were developed from the gourd seed by direct selection. At any rate, because of its extreme lateness, the gourd seed type was not extensively grown by the settlers who moved into what was to become the Corn Belt.

The Iowa settler had two choices as to the type of corn he could plant: local strains obtained directly from the Indians or relatively unadapted strains which he had brought with him from the East. The

Indian varieties probably were too early for maximum yield and the varieties brought from farther east were often too late. This led to an immediate interest in developing better adapted types.

The development of adapted types falls roughly into three periods, 1846-90, 1890-1920, and 1920 forward. The limits assigned to these periods are somewhat arbitrary. In the first period, corn breeding was almost exclusively in the hands of practical farmers. In the second period the experiment stations assumed the leadership and the corn show and corn yield test came into prominence. The third period also was dominated by the experiment stations and commercial hybrid seed producers, the emphasis being shifted to the isolation and testing of inbred lines and the commercialization of hybrid corn.

We know little as to the varieties commonly grown during the first period. In a survey made by the Patent Office in 1850, the only named variety mentioned as being grown in Iowa was "Elkhart," although mention also was made of "a South Carolina variety which was gaining favor."

Calico and Bloody Butcher were two types, commonly grown by the early settlers, which persisted on a small scale to the end of the second period. Strains known by these names were constant in only one characteristic, their color. The Calico strains had a variegated red and white seed coat; the Bloody Butcher types were solid red. It is probable that both types represented hybrids between strains of corn brought in by the settlers and highly colored Indian types.

PIONEERS IN DEVELOPMENT

During this period many men were interested in corn. Relatively little is known, however, as to their achievements unless the strain they developed achieved some degree of popularity. Many varieties which later became very popular had their origins in the 1850-60 period. One of these, Reid Yellow Dent, became one of the most widely grown varieties in Iowa, so its mode of origin deserves some mention. Wallace and Bressman, in their *Corn and Corn Growing*, report that:

Reid Yellow Dent was originated by an accidental cross between a rather late, light-reddish colored corn and a small, early yellow corn. Robert Reid, the originator, brought the reddish colored corn, known as Gordon Hopkins corn, to Illinois from Brown County, Ohio, 1846. Because of a poor stand in 1847, a small yellow corn, probably a flinty type, was used in replanting the missing hills, and so the cross occurred. James L. Reid, a son of Robert Reid, improved the hybrid by selection, his best work being done from 1870 to 1900. He won a prize with it at the World's Fair in 1893, and as a result it soon became widely distributed.

Reid Yellow Dent requires from 110 to 120 days to mature and should be classed as medium late. At present, due to wide adaptability, it is the most common yellow

variety in the Corn Belt, although the type necessarily has been modified to fit many different conditions. The type as now generally grown is rougher than the type which Reid originally preferred.

Outstanding strains of Reid corn are Iodent, Black, McCulloch, and Krug. Iodent is an early Reid developed by L. C. Burnett after years of painstaking ear-row work at the Iowa Station. Black has resulted from a cross of Iodent and a late show type of Reid, made by Clyde Black, of Dallas County, Iowa. McCulloch was produced by selection from a cross of a small amount of Pride of the North with a large amount of Reid. Fred McCulloch, of Iowa County, Iowa, was the originator. George Krug, of Woodford County, Illinois, in 1903 crossed Gold Mine with a Nebraska strain of Reid and has developed Krug corn by selecting continuously for a smoother, rather small-eared type. All of these strains have demonstrated their ability to yield.

Another variety which achieved considerable prominence was Leaming. J. S. Leaming began his selection work about 1856. The variety "Leaming" became popular in the eighties and nineties largely because of the publicity it received in winning prizes at the World's Fair in 1878. Other varieties which received prominence were developed at a somewhat later period. These include such varieties as Boone County White, Johnson County White, Silvermine, and Silver King.

Many men whose names are not linked with some variety did much to improve the open-pollinated varieties of corn, among them P. G. Holden, H. D. Hughes, L. C. Burnett, and the late "Uncle" Asa Turner.

Asa Turner was a devout man. He was also keenly interested in corn improvement—more so than some of his fellow churchgoers thought desirable. One Wednesday, as tradition has it, he attended prayer meeting at Maxwell, in a little village church which was later named for him. The congregation was small. One old lady bowed her head in deep concern and prayed, "Oh God, help Brother Turner pay a little more attention to the Lord's work and a little less attention to corn." Whether the criticism was justified or not, Asa Turner was credited by his neighbors with helping farmers in his community learn better ways to select and store seed corn.

EXPERIMENT STATIONS

During the second period, 1890–1920, experiment stations in the various states assumed the lead in corn breeding. Mass selection had been used extensively by the farmer-breeders. This method of breeding had been in use since the domestication of the corn plant. A second method of breeding—varietal hybridization—was suggested by W. J. Beal, of the Michigan Station, about 1880. In two out of three tests

he obtained varietal hybrids which were higher yielding than either parent. The method aroused little interest at that time. It was further explored during the period 1908-16, but never came into general use.

Rather widespread interest was aroused by a quite different breeding method called ear-to-row breeding. This method was introduced by the Illinois Station about 1896. It was a combination of selection for appearance, which had dominated corn breeding up to this time, and progeny performance. Carefully selected ears were planted, one ear to a row, and records obtained on their performance. The first results appeared promising and the merits of this scheme were vigorously explored.

CORN SHOWS

This period was really dominated, however, by the corn show and later by the corn yield test. As previously mentioned, winning awards at state and world fairs brought such varieties as Reid, Leaming, and Johnson County White into widespread prominence. A score card for judging corn was prepared by Orange Judd for the Illinois State Fair of 1891. This idea was quickly adopted and the corn show was in its "heyday" about 1900-10. Valuable prizes were offered for the best ear and the best ten-ear samples. Often these winning samples were sold for fantastic prices. An example is D. L. Pascal's prize winning single ear. This beautiful ear is now the property of Iowa State College. It won first prize in the 1907 Iowa State Corn Show and after the show brought \$150 at auction. By accident or design one or two kernels were lost from this ear. Pascal felt this loss marred the beauty of the ear to such an extent that he offered \$5 to anyone who would supply the missing kernel. In other shows, winning single ear entries have sold for as much as \$250.

A prize winning sample at a major corn show was not a good measure of the value of that particular variety or strain. It was really a measure of the showman's ability and patience in sorting over hundreds of bushels of corn to find a ten-ear sample corresponding with the score card ideal. Winning a corn show prize became a profitable side line for some farmers. It greatly increased the sale of their particular strain or variety, and the premiums won often amounted to a considerable sum. It is estimated that the premiums won by E. R. and J. C. Mawdsley of Burt, Iowa, in local contests, the state corn show, and the State Fair amounted to at least \$1,200 during a five-year period.

Another important development occurred during this "Corn Show" period. P. G. Holden became impressed by the general poor

stands which were being obtained by farmers. About 1905 he began to accumulate data on this point. Samples of corn were obtained from the farmers' planter box and these lots were compared in test plots located on county farms throughout the state. The results indicated quite clearly that the yield of corn was closely associated with the number of plants per acre. Holden became so convinced of the necessity for bettering stands if high yields were to be produced that he solicited the co-operation of the various railroads operating in Iowa. Special corn tours were organized and lectures and demonstrations were given at every stop on the value of good seed and the relationship between good viability and high yields. This work undoubtedly was responsible for increasing Iowa's total corn production by several million bushels.

In spite of the popularity of the corn show, many people remained skeptical as to its value. As early as 1895 Plumb stated that the corn score card has no more value than a scale of points in judging butter when the breed of cow or her profitable character are not considered. This skepticism increased when various experiment stations began to present data indicating the various score card points were not closely related to field performance. Consequently, more and more emphasis came to be placed on field performance. In many states this took the form of a state yield test. This was true in Iowa where Henry A. Wallace and Professor H. D. Hughes were responsible for starting the Corn Yield Test in 1920. This test disclosed a number of high-yielding strains of corn which became widely grown over the state. Most of these varieties were developed by farmer-breeders and represented selections from Reid Yellow Dent or various Reid hybrids. Included were the familiar names of Clyde Black, H. F. Osterland, Fred McCulloch, George Steen, George Krug, and a score of others who developed superior strains with proven performance and show type characteristics to a marked degree. In spite of apparent progress, the days of these open-pollinated varieties were numbered, although few realized it at that time.

INBREEDING AND CROSSBREEDING

The third period could be designated as starting in 1905 with the systematic beginning of studies on inbreeding and crossbreeding corn. Or 1933 might be chosen, when hybrid corn began to grow on a small but significant scale. However, 1920 was chosen because it was at about that date that the Cornbelt experiment stations began extensive inbreeding investigations with corn.

In 1905, at Cold Spring Harbor, on Long Island, New York, work was begun which eventually was to revolutionize corn production and to make old corn varieties nearly as extinct as the dodo. Dr. G. H. Shull found that when corn was inbred for two or more generations, there was a marked reduction in vigor. This loss in vigor was greatest after the first inbreeding and became progressively less in each succeeding generation. Although this loss in vigor was undesirable from a practical standpoint, it was accompanied by a marked increase in uniformity.

Dr. Shull's experiments didn't stop with inbreeding, however. He crossed some of these inbred strains and in some crosses obtained yields considerably better than the original parent variety. Dr. Shull possessed sufficient imagination to see that such hybrids could be used commercially. The inbred lines then available, though, were so low in yield that the use of such hybrids didn't appear feasible.

In the years that followed only a few people continued inbreeding and crossbreeding experiments with corn. D. F. Jones, at the Connecticut Station, suggested the use of double crosses (a hybrid between two single crosses) rather than the single crosses (hybrid between two inbred lines) used by Shull. This use of double-cross hybrids permitted the production of better size, shape, and quality of seed and materially reduced the cost of such seed.

About 1920 many of the Cornbelt stations started extensive programs looking toward the development of good inbred lines of corn, and eventually hybrids. The work at the Iowa Station was started in 1922. The work was co-operative between the Iowa Agricultural Experiment Station and the United States Department of Agriculture. Dr. Merle T. Jenkins had charge of the program and made several important contributions.

In the early stages of the work, little information was available on what constituted a good inbred line. Any line which could be maintained without too great difficulties was considered worth keeping. However, the value of a line is determined mainly by its performance in hybrid combinations, and the making and testing of such hybrids proved to be a very serious bottleneck. If a corn breeder had four hundred inbred lines, not a very large number as most programs go, it would require the making and testing of 79,800 single crosses to determine the merits of such a group of lines. The production and testing of this number of crosses is practically impossible. Dr. Jenkins and Dr. A. M. Brunson, then located at the Kansas Station, developed and proved the value of a scheme of testing, called the top-crossed test, which has since come into general use. With this scheme

each inbred line is crossed with a common parent, such as an open-pollinated variety, and the resulting top cross is used to evaluate the line. Thus only four hundred crosses were necessary to test the four hundred lines. This simplified very materially the testing of new lines and undoubtedly was an important factor in hastening the widespread commercial use of hybrid corn.

The next problem was of a somewhat similar nature. Suppose that through the use of the top-cross testing procedure the original four hundred lines had been whittled down to one hundred lines.

If these one hundred lines were combined in all possible single crosses, the number of such crosses is 4,950. The hybrid corn used by the farmer is a double cross rather than a single cross. Now when these single crosses are combined into double crosses the total number possible is 11,763,675. If all of these hybrids were made and Iowa's entire corn acreage planted to such combinations, there would be less than one acre planted to each possible hybrid. Assuming one had sufficient staff and funds to test ten thousand double crosses per year, it would require over one thousand years to make and test these 11,763,675 double cross combinations. Of course it is impossible to make and test this number of hybrids. Here again Dr. Jenkins developed a satisfactory and highly efficient short cut by devising a method whereby the performance (yield, lodging, etc.) of double crosses could be predicted from single cross yield records. With such a prediction method available it was necessary to make and test only a small percentage of the total possible combinations. This prediction method is widely used and materially shortens the period between the first inbreeding and the final tested product—the double cross grown by the farmer.

INTRODUCTION IN IOWA

The total process from the beginning of inbreeding through the period of testing until the proven hybrid is ready for the farmer's field requires a period of about ten years. The corn breeding program at Iowa State College was started in 1922. The first hybrids were ready for release in 1932 and 1933. At that time hybrid corn was still considered as some sort of new fangled magic—a passing fad. To help acquaint the farming public with hybrid corn, small samples were distributed to farmers over the state. This seed did not have the show corn kernel and type and many who received the seed refused to plant it, feeding it to the hogs or chickens. A few adventurous souls, however, planted it alongside their regular corn. At harvest time most of these reported a higher yield from the hybrid.

During these early years hybrid corn came in for much criticism.

Corn showmen didn't like it because the ear type didn't conform to the score card ideal. Livestock men who didn't understand the principles involved were very skeptical of developing a superior corn through the use of runts (the inbred lines). Henry A. Wallace and

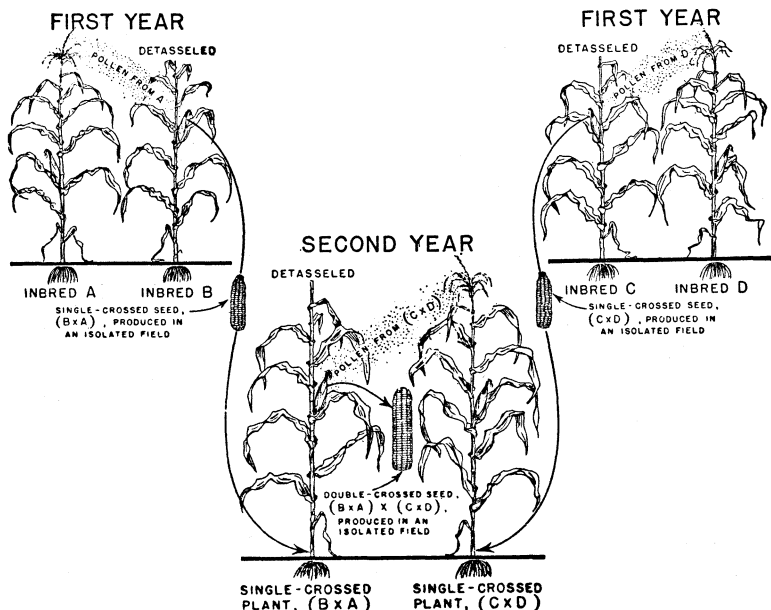


FIG. 3.—Hybrid seed corn, now used for almost every acre of corn planted in Iowa, is produced by means of these carefully-supervised methods. This is the method of producing seed of single and double crosses.

the Pioneer Hi-Bred Corn Company played a very important role during this period in publicizing hybrid corn and in demonstrating that large-scale commercial production was feasible.

The Iowa corn yield test demonstrated year after year that the best hybrid combinations regularly outyielded the best open-pollinated strains. This happened with such regularity that a special class was set up for hybrids. The various hybrid entries competed only with each other. In spite of this distinction the final yield reports continued to tell the same story; an average superiority of 20–25 per cent for the hybrids over the open-pollinated varieties. It was not mainly increased yielding ability alone that sold hybrid corn to the farming public, however. The ability of the various hybrids to stand up when mature probably was the biggest factor in their eventual adoption.

This may appear surprising, since we normally think of the farmer

as being interested in a maximum production per acre. The explanation is simple. Many farmers do not possess wagon scales and therefore cannot determine small variations in yield. Differences in yield must amount to at least 10 per cent to be visible to the eye. But differences in lodging (stalk breaking or root lodging) are readily discerned. During the harvest period these differences become more deeply engraved on the husker's consciousness with each additional ear that he has to stoop to gather.

The development of hybrid corn, its rapid acceptance, and the effect on production has been said to be the most important development in agricultural production of the past century. This is especially true in Iowa where adoption of hybrid corn was more rapid than in any of the other Cornbelt states. In 1933, less than 1 per cent of Iowa's corn acreage was planted to hybrid corn. Ten years later, in 1943, 99 per cent of Iowa's corn acreage was planted to hybrid corn. The effect of hybrid corn on the average yield per acre was striking.

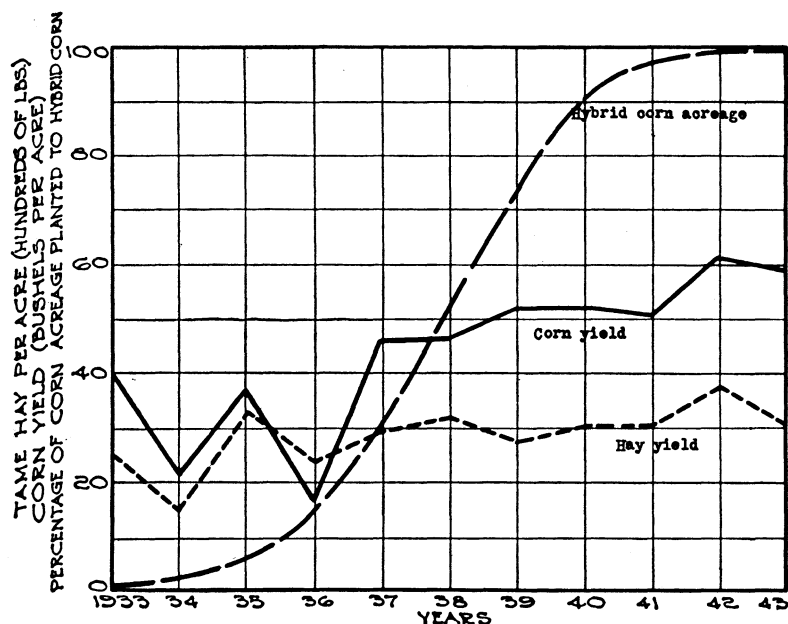


FIG. 4.—The effect of hybrid corn on acre yields.

Increased yields result from many factors: a series of favorable years, improved soil conditions, better practices, etc. However, tame hay should respond to such changes much as corn would. In addition

its growing season is virtually the same and acreage has been relatively constant. Where corn yields rose more than yields of tame hay, the difference may then be ascribed to the effect of hybrid corn.

YIELDS

The average yield of corn in bushels per acre was 53.8 for the five-year period, 1941-45. In four of these years the average yield was in excess of fifty bushels per acre. State average yields in excess of fifty bushels per acre have been recorded only twice before in the history of the state. These two years were 1939 and 1940, years in which hybrid corn comprised a considerable part of the state's acreage.

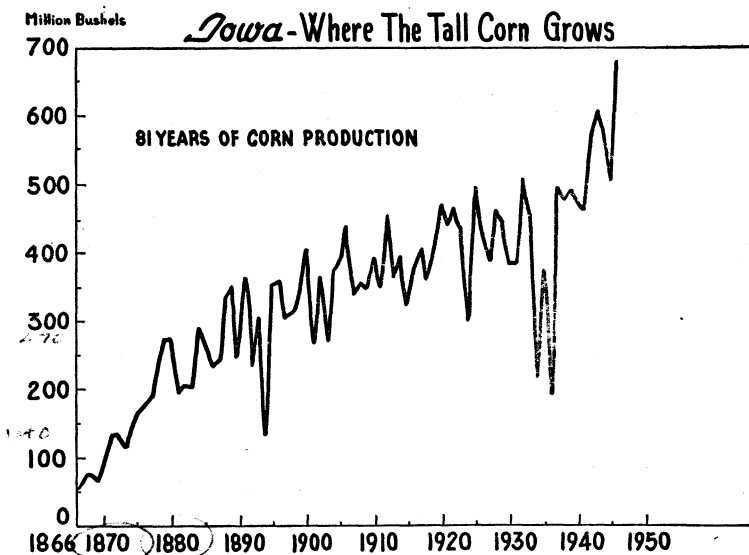


FIG. 5.—By its centennial year of statehood, Iowa's total annual corn production was nearing the 700-million bushel mark in its steadily climbing output.

These figures on acre yield are impressive, but it is difficult to conceive what can be done with 500 million bushels of corn. Table 6 expresses this production in terms of livestock products.

The "what and how" of hybrid corn has been told many times in both popular and scientific language. In spite of this many people think all hybrids are alike. When asked what kind of corn they planted they reply, "It was hybrid corn" or it was "Pioneer," "Funk," "DeKalb," "Station hybrid" or any one of a host of other names. They seldom remember the name of the hybrid, the only means by which they can be sure of getting the same thing the next season. They

assume that all hybrids sold by any one dealer are similar and equal in performance. This is far from true. Different hybrids differ as much in their characteristics as do different people.

Any open-pollinated variety is a complex mixture of types. Some

TABLE 6
IOWA CORN PRODUCTION CONVERTED TO LIVESTOCK EQUIVALENTS

Year	Million Acres	Average Bushels Per Acre	Total Production (Million Bushels)	Pork Equivalent (Billion Pounds)	Beef Equivalent (Billion Pounds)
1941.....	9.1	51.0	465	6.5	3.7
1942.....	9.6	60.0	574	8.0	4.6
1943.....	10.9	59.0	641	9.0	5.1
1944.....	11.0	52.5	579	8.1	4.6
1945.....	10.9	46.5	508	7.1	4.0
Average....	10.3	53.8	553	7.7	4.4

plants are tall, others shorter, some have good ears, others have only nubbins or are completely barren, and so on for all the characteristics which could be listed. Inbreeding, to develop pure strains, is merely a convenient means of sorting this complex mixture out into its separate component parts. Selection practiced during this sorting process enables the breeder to save the desired types and discard the inferior ones. These true breeding strains then form the building blocks from which hybrids are produced. The characteristics of the hybrids vary, depending on the blocks used in its construction.

Hybrid corn's superiority in yield and its standing ability are important qualities, but possibly no more important than resistance to various diseases and insect pests or suitability for mechanical picking. Evaluation of hybrids from these standpoints is somewhat more difficult, however. Serious epidemics of the various corn diseases occur only sporadically, hence data are meager. The same is true for resistance to the various insect pests. But it is a common observation that the hybrids now being grown possess more resistance to disease and insect attack than the open-pollinated varieties previously grown. It also is the opinion of many that the mechanical corn picker would not have come into almost universal use except for hybrid corn.

USES OF CORN

This story thus far has dealt with the changes in corn varieties, production, and breeding methods. There have been comparable changes in the uses of corn. Corn yields more industrial products than

any other grain, but its main use has been and probably will continue to be for livestock feed. The bulk of Iowa's corn production is fed to livestock on the farm where it is raised, but industries use more than 500 million bushels yearly. From one-fourth to one-third of the corn processed by the wet and dry millers and the distillers is returned to the farmer in the form of by-product feeds.

The mixed feed manufacturers are the largest industrial users of shelled corn. This outlet for corn is relatively new and expanding rapidly. The next largest industrial outlet for corn is the dry milling industry. This industry is relatively old and mills for grinding corn were established shortly after the first settlers arrived in Iowa. Their chief products are corn meal, grits, breakfast cereals, and flour. Approximately 85-90 per cent of the dry milled corn products are used as food.

The main product of the wet milling industry is starch, with feed and oil as important by-products. The starch is used for food or for industrial purposes such as a core binder for use in making metal castings, and adhesives. It may be modified by heat, chemical, pressure, etc. into various types of products having adhesive properties. By conversion with acids, syrup or sugar may be obtained. These in turn may serve as raw material for further modification to fill special industrial requirements. When so modified they may be used in bakery products, beverages, chewing gum, lactic acid, jams, jellies, infant and invalid foods, mayonnaise, pharmaceuticals, vinegar, and vitamin C.

The corn oil which is recovered as a by-product is used largely as a cooking or salad oil. The gluten and oil cake by-products find their way back to the farm as livestock feed.

The use of corn by the distilling and fermenting industries is important, but the amounts of corn used are not large compared with other industrial outlets. The principal products are ethyl and butyl alcohols, acetone, and whiskey. Industrial alcohol is used by the manufacturers of such diverse products as medical supplies, synthetic rubber, shatter-proof glass, lacquers, and plastics.

The story of corn in Iowa during the past one hundred years is a story of progress. Superior open-pollinated varieties gradually replaced the immigrants' corn, to be replaced in turn by even better hybrids. Corn acreage increased with an increase in population, more efficient machinery, and better production methods. The livestock population increased with the expanding corn acreage. Corn in excess of livestock feed requirements has found an ever increasing industrial outlet to provide many articles now required by our complex civilization.

Today's major small grain crop in Iowa is oats. The new Clinton oat promises an acre yield increase of 20 bushels or more over the best varieties available even in 1938.

4. The Fields of Waving Grain

H. D. HUGHES, *Farm Crops*

SMALL GRAIN IN IOWA TODAY MEANS OATS. SINCE THE time that Iowa was settled, the state has led the nation in the acreage planted to oats.

Although oats have been of importance in Iowa for almost its entire history, the kind of oats raised has changed a great deal over the past one hundred years, even the past fifty years. Chiefly responsible in the development of one new variety after another has been the Iowa Agricultural Experiment Station. As early as 1889 the Experiment Station was experimenting with oats, reporting that year on the relative performances of fifteen varieties. In 1908 the Experiment Station, summarizing all the oat variety tests made since 1898, reported on seventy different varieties. In 1912 it reported on forty-eight varieties and in 1918 summarized twenty-two varieties that had been studied for six years and seventeen varieties that had been studied for ten years.

The job of getting out new varieties adapted to the weather and soil of Iowa and the Corn Belt was not begun in an extensive way at the Iowa Station until 1907. It was in 1906 that L. C. Burnett, then a young man of twenty-five from the University of Nebraska, came to the agronomy staff to devote his efforts especially to the oat improvement program. He has continued as an employee of both the Iowa Station and the cereal office of the United States Department of Agriculture. Dr. H. C. Murphy, who also has contributed significantly to the oat improvement program in Iowa, has represented the U.S.D.A. in the oat improvement program since 1928.

By 1930, five new varieties of oats originated by Burnett had been distributed from the Iowa Station. Iowa 103 (Albion) was first distributed in 1913. Next followed Iowa 105 (Richland), an early-maturing, yellow-grained, short-straw, stem-rust-resistant variety, distributed in 1914. Iowar was distributed in 1919, and Iogren in 1922. Iogold,

another early, yellow-grained, stem-rust-resistant, pure-line selection from Kherson, was first distributed in 1927.

These five new varieties developed especially for Iowa conditions were all so-called "pure-line" selections, no hybridization being involved. All but Iogren were selections from the Kherson variety. These varieties were quickly adopted by Iowa farmers in place of the old varieties they had been growing.

Thirty-four different varieties of oats were being grown in Iowa in 1910. Green Russian and Early Champion were more commonly grown than others, although Silvermine and White Russian were grown extensively in a few localities. Kherson, introduced into Nebraska from Russia in 1896, was just coming into its own. In the years immediately following 1910 the acreage of this variety increased markedly. Taking the state as a whole, Early Champion constituted 26 per cent of the Iowa crop, Green Russian 28 per cent, Kherson 8, White Russian 6, and Silvermine 4 per cent.

A second survey, in 1924, indicated that only ten varieties were being grown on an appreciable acreage in practically all parts of the state, and only five on any considerable acreage. Of these five, three were Station varieties: Iowa 103, Iowa 105, and Iowar. The other two were old varieties: Green Russian and Kherson. Over 46 per cent of the oat acreage in 1924 was sown to varieties originated by the Experiment Station. Except for Kherson, most of the varieties which were grown in 1910 had been eliminated entirely. Green Russian, the most important variety in 1910, showed an acreage reduction of considerably over 50 per cent. Iowa 103 was grown more extensively in 1924 than any other variety. It was particularly popular in the southern half of the state. Iowar was second in acreage, with its greatest popularity in central and northern Iowa. Iowa 105, a special purpose oat recommended for planting on the more fertile soils where other varieties were inclined to lodge, was grown very extensively in some areas in north central and northwestern Iowa.

A third survey of oat varieties grown in Iowa was made in 1934. The first of the varieties released by the Station, Iowa 103, had given way to Iowa 105 and to Iogold, both of which possessed considerable resistance to stem rust. Iowar, a variety with no rust resistance which had been popular for a time in north central and northern Iowa, was giving ground rapidly at this time to Gopher, a variety from the Minnesota Station with some tolerance to stem rust. The fact that 70 per cent of the Iowa oat acreage at this time was sown with Station varieties indicates the degree to which Iowa farmers took advantage of the best available varieties.

FARM COMPARISONS

When the first of the new oat varieties was available, farmers throughout the state were invited to test this variety on their own farms in co-operation with the Station, by planting a measured acre in comparison with the variety they were growing.

With the new Station varieties being compared with the old kinds on individual farms in all parts of the state and with the threshing usually done by neighborhood groups, information on the superior performance of these new varieties rapidly became common knowledge. Farmers who made these tests sold seed to other farmers in the locality. It is believed that this method of testing and increasing the seed did much in making farmers variety-conscious. This method of distributing and testing the new Station varieties was continued from 1913 until 1938. The difficulty encountered in threshing a small plot of grain and keeping it free from mixture with other varieties finally led the Station, however, to increase the amount of seed supplied to a given individual. Emphasis shifted to establishing seed increase centers, rather than comparing new varieties with those commonly grown.

A new era in oat improvement in Iowa was initiated by Dr. H. C. Murphy, with his discovery of two varieties with outstanding resistance to crown rust and smut: Victoria in 1929, and Bond in 1931. A continuous search for sources of adequate resistance to crown rust had been under way at the Iowa Station since 1915.

Breeding for disease resistance in oats is not a simple matter. The organisms responsible for the more important oat diseases are made up of numerous strains or races which differ greatly in their ability to attack various oat varieties. There are known to be at least 82 races of crown rust, 13 of stem rust, 31 of loose smut, and 14 of covered smut. The distribution and prevalence of these and other oat diseases does not remain constant. Nature is continually producing new races of the organisms responsible for these diseases. Breeding for disease resistance, therefore, is a never-ending task. Fortunately, there are varieties of oats resistant to each of the known races of both rusts and both smuts of oats. These varieties can be combined to produce new varieties resistant to all or nearly all of these races.

Each year since 1929 all of the newly introduced oat varieties obtained by the United States Department of Agriculture from different parts of the world have been grown at Ames and their resistance or susceptibility to the different diseases determined. In 1929, for example, approximately 1,500 oat varieties and selections, obtained from various sources, were observed for reaction to crown and stem

rusts. One of these, Victoria, found to possess a very marked resistance to crown rust and to smut, came from Uruguay. Another was Bond, one of about 100 varieties newly introduced from Australia. Neither Victoria nor Bond was known to be resistant to crown rust or smut until this fact was determined by Dr. Murphy. These two varieties are now used almost exclusively throughout the United States and Canada as sources for resistance to crown rust and smut. Neither of these varieties in its original form is adapted to production in the United States. They are of great value, however, as parent material for the qualities which they can transmit to their progenies when crossed with other varieties.

The marked superiority of the rust-resistant varieties made possible by crossing Victoria on Richland is indicated by the rapidity with which Iowa farmers have replaced previously grown varieties. The Boone, Tama, Control, and Vicland, for example, are all similar-appearing selections from a cross of Victoria and Richland made in 1930. The first of these varieties, Boone, was released in 1939.

These varieties occupied 67 per cent of the Iowa oat acreage in 1943, 90 per cent in 1944, and 95 per cent or more in 1945. The rapidity of this complete variety turnover is believed to surpass that of any similar change, even that from open-pollinated to hybrid corn.

CLINTON OATS APPEAR

On the basis of the above acreages and the farm price of oats in these different years, Iowa farmers profited by higher yields resulting from the oat breeding work of the Iowa Station to the extent of slightly more than 75 million dollars in the three-year period 1943-45. Profitable to Iowa farmers as these varieties have proved to be, they are being replaced by Clinton oats, a still better variety.

In forty-nine community grain trials in all parts of Iowa in 1945 the average yield of Richland and Gopher was 57 bushels to the acre. Marion, Tama, and Boone averaged over 70 bushels. Clinton excelled them all with 84 bushels per acre. In short, Clinton oats promise an acre yield increase of 27 bushels over the best varieties available in 1938.

Clinton proved its worth in still another respect when Iowa's 1946 oat crop was hit hard by a new *Helminthosporium* disease. Yields dropped on thousands of farms, some as much as 50 per cent.

Boone, Tama, Control, Vicland, and other varieties which had the numerous desirable characteristics passed on to them from Victoria as

a parent, were found in 1946 to be susceptible to *Helminthosporium*.

Clinton, Benton, and Marion were among the varieties resistant to the new *Helminthosporium*. Treatment of all seed oats with New Improved Ceresan dust was recommended as the only thing a farmer could do to obtain partial control of the disease when growing one of the susceptible varieties. Field trials showed that when *Helminthosporium* was present, seed treatment might mean the difference between a very poor crop and a fair yield.

With a new variety, Overland (a selection from a cross of Victoria—Richland x Bannock), badly-diseased seed yielded only 30 bushels per acre. Dusting with New Improved Ceresan raised the comparable yield to 49 bushels—an increase of 19 bushels per acre. Clinton in the same trial yielded 88 bushels per acre.

Fifty-five community grain trials were recorded in 1946. Clinton gave an average yield of 80 bushels per acre. Marion showed 76; Gopher 75; Richland 70; Tama 64; and Boone, 59 bushels per acre. The seed used of Tama and Boone was infected with *Helminthosporium*, but all of the seed was treated before planting. Because 98 per cent of Iowa's 1946 oat acreage was sown to resistant varieties, the rusts and smuts did not appreciably influence the 1946 yields.

The upset written into the oat planning program by the appearance of *Helminthosporium* was that for the first time in the history of the community trials, the old rust- and smut-susceptible Gopher and Richland varieties outyielded Tama and Boone.

When the new Clinton oat was developed, there was the problem of getting enough seed to distribute to farmers. Starting with 25 *pounds*, Clinton oats were increased in one year to 1,207 *bushels*. In the fall of 1943, 25 pounds of seed were shipped to Arizona for a winter crop. There it was sown in October, and from this planting 67 bushels were harvested in May, 1944. This seed was rushed by express to Idaho where it was immediately planted, and 1,207 bushels harvested in August and shipped to Ames.

Iowa farmers grew it under contract during 1945 and in the spring of 1946 more than 24,000 bushels of the seed were distributed to farmers in Iowa, allotted to the various counties on the basis of their 1944 oat acreage. Those who planted Clinton oats were required to sell at least one-half the crop to other farmers for seed, and not to sell more than fifty bushels to any one farmer without the consent of their county seed distribution committee.

The seed could not be sold at more than \$1 per bushel above the

price of U. S. No. 2 oats at Des Moines on December 1, 1945. Every precaution was taken to insure that Clinton oats would be available to Iowa farmers in the shortest possible time, and to assure crops would be handled by farmers who had the soil and equipment to get the most and the best possible seed from that distributed.

In the past the effects of a new variety have seldom been apparent quickly. For example, few variety introductions have had far reaching importance equal to that of the Kherson, introduced into Nebraska from Russia in 1896. Although Kherson had become an important variety in Iowa in 1910, its greatest influence was as the parent of other varieties. The four varieties distributed from the Iowa Station prior to 1930—Iowa 103 (Albion), Iowa 105 (Richland), Iowar, and Iogold—are all pure line selections by Burnett from the Kherson. The Richland, in turn, was one of the parents of the disease-resistant varieties Tama, Boone, Control, Vicland, and others. The Kherson contribution to the Clinton variety is regarded as of still greater importance, for the Clinton stems back to a cross made by Murphy in 1932 between Bond and D-69. The D-69 is a selection from a cross made by Dietz in 1918 of rust-resistant Richland and Green Russian.

The production of superior new varieties is not a short-time program. It was seven years after the pure line oat improvement program was inaugurated by Burnett at the Iowa Station before the first variety went out—Iowa 103 in 1913. Iogold, the last of these varieties (not released until 1927), came from a plant selected in 1906. The crown rust and smut resistance of the Victoria variety was discovered by Murphy in 1929, but it was ten years before the first variety resulting from the use of Victoria as a parent in crosses went out from the Station—Boone in 1939.

The parents of Clinton oats have an even longer history. The crown rust and smut resistance of Bond, one of the parents, was discovered by Murphy in 1931, fourteen years before Clinton was obtained. The other parent of the Clinton represents work continued over an even longer period—work that it seemed for many years was not to yield any economic returns. Of many crosses and selections made by Dr. S. M. Dietz in 1918, none of which came into commercial use, two were used by Murphy in 1932 to cross with the Bond. These were the selections D-67 and D-69. Both of these got their stem rust resistance from the Richland and Green Russian varieties crossed by Dietz. Richland was Burnett's pure line selection out of Kherson, first selected by Burnett in 1906 and released to Iowa farmers as a new variety in 1914.

WHEAT

Iowa is not a wheat-growing state today, in spite of the relatively large acreage grown in the earlier years of its history. The farmers who broke the Iowa prairies seeded them to wheat for the quick harvest of needed food and because wheat could rather easily be transported to a ready market, providing a cash income. Changing market and economic conditions, the greater prevalence of wheat diseases, and increased profitableness of other products of Iowa farms all contributed to the rapidly diminishing importance of wheat.

Iowa lies in a peculiar position with reference to the principal wheat-producing areas of the Midwest. The spring wheat area on the north, the hard wheat area on the west, and the soft wheat area on the south and east, all find their limits within the borders of Iowa. The boundaries of these areas are not well defined, however, each different type fading out as the profits from it, compared to other crops and other types of wheat, diminish. The boundaries change from time to time as a result. The history of these shifting boundaries, together with the causes for such shifts, constitute the history of wheat production in Iowa.

When the land between the Mississippi and the Missouri rivers was taken up by pioneer farmers, all of the territory now known as Iowa was in the spring wheat area, and continued so until nearly 1900. In 1860, thirty-four counties reported winter wheat being grown, but in only five of these counties was it considered a dependable crop. As better, more hardy, winter varieties were introduced, their acreage expanded, but it was 1912 before the winter wheat acreage equaled that of the spring varieties. Since that time, the winter wheat acreage usually has been consistently larger than that of spring wheat. The apparent reason for this change was the replacement of the soft red varieties by the hard red Turkey wheat, which was much more winter-hardy and produced a high quality of flour.

So far as is known, the late George W. Franklin, of Atlantic, was the first Iowan to grow this type of wheat. Before his death Franklin described his connection with Turkish wheat as follows:

In 1855 I bought a load of rye from a man and sowed a field I wished to put to clover. In the fore part of the next summer when the rye was heading out I discovered that a large percentage of it was wheat. Having a portion of the field extending in a neck, I concluded to remove the rye from that part of the field and get some seed of the wheat. By the appearance of the heads I observed that it was not Odessa, but that it was some very hard variety, heavily bearded, not known in this part of the country. That fall I sowed this seed and it lived and gave good returns. There was still some rye in it. On a sandy knoll I observed that both rye

and wheat killed out, and this led me to the belief that it was as hardy as rye, and so I advertised it for years.

I kept on sowing this wheat, removing the rye each year as it headed out until I got it practically free from rye. From the year 1886 I began sending it out to other states and all over Iowa under the name of Hardy Turkey Red winter wheat.

When I first introduced it the millers would not give within 5 to 10 cents per bushel as much for it, claiming that it was too hard for milling purposes. As the years rolled by it became quite plentiful and the millers learned how to mill this hard wheat. Our yields have been from 22 to 42 bushels per acre. Have never had any of this variety winter kill, but have lost some on account of exceedingly dry weather in winter.

While every Iowa county now reports the growing of winter wheat, by far the heaviest concentration is to be found on the bottomlands of the Missouri and the Mississippi, and along the Iowa River and its tributaries in central Iowa. A very limited acreage of spring wheat is found in the northern half of the state, where the crop is used largely as poultry feed.

The largest acreage of winter wheat in Iowa was the 1919 crop of 864,588 acres. This has declined steadily until in 1945 the acreage was but 120,000. The largest acreage of spring wheat, 1,539,391, was the 1899 crop. In 1945 it amounted to only 3,000 acres.

BARLEY

Barley usually has been a profitable crop in about fifteen northwest Iowa counties, but in the state as a whole it has never been very popular. Only twice during the last fifty years, in 1901 and again in 1928, has the acreage reached six hundred thousand, and in only seven of these fifty crops has the yield averaged as much as thirty bushels per acre. By 1945 the acreage had dropped to three thousand.

The problem of barley production under Iowa's relatively high moisture and temperature is one of disease, chiefly scab. This organism grows readily on corn and wheat as well as on barley. It winters on cornstalks in the field and thus in Iowa, where more than 50 per cent of the land is planted to corn, we have an ever-ready source of infection. As yet no disease-resistant varieties are available, and other control measures have not been effective.

RYE

Rye has never been an important grain crop in Iowa. The largest acreage in any one year was 222,000 in 1897. The 1945 acreage was approximately 12,000. Only the winter variety has been planted in Iowa. Rye is relatively better adapted than other small grains to sandy, infertile soils. The varieties generally grown in Iowa are extremely winter-hardy, so it is possible to seed later in the fall than

any of the winter wheat varieties. As in pioneer days, much of the winter rye acreage seeded is used for pasture in the very early spring, and sometimes also in the fall.

FLAX

Fiber varieties of flax were among the first crops introduced from Europe and were grown for home use on most American farms as late as 1840. Fiber flax has long since disappeared for all practical purposes from American agriculture. All of the flax acreage in Iowa is of the seed type, for processing into linseed oil and meal. In Iowa the peak acreage of 322,778 was reached in 1885. As the new land disappeared, the acreage decreased gradually for about twenty years and then very rapidly fell to only 10,000 acres in 1915. Since 1925 there has been a small but consistent increase and with the war needs for oil seeds, flax acreage exceeded 300,000 in 1941 and 1943. The important flax area in Iowa lies in a dozen or so counties in northwest Iowa.

As with the small grain crops, disease has been of primary importance in the production of flax. Until varieties resistant to flax wilt were developed at the North Dakota Station about 1900, flax was thought to be a crop that could be grown only on virgin soil. Now that the wilt disease is better understood and resistant varieties have been developed, flax is grown successfully in the northern area in farm rotations.

Wild prairie grasses that once covered most of the state have had their role taken over by other, more valuable grasses and legumes.

5. Forage Crops that Feed the Livestock and Save the Soil

H. D. HUGHES, *Farm Crops*, and
MAURICE E. HEATH, *Soil Conservation Service*

FORAGES, INCLUDING PASTURES, UTILIZE THE LARGEST acreage of any Iowa crop. Iowa folks are more aware of the extent of the corn fields of the state than of the hay and pasture acreage. Iowa's pasture acreage alone, however, equals that of corn—between ten and eleven million acres. This means that about 30 per cent of Iowa's farms is in pasture. The hay acreage is a little less than half this, averaging over the long period of years between three and four million acres.

When Iowa was first settled, most of the prairie—and 85 per cent of the state *was* prairie—was covered with tall grass, almost head high. In some places Indiangrass and big bluestem grew “so tall and dense that herds of cattle were lost to view and could be found at evening only by listening for the tinkling of a cowbell or watching for the waving of the tops of the grass.” One pioneer said, “The white-topped blue wagons of the pioneers moving slowly across the prairies looked like boats at sea, a sea of grass, the surface of which the winds caused to roll in great billows.”

The prairie was a complex of native grasses, legumes, and other flowering plants. Along the sloughs the tall, coarse prairie cordgrass and bluejoint reedgrass were often found in pure stands. On well drained aerated soils big bluestem and Indiangrass held forth. Little bluestem and sideoats grama were found on the steeper hillsides and drouthy sites. Except in spring, when snow was melting, water was scarce and had to be shared by the prairie grasses. Plants with shallow roots, extending only about a foot and a half into the ground, gave way to other grasses with roots that went down four or five feet. Still later other grasses came on with roots that sometimes went as deep as twenty feet. About 65 per cent of the prairie grasses extended their

roots below five feet. The bulk of the prairie was below, not above the surface of the soil. When a farmer mowed the prairie in the fall, getting yields of as much as two to three tons of dry hay per acre, he left a still greater tonnage of living plant material in the surface few inches of soil. As a result of such subterranean growth and decay, native grasses over thousands of years built up our deep, rich, black soils.

Little of the rainfall ran off the soils and the water that did run off was clear, for the soil was protected by litter and leafmold, held in place by the stems and the deep spreading grass roots. Because the prairie cover broke the force of even torrential downpours, mud did not clog the pores of the soil and so keep water from soaking in. So thick and tough were the roots of these grasses that where possible the pioneer did not attempt to break the sod until the grasses had been weakened by grazing and repeated mowing.

For a time the prairies furnished the settler both pasture and hay in unlimited amounts. Later, overgrazing of pastures and need for more nutritious forms of hay led to the replacing of wild prairie grasses with other, more valuable, grasses and legumes. Today, these original grasses can be seen only occasionally along railroad right of ways, in early settlers' cemeteries, and on an occasional small area of native hay land. One of the best examples of the prairie cover of one hundred years ago is to be found in a pioneer burial ground fourteen miles west of Albia on Highway 34. Somewhat similar areas also are to be found in northern and northwestern Iowa where small areas have remained unbroken, the grass being cut at hay.

The dreaded ravages of prairie fires have been described in George A. Ide's *History of Union County*:

In the autumn the annual fires on the prairies were a menace to the first settlers. At the first heavy frost the prairie grass was killed and becoming dry in a short time would readily burn. There was nothing to hinder the ravages of the fierce fires that swept over the prairie, and the approach of a prairie fire fanned by the wind meant danger to life and property. Few indeed were so incautious as to make no preparations against them. The usual method of protecting buildings, stacks, fences, and bridges was to plow a few furrows around the property and set "back fires," burning the grass slowly against the wind, thus placing a burned strip between the pioneer's home and the oncoming flame. . . Fires were sometimes started by the carelessness of hunters or travelers. These fires were frequent during the entire dry season and the flames could often be seen at night at a great distance reflected in the sky. They left in their blackened path ashes which were taken up and hurled in clouds by the high winds which generally prevailed in connection with them. This often continued for days after great areas had been burned in this and surrounding counties. The smoke and dust at such times were of such density as to partially obscure the sun for days.

As late as 1887 prairie hay was being shipped from Iowa to eastern markets, especially from Kossuth, Palo Alto, and Pocahontas counties. After making a trip through northwestern Iowa in 1887, Professor A. A. Crozier, botanist for Iowa State College, reported:

The area available for cutting is being rapidly diminished, owing to demand for land for cultivation and for pasture, so that the privilege of cutting on the open prairie is no longer free. The price of hay in the field . . . was \$2 to \$2.50 a ton. . . Tame hay usually brings \$1 a ton more . . . In some localities it is the practice to burn the prairies in the fall or early spring.

As pastures were inclosed and grazed heavily throughout the summer, native grasses were weakened and gave way to a newcomer, Kentucky bluegrass, fully as aggressive as some of our most noxious weeds.

BLUEGRASS

Bluegrass came to the United States from Europe, where it is native but of little importance. Although it is not known where bluegrass first entered North America, it is believed to have been used as packing material by the early immigrants from Europe. It was reported at Montreal, where the French seeded it with white Dutch clover as early as 1751. Today, bluegrass is by far the most extensively grown pasture grass between the Missouri River and the Atlantic, and as far south as Kentucky and Tennessee. More than 90 per cent of the bluegrass pastures in Iowa developed spontaneously, encouraged unwittingly by early settlers who weakened the prairie grasses by close grazing, frequent mowing, and burning.

Once bluegrass had become established, Iowans were not slow to recognize its advantages. In 1889 a Bluegrass League was formed, with members from eighteen counties and headquarters at Creston, in Union County, for the purpose of advertising the bluegrass region of southwestern Iowa as a place for permanent home building. Stock was generally subscribed to at the rate of \$25 per share, and the League erected a "Bluegrass Palace" on the fair grounds near Creston in the fall of 1889.

The palace was one hundred feet square with four main towers at its corners, the principal tower rising ninety-two feet. The main entrance was through a horseshoe arch built of baled hay, the top of which furnished a speakers' stand. Baled hay was used for gateways and for all projections and towers. The Exposition was formally opened by the governor, accompanied by his official staff in uniform. In 1890 the palace was enlarged. Two wings increased the length to 265 feet and the width to 130 feet. The main tower of the building

was 120 feet, with 90-foot towers on the wings and a 100-foot tower over the main entrance.

Since the beginning of the century, Iowa has had between ten and eleven million acres of open and wooded pasture each year, most of it bluegrass. The acreage of permanent pasture is particularly large in southeastern Iowa where it accounts for as much as 50 per cent of some townships. Land left in pasture usually is that too rough or gullied to be cropped. Some Canada bluegrass is to be found on the less fertile side hills, with Kentucky bluegrass on the bottoms, and on the flat, less eroded tops. A good deal of redtop is also found, usually mixed with bluegrass. Northeastern Iowa, where much of the land is rather steeply rolling, also has a large acreage of permanent pasture. Comparatively little Canada bluegrass or redtop is found here, however. In eastern and east central Iowa the acreage of pasture is large but most pastures are rotated, planted to red clover, alsike, and timothy. Unless generous quantities of lime are used, the soil is too acid for alfalfa or sweetclover. In the Western Livestock Area, sweetclover seeded in small grain has been generally used in the late summer and fall as pasture for cattle brought in from western ranges. Bromegrass and alfalfa are now coming to be used here extensively for pasture as well as for hay.

Early settlers discovered that bluegrass was a "cool-weather grass," growing early in the spring and then turning dormant in midsummer—one of its greatest weaknesses as a pasture plant. In more recent years the heat and drouth of 1934 in southwestern Iowa and of 1936 in western and southern Iowa was so severe as to entirely destroy a large portion of the bluegrass on permanent pastures, particularly that which had been closely grazed. Although bluegrass always becomes dormant and unproductive when temperatures are high, this is the only known record of actual killing of bluegrass by excessive heat.

With the destruction of bluegrass, keen interest developed in bromegrass and large acreages of it are now being seeded for pasture in all parts of the state. The advent of such high yielding plants as bromegrass, the clovers, and alfalfa, together with the soil treatments needed for them to flourish, has prompted a few farmers to say goodbye to bluegrass.

From the very beginning the native grasses, and later the aggressive bluegrass, which is a heavy seed producer and forms a heavy dense sod, provided pasture without any effort on the farmer's part. Because of this, pastures were neglected, both as to maintenance and grazing management. As a result they deteriorated greatly, and peren-

nial weeds crowded in to take up much of the plant food and moisture that might have gone into grass.

Iowa farmers are generally regarded as among the world's best in the production of corn, soybeans, and small grain crops, but Iowa land had been under the plow for three-quarters of a century before any particular attention was given to methods of increasing returns from permanent pasture lands.

Reports from studies at Iowa State College showed that continuous close grazing resulted in a weak, thin sod, because root reserves could not develop, and weedy plants came in to compete with the grass. It was shown that greater seasonal returns could be obtained when grazing was not permitted in the spring until the grass had made a cover growth of several inches. Forage-minded farmers here and there accepted a pasture renovation program and doubled the returns from permanent pasture by liming, phosphating, and introducing a mixture of clovers.

ROTATION PASTURE SEEDINGS

Greater acre returns were obtained by farmers from pasture sufficiently level to be plowed, by including it in the regular rotations, leaving land in pasture for only a few years at any one time. A mixture of timothy and red clover or timothy, alsike, and red clover, probably has been used much more extensively for rotation pasture seedings than any other. Beginning about 1910 an increasing number of farmers seeded sweetclover in small grain, which was pastured in the late summer and fall of the seeding year and again in the second year of growth, giving unusually large acre returns. The loss of animals from bloat on sweetclover pasture became so serious in some parts of the state, however, that the use of this legume for pasture, except in mixture with other clovers and grasses, has been considerably reduced.

Although the native grasses could not maintain themselves as pasture with close, continuous grazing, this was not the case when they were allowed to make their full growth and were harvested for hay late in the season. Native grass stands maintained themselves for many years when harvested as hay. In general the acreage of the native grasses went out rather rapidly, because under Iowa conditions the improved grasses and clovers were more palatable and nutritious. Also, it was practically impossible to re-establish stands of these native grasses once the land had been plowed. By 1910 the acreage of wild grass harvested as hay was down to 845,000 and by 1940 it had almost disappeared.

Agricultural reports from southeastern and central Iowa counties as early as 1860 indicate that more and more timothy and red clover was being seeded at that time for hay, with excellent results. Settlers coming into southeastern Iowa from Ohio and states farther east were familiar with timothy and red clover, and the soil and climate of Iowa were found to be especially well suited to this combination. A mixture of red clover and timothy has continued to be the most generally grown hay crop in southern, central, and eastern Iowa. Red clover and timothy also are used extensively for hay in central and north central Iowa, although farther west in the state this combination gives way to alfalfa or to alfalfa and brome grass. In comparatively recent years the straight seeding of alfalfa has given way to combinations with grasses.

The census of 1910 reported four million acres of hay in Iowa, a little less than one-fourth of which was in wild grass. The total alfalfa acreage at that time was twenty-nine thousand, with practically all of this in the extreme western counties. By 1941 Iowa had slightly over one million acres of alfalfa, with by far the largest acreage still found in the western Iowa counties. Excellent fields of alfalfa are found in all parts of the state, however.

Timothy, brome grass, reed canary grass, and Canada blue grass, in addition to the Kentucky blue grass, have survived the testing years and continue to be grown in significant acreages in Iowa.

TIMOTHY

Timothy is the hay grass which has been grown more extensively in Iowa than any other through all the years of the state's history. Brought in by the first settlers, it was found to be unusually well suited to Iowa's soil and climate. A large acreage in southeastern Iowa, and a somewhat smaller acreage in the northeastern part of the state, is harvested annually for seed. Iowa has continued to lead all other states in the production of timothy seed. The general procedure in harvest has been to cut with a grain binder when the heads were fully mature and the seeds were beginning to shatter, complete the curing in the shock, and thresh with an ordinary grain separator. More recently, the combine has come into extensive use, though the quality of the seed obtained in this manner of harvest is considerably inferior to that cured in the shock.

BROMEGRASS

Professor R. P. Speer, director of the Iowa Station, stated as early as 1890 that smooth brome grass was the most promising grass for Iowa

ever grown at the Station. It was not used much in Iowa, however, until after the drouths of 1934 and 1936 in western Iowa, where bluegrass was so generally killed.

Bromegrass has been found one of the best grasses for use in combination with alfalfa on the more rolling lands of Iowa. Its spreading root system qualifies it for soil conservation, where it has found use in waterways, terrace outlets, and sod flumes.

One of the factors that discouraged the use of bromegrass following the drouth years was the fact that some of the seed generally available was of strains or types not best suited to Iowa conditions. Recent tests have shown that the so-called "southern strains" grown in Nebraska, Kansas, and Iowa are better adapted to the soils and climate of Iowa than the northern type. Farmers using the recognized southern strains of Fischer, Lincoln, and Achenbach obtain stands easily with good production the first hay or pasture year. Bromegrass and such high-producing legumes as alfalfa or red clover make an unbeatable combination as a forage crop for hay and pasture purposes.

REED CANARYGRASS

Reed canarygrass, unlike other cultivated grasses grown in the state, is native to Iowa. It originally was found in poorly drained areas, where water may stand for months at a time. It forms a very heavy, deep sod, and from a thin stand will, in a short time, cover the ground completely. Mucky, bottomless quagmires, in which animals became bogged down, when seeded to reed canarygrass have grown such dense sod that animals can pasture freely or the growth be mown for hay.

Strange as it may seem, this grass also has been found to be one of the most drouth-resistant and productive grasses on upland soil. In the hot, dry seasons of 1934 and 1936 it was the one grass that maintained its green, succulent appearance on uplands when other grasses became dry and brown.

In recent years considerable attention has been directed to this grass because of its apparent value in erosion and gully control. It is particularly adapted for use on overflow and poorly drained soils along stream bottoms, and in peat and muck areas. With one of the strongest and heaviest root systems of all the common grasses it is ideal for waterways, sod flumes, and along the waterline of farm ponds. It is believed that up to a million acres of Iowa land are suited to the growing of reed canarygrass. Considerable selection work done by the Iowa Station since 1920 resulted in an improved strain recently released as Ioreed canarygrass.

REDTOP

Redtop, like timothy, came into Iowa with migrating farmers from states farther east. It is mentioned repeatedly in the earliest records on Iowa agriculture. Its growth is mostly as a volunteer catch in permanent pastures, usually in mixture with Kentucky bluegrass. It thrives on distinctly acid uplands and is especially well suited to poorly drained bottoms. It is not regarded highly as hay or pasture since the feeding value is relatively low and the plant readily becomes unpalatable as it matures.

CANADA BLUEGRASS

Canada bluegrass is another of the grasses found volunteering freely on a rather large part of the permanent pasture areas in southern Iowa. As lands become thin and unproductive, Kentucky bluegrass is replaced by Canada bluegrass. Pure stands of Canada bluegrass are likely to be found on steeply rolling pastures of the thinner side hill slopes, with Kentucky bluegrass in pure stands or in mixture with redtop on the more level ridge tops and on the more fertile bottomland areas.

Canada bluegrass is regarded as much less desirable than the Kentucky bluegrass since it produces few basal leaves, and such leaves as are borne on the stem are relatively small. When once grazed off, there is very little recovery during the balance of the season. This grass is easily distinguished from Kentucky bluegrass by its flat stems and bluegreen color.

Legumes, like the grasses, differ in their values under different soil conditions and for different uses.

RED CLOVER

Red clover was the first legume to be grown extensively in Iowa. It was first planted extensively in southeastern Iowa where, as land was cropped through a period of years, the need for a legume in the rotation became apparent. Red clover bacteria apparently were naturally present in the soil. Good stands usually were obtained from the very first. As cropping continued the soils became increasingly acid in reaction, but since red clover has a rather high tolerance to acid soil, it made satisfactory growth under soil conditions which would have made alfalfa or sweetclover growth impossible. The acreage of red clover has continued to be largest in the southeast third of the state where it is ideally suited to rotations there and to a wide variety of soils. In this area many seedings of straight red clover are made,

often the second cutting being harvested for seed, but more generally for hay.

If the plants are cut when in full bloom, a vigorous second crop comes on. Iowa is one of the most important red clover seed-producing states, though we do not usually produce as much seed as we use. Seed yields have not been large as a general rule. It is necessary for insects to visit the red clover flower in order to bring about cross-pollination. Flowers of this plant are generally self-sterile. The bumblebee is ideally suited to the fertilization of the red clover flower, but with the increased proportion of land under the plow, bumblebee nesting places have been generally destroyed. Honeybees have been observed working red clover extensively in certain seasons, but are likely to neglect the red clover when pollen can be obtained more easily from flowers of other species.

An acreage greater than that of straight red clover is seeded with timothy, to which alsike is sometimes added. This combination is used extensively in eastern and northeastern Iowa where straight seedings of red clover are not common. Comparatively little alsike is seeded alone in Iowa as it does not give the second cutting usually had from red clover.

ALFALFA

Alfalfa first made its appearance in Iowa on a significant acreage in the southwestern counties in the late nineties, coming in from Nebraska and Kansas. This crop gave large yields and grew thriftily on the Missouri River bottoms, as well as on the deep, loess upland soils of this area. Small trial plantings by individual farmers throughout the state, however, were not generally successful, owing to the fact that many of the soils were acid and the proper bacteria not present. Little or nothing was known of the acidity of Iowa soils at that time. It was assumed that because alfalfa was successful in western and southwestern Iowa and that good results were obtained from plantings by the College at Ames without liming and without inoculation, that the same condition might be expected to prevail in other parts of the state.

In 1910 some thirty-five farmers in different parts of Iowa made experimental plantings of alfalfa in co-operation with the Experiment Station. Part of each of these plantings was limed, another inoculated, and still another both limed and inoculated. The results reported by the Experiment Station in 1913 showed that for success with this crop in most parts of Iowa it would be necessary to apply finely ground limestone to correct the soil acidity, and to inoculate, since the bacteria

necessary to enable alfalfa to take the nitrogen from the air were not generally present.

With this information available the acreage planted to alfalfa increased rapidly throughout the state. The heaviest plantings continued to be made on the deep, porous loessial soils of western and southwestern Iowa where liming was not necessary, but successful fields of alfalfa were soon found in every Iowa county. In 1910, total alfalfa acreage was slightly under 25,000. This increased steadily and rather rapidly, with a peak of 1,134,000 acres in 1942.

After the Grimm variety came to be recognized generally as a particularly winter-hardy variety, the more progressive farmers insisted upon getting certified seed of this, and no other. Early in the twenties, however, a wilt, a disease previously unknown, made its appearance. Prior to that time seedings of alfalfa often continued productive through as many as six to ten years. Stands thinned and became unproductive by the end of the third year—sometimes sooner. Grimm, which had been generally accepted because of its winter-hardiness, became undesirable because of marked susceptibility to wilt. Two varieties introduced from abroad, however, proved wilt-resistant, and alfalfa acreage has increased steadily. One of these new strains, brought in from India and first tested extensively in northern Montana and later by the Iowa Experiment Station, was Ladak. It was found to be somewhat wilt-resistant and winter-hardy, as also was the Cossack variety. More recently two new varieties markedly superior in wilt resistance, Ranger and Buffalo, have been developed by the United States Department of Agriculture in co-operation with the different state experiment stations.

SWEETCLOVER

Sweetclover, a legume but not a true clover, was long regarded as a troublesome weed. As early as 1900, however, an occasional Iowa farmer was using it for pasture and for soil improvement purposes. One of the outstanding pioneers was Frank Coverdale, a farmer near Maquoketa, who not only used the clover extensively, but with a crusading spirit went out to sell it to the world. He wrote extensively for agricultural journals and addressed farm groups at every opportunity. By 1910 it was not uncommon to see fields seeded to sweetclover, and by 1920 it was seeded very generally on the nonacid soils of western and northwestern Iowa.

The sweetclover has a very hard, dense seed coat so that the seed at maturity cannot absorb moisture and germinate promptly. Many

seedings failed to make stands until the "Ames Scarifier," invented by H. D. Hughes, was released by the Station in 1913. It was adopted immediately by many seed growers and most seedsmen. It is credited with making the use of sweetclover as a field crop possible. Seeds put through this equipment are scratched and the seed coat softened so that after scarification excellent stands are obtained from seed which otherwise would fail entirely. The scarification of sweetclover seed has come to be recognized as essential.

Educational and research agencies came generally to advocate the seeding of this legume, because of its value in soil improvement as well as in mixtures for pasture. Its use became general throughout the Corn Belt and over an even larger area wherever soils were sufficiently sweet to permit its production.

Because sweetclover was generally seeded in small grain and plowed down late the same fall or early the following spring as a means of adding nitrogen and organic matter to the soil, it has never been possible to get data on the acreage planted. The only count on sweetclover acreage is on that held over for the second year to be harvested for seed, as hay, or used for pasture. Such acreage was but a very small percentage of that seeded. It has been estimated roughly that perhaps two million acres were seeded annually.

Biennial white sweetclover at first was grown more extensively than the biennial yellow. Greater persistency of the yellow and the fact that it produced seed much more generously led gradually to the more general acceptance of the yellow flowered species. Most seedings in recent years have consisted of a mixture of the biennial yellow and biennial white kinds. A superior new yellow, known as Madrid, is now becoming available.

In 1919 seed of an annual, white flowered sweetclover was given wide distribution by the Iowa Experiment Station. This clover has come into extensive use in certain sections of the country, under the name of Hubam clover. It is grown most extensively on the heavier soils in the Cash Grain Area in northwest central Iowa, where it is particularly desirable to plow in the fall. Hubam is also grown in the cotton area of southern Texas and the sugar beet area of Colorado.

SOYBEANS

Soybeans for many years were considered a forage in Iowa. At least 60 per cent of the crop was cut and used for hay. War needs for increased supplies of oil and high protein concentrates increased soybeans from a few thousand to over two million acres annually.

Almost all is harvested for the mature beans, the crop going to soybean processing plants for oil extraction.

The first extensive planting of soybeans in the state was in southeastern Iowa, where the common procedure was to drill the beans with a small grain drill, cut them with a mower, and handle as any other hay crop. Although soybeans respond to liming and fertility they can be grown with great success on distinctly acid soils where alfalfa and sweetclover cannot be grown, and where most other legumes make a rather unsatisfactory growth.

A little later a considerable acreage developed in northeast central Iowa, where the crop was used with great satisfaction as a high protein hay and also as a concentrate in the feeding of dairy cattle.

As the demand for an increased acreage of soybeans developed in World War II, the big expansion came on the level soils of central and northwest central Iowa, where soil erosion is least likely to occur. On the more rolling soils, serious erosion sometimes was associated with the soybean crop.

Korean lespedeza was first introduced into the Corn Belt by the United States Department of Agriculture. Extensive seedings were made in southern Iowa. This legume is an annual which must reseed, carrying over from year to year by volunteer seeding. Even in southern Iowa the season is hardly long enough to insure seed maturity although in Missouri the lespedeza acreage is now estimated at about fifteen million. Earlier-maturing strains have been developed by the Iowa Experiment Station, however, and as these become generally available it is anticipated that lespedeza will come to play a very important part in pasture improvement on the less fertile, acid soils of southern Iowa.

Development of oats that don't rust even in wet years, varieties of other grains and plants that are disease-resistant, seed-treatment methods that insure better crops—all mean money in the farmer's pocket.

6. Winning the Fight Against Plant Diseases

J. C. GILMAN and MILDRED HEMMINGSEN, *Plant Pathology*

TODAY IOWA FARMERS PLANT OATS THAT ARE RUST RESISTANT, potatoes that are certified disease free, seed corn that has been protected from root rot and seedling blight. They grow relatively little barley and wheat, knowing how often these are attacked by disease. They know that sick plants, like sick animals, mean a loss for the farmer. Yet a century ago the idea that plants could have disease was looked upon by many as a wild and fantastic dream.

The pioneer settling the prairie was looking for an opportunity to establish himself and his family on this new and uncropped land. Food and money were primary. Self-sufficiency was all-important. A farmer had to raise corn, oats, and barley for his livestock; potatoes, fruit, and vegetables for his family; cash crops like flax and water-melons if possible.

But as the years passed, plant diseases helped decide what crops would be grown. Wheat, once a standby, faded to minor importance with passing years. Many years the yield was high, but occasional losses from scab and rust, as well as heavy rains at harvest, made it undependable. Flax wilted and died. Barley was subject to a host of diseases that finally drove it from Iowa. But corn was a staple that always paid out. It seemed to stay healthy while plants on all sides were stricken by disease. That was one reason that Iowa became a corn-growing state.

Early in Iowa history, when science first began talking about fungi and parasites on plants, it didn't make sense. Farmers knew the weather had something to do with rust and rots. Those plants might have been dying as a direct result of heavy rains or hot sunshine even without the fungi. But in recent times when science has developed

watermelons and flax that don't wilt, oats that don't rust even in wet weather, and chemicals that keep away the smuts, things look different. In rust years the new Clinton oats yield double the varieties once used. They mean money in the farmer's pocket. That is something he can understand.

In 1850 and the years following, when Iowa farmers watched their newly-planted apple orchards shrivel and die, when they saw dark patches appear on the leaves and the blossoms wilt and turn brown, they couldn't understand what was happening. Insects weren't eating those leaves—there wasn't a bug or a grasshopper in sight. There hadn't been a fire either, yet the ends of the branches looked brown and scorched. As late as the seventies they couldn't explain it.

There were writers who thought a tiny invisible insect bored its way into the tree. Others blamed the sunshine after a rain. In Garden Grove one citizen insisted the apple crop was destroyed by blood poisoning. The trees were caught by an early frost, he wrote, the vessels burst, the liquids in the tree fermented, and when the leaves appeared, the tree succumbed to the poison.

Hoping to save the orchards with magical cures, some placed bones under the trees. A few recommended that iron filings and scales be sprinkled on the ground. Only a handful suspected that fire blight, apple scab, and cedar apple rust were contagious diseases of plants, like smallpox and measles of human beings.

But across the Atlantic in the early 1850's a German scientist, de Bary, was thinking seriously about plant diseases. Many of them, he discovered, were caused by tiny plants, the fungi, that lived on the trees, shrubs, and grain. Fungi didn't have leaves to make their own living, so they got their food from a plant that made its own. Out of this discovery grew the whole study of plant diseases.

But it takes a long time for a scientific discovery to work its way out of the laboratory and into the hands of the common man. As late as 1888 orchardists in Iowa sneered at the idea that trees could "be killed by some mysterious bacteria floating around in the air." The buzzards, they said scornfully, never come until after the body is dead.

When farmers first discovered that you couldn't grow fruit trees easily in Iowa, they weren't too worried. If apples wouldn't grow on that rich black soil, almost everything else would. Each year the corn stood straight and tall and the wheat and oats produced high yields.

Prices in 1855 and 1856 were high. It was the time of the Crimean War, and with Russia cut off from the western European markets the Iowa farmer harvested a big crop of wheat and sold it at high prices

to western Europe. Continuous rains at harvest destroyed a large part of the crop in 1857. Wheat prices dropped with the end of the war, but hopeful farmers still increased the acreage of wheat. In three years it more than doubled.

RUST STRIKES WHEAT

They planted nearly eight hundred thousand acres of wheat in Iowa in 1868 and watched it grow tall, sturdy, and green. Then disaster struck. Black stem rust shriveled the green stalks and turned them black. It cut that crop to four bushels per acre. On more than twice the land planted to wheat three years before, farmers harvested just over half the crop. It was the beginning of the end for wheat in Iowa.

All over the state except in Van Buren and Woodbury counties the wheat crop failed. And with the wheat, rust also took the oats. Rust extended throughout the wheat-growing country—Ohio, Indiana, Illinois, Missouri, and Iowa.

Wild stories spread. In Davis County one farmer insisted he had lost three horses by turning them into a badly rusted field of oats. The Democratic *Clarion* warned of a mysterious deadly poison in the rust.

Most farmers believed their wheat was "running out." The wheat deteriorated, they decided, as it was planted year after year, so they brought in new seed. Still there were losses, sometimes heavy. As farmers wondered "why," some began to gaze in suspicion at the barberries so often growing near rusted grains.

The common barberry bush was first introduced into Iowa in the early 1850's. Everybody liked that shrub. It was beautiful, and it grew well on the rich Iowa soils. Before long it was widespread in the state, growing wild in the fields where birds had spread the seeds.

The suspicion grew, however, until barberries attracted attention for reasons other than their beauty and usefulness. More and more observers noticed that wheat and oats near the bushes turned black with rust. They saw that single bushes growing wild in the fields were surrounded year after year by large patches of rusted grain. Then they knew the barberry would have to go.

Yet it wasn't until 1918, some sixty-five years after barberries entered Iowa, that farmers and the men working with them set out seriously to destroy the bushes. This was true though de Bary in Germany had proved fifty years before that rust lived a part of its life on the barberry, and scientists had known for many years the role that barberries played in black stem rust.

It seemed that rust lived over winter in the stubbles. But it couldn't

cause any trouble to the wheat in the spring until it had spread first to the barberries and then back to the grain. Surely without those bushes, then, there could be no rust.

On this cue, throughout the wheat-growing area, agricultural experiment stations inaugurated an all-out campaign to destroy the bushes. School children were recruited to find them. Magazine articles were written, pamphlets were circulated, and "Eradicate the Barberry" posters were displayed in prominent places. Workers combed the areas to hunt out the bushes and kill them. Yet when all the barberries were gone from a field, rust remained. Where did it come from?

Scientists, having looked at the ground, decided to search the air for the tiny seedlike spores that spread the disease from wheat to wheat, from oats to oats, and from barberry bushes to both of them.

They flew in planes over the wheat, oats, and barley area and found those tiny spores floating in the air as high as 7,000 feet above the ground. That meant the rust could travel from south to north as the crops ripened from Texas to North Dakota and Canada. It meant that rust was too widespread to stamp out. So they set out to find a new wheat, a new oats that wouldn't rust.

Wheat in Iowa had to be spring wheat, for it was used as a rotation crop with corn, and corn was still standing at the time winter wheat should be planted. After experimentation, scientists found a few wheat varieties that were better than the old, but spring wheat never became dependable. Besides black stem rust, there were orange leaf rust and scab to strike it down. Iowa farmers turned to other grains.

Early in Iowa history, farmers had preferred oats to barley. To be sure, barley was a more profitable crop, but oats made excellent horse feed, and in the days before tractors it was important that horses be well fed. Later barley became less dependable than wheat and oats. It was susceptible not only to black stem rust, but to scab, blight, and smut. Barley was grown, like other crops, on fields where corn had been planted before. And the scab lived over winter on the cornstalks and was ready to strike the barley in the spring. In dry years Iowa could grow barley, but when conditions were right for corn, the barley crop failed. In the end, barley virtually left Iowa.

OAT CROPS SUCCUMB

Oats were always important in Iowa. Since 1890 they have ranked second only to corn in grain acreage. Yet at the close of the last century it looked as if oats would follow wheat and barley, and Iowa would be left wondering what to plant on the land where you didn't

plant corn. Crown rust grew as orange specks on the leaves of oats. When harvesters saw clouds of dust following their machines, they knew the dust was the tiny seedlike spores of crown rust.

Farmers didn't have a great fear of crown rust. It was a common belief that rust was of no danger unless it turned black. Yet in 1907, 50 per cent of the oat crop was swept away by crown rust. Since that time there have been other losses as high as 20 per cent. The rust occurred all over Iowa, wherever oats were grown.

In his experiments in Germany, the scientist de Bary had noticed in 1866 that crown rust spent a part of its life on buckthorn just as black stem rust grew on barberries. But in the 1880's when farmers first realized the dangers of barberry bushes, many of them had turned to the buckthorn, not realizing that the buckthorn did for crown rust what barberries had done for the black stem rust. It was 1900 before farmers in Iowa realized you couldn't grow oats in a field surrounded by a buckthorn hedge. But it was more than the buckthorn that was spreading crown rust. Scientists saw that it also spread from south to north in showers of spores carried each year by the wind.

If oats were to be grown in Iowa, it meant a new variety must be found, a kind that would be strong enough to withstand the common oat ills of rust, smut, blight, and scab.

The Iowa Agricultural Experiment Station decided to do something about the oat situation. Its researchers began looking for a new oat. The Iowa State College agronomists collected varieties of oats from distant lands, seeking parent stock for plants with stiffer straw and greater yield. Might there not be found among these varieties or even individual plants which could withstand the rusts? Botanist S. M. Dietz initiated the trials, and H. C. Murphy, also a botanist, and L. C. Burnett, the oat specialist of the Experiment Station, continued the work. The plants were subjected to the disease, and those that remained healthy were carefully selected and multiplied.

Oats breeding at Iowa State College began to attract national attention, for the new varieties were shown distinctly better than the old. Through selection and breeding, rust- and smut-resistant varieties were produced and were widely adopted. Yet every time the problem seemed solved, a new race of rust would develop that would attack the grain.

Breeding new varieties of oats wasn't easy, for oats are self-pollinated. That means that each tiny flower must be opened and the pollination made by hand—a very slow and tedious process.

Without being perfect, the new cross, Clinton oats, in 1945 certainly

seemed to be the answer to an oat-grower's prayer. The straw, so stiff that it would hold a blackbird or a sparrow, could stand in the field until it was dead ripe without a sign of weakness. That meant the oats might be combined. The oats had a higher test weight, plumper kernels, and thinner hulls than the old varieties. And for yield, here, too, it excelled.

Previous to the development of Clinton the problem of disease resistance in oats seemed solved by new varieties, Boone, Tama, Control, Vicland, and others. They were resistant to smut and rust, and enabled the American farmers to produce many extra bushels of badly needed grain during the World War II period. In 1945, a little-known parasite, *Helminthosporium*, became widespread on the seed and prevented maximum yield. Fortunately Clinton was not susceptible, hence the plant breeder had reserves to throw into this campaign against oat diseases.

Without a doubt the victory over diseases in oats will stand as a landmark in American agriculture. But the work is not finished. Plant pathologists are still on the lookout for the appearance of new races of rust that may arise to trouble the oat farmer. Breeding for disease resistance is work that goes on forever.

BUNT ON WHEAT

There had been troubles other than the rusts with the cereals. There was loose and covered smut on oats, stinking smut or bunt on wheat. For many years before Iowa was settled, treatments for some of these diseases had been known and commonly used in some areas of the world. But as always, the gap between the farm and the laboratory was wide.

For centuries some farmers in all sections of the world treated seed wheat with chemicals containing copper, like copper carbonate and blue vitriol. As late as 1914, many had no idea why they used them. They only knew that their fathers and grandfathers had treated their wheat—it made a better crop that way.

What the copper really did was to stop the growth of fungus that caused stinking smut, or bunt, on wheat. Stinking smut smelled like rotting fish; it changed wheat kernels to a mass of smut balls, and dwarfed the plants.

Bunt had been known for more than two thousand years, and the secret of its control, like so many other scientific discoveries, had come to light purely by accident.

Seed treatment had begun in the middle of the Seventeenth Cen-

tury with a shipwreck off the coast of England. The ship had been loaded with wheat, and when some of the wheat seeds were salvaged from the salt water and planted, they were found to be relatively free from the smut that was raising havoc with the crop. Experimentation started there. By 1752 a French farmer, Tillet, had proved that copper would check the bunt.

Yet in 1863 when an Iowa farmer in Pottawattamie County claimed to control it with blue vitriol, the idea was considered crazy by some. It was much later that seed treatment became understood by the average man. With advances in science came new, modern ways to treat seed. Sulphur, ammonia, formaldehyde, copper, and finally new chemicals containing mercury were used.

With the new chemicals there was no need of soaking the wheat. They came in the form of a dust that would stick to but wouldn't kill the seed, as formaldehyde so often had done. The first of the new mercury chemicals had come out of Germany after World War I. Later others were discovered, including some developed at Iowa State College by C. S. Reddy.

There was another kind of smut on wheat that wasn't controlled so easily. Loose smut grew on the inside of the kernels. To kill that fungus something had to reach inside and poison it without killing the seed. In 1888 a scientist in Denmark found that soaking the wheat in hot water for half a day would solve the problem. But the water mustn't be too hot, for the seed was only a little stronger than the fungus. It took care to kill one without injuring the other. In spite of the fact that a preventive for the smuts is known, Iowa, even in modern times, suffers a loss averaging about 1 per cent of the wheat crop from loose and covered smut. The loss would be much greater, did not a great percentage of farmers treat their seed. The smuts were a grave problem in the history of Iowa agriculture, but they were much outweighed by the greater problem of rust.

FIGHTING CORN DISEASES

Corn had been considered invincible for many years. Few farmers thought that treating this crop could be valuable. To be sure, root rot and seedling blight, as well as smut, took their toll in corn year after year. But the loss was small compared with that caused by epidemics of rust in the cereals. Most farmers never thought of corn diseases other than smut, and even the scientists who made plant diseases their business didn't realize that those diseases were important until the World War I years. They decided then that good corn crops would

be even better if root rot and seedling blight were wiped out. To do this they recommended treating seed corn with the new chemicals containing mercury.

Seed treatment meant, too, that corn could be planted early without danger of rotting in the field. It gave it a longer growing season. Later, hybrids came to cut disease even further. The hybrid seed was harvested early and dried quickly. There was no time for the disease to get started in the kernel. The new seed wasn't picked from the crib helter-skelter like much of the old seed corn. It had to meet rigid requirements. Hybrid seed treated chemically meant a corn that was healthy and protected from disease already in the soil.

Seed treatment had cut the loss from root rot and seedling blight, but what could be done for smut? Not much, it seemed. Pathologists recommend that farmers plant corn only once in three years on the same land. But in a Cornbelt state that isn't often enough. Burning the cornstalks would destroy the smut, but at the same time it would destroy the land. Spraying with Bordeaux mixture would control it, but spraying was far too expensive. Average losses from smut in Iowa have ranged from 1 to 9 per cent in the days since World War I. The only answer seems to be a corn that won't smut, and no such corn has yet been found.

POTATOES

A hundred years ago when Iowa was just being settled, farmers had to be self-sufficient. Their food came from the soil. Potatoes were one of the mainstays of the pioneer's diet. But once again disease stepped in to mix things up for the farmer. In 1865 and 1866, growers in parts of Iowa noticed that their tubers were rotting. They blamed the rot on the weather, as farmers for centuries before them had done with all plant diseases. To be sure, the weather was at fault—when the weather was right for the fungi and for insects that helped to spread disease. They grew faster than the plants they lived on. That spelled death for the crops.

From an all-time high of 170,285 acres of potatoes in the nineties, Iowa's production dropped to an all-time low of 44,000 acres in 1930. One of the greatest reasons for the drop was potato disease. Rot wasn't the only disease on potatoes. There was scab that dried up the surface of the potato and produced ugly scabby spots. There were also blight, black leg, black scurf, and dry rots.

Another group of diseases baffled farmer and scientist alike. They were the viruses. On potatoes they caused leaf wilt, mosaic, and spindle

sprout. And no matter how powerful his microscope, nobody could see the viruses. Like scab, they were carried in seed potatoes. They were carried, too, by insects and weeds.

The virus spread like measles. If any potatoes growing together were affected by the viruses, it wasn't long before they all were diseased. Farmers found that if they planted potatoes in Iowa, saved some for seed and planted them the next year, their yield was low. They said the potatoes were "running out" from using the same stock year after year. When they imported seed from the northern states, the crop was better. It was better because there was less disease in the north where the weather was cooler and insects were fewer.

Treating seed potatoes with hot water for four hours would do much in control. So would treating with formaldehyde for four hours. I. E. Melhus at Iowa State College put those two ideas together. If hot water and cold formaldehyde would both control potato maladies, what about hot formaldehyde? That should be much faster for treatment and therefore less expensive and more convenient. It was. A solution of one part of formaldehyde in 125 parts of hot water was the answer. It did for potatoes in one minute what it had taken four hours to do before in whipping the fungi.

During the last decade agricultural experiment stations in the cool northern states—Maine, the Dakotas, Minnesota—and the mountain regions of Colorado have co-operated with those in Iowa as well as other states farther south where potato diseases are prevalent. They have set up a standard for freedom from disease. Northern-grown potatoes meeting the standard are certified disease free, and the farmer who buys this seed and treats it with hot water or hot formaldehyde as a further precaution has a good chance for growing healthy potatoes.

FLAX

When Iowa was new, a farmer could break a plot of prairie land, plant it to flax and pay for his farm in one year. But it always took new land. When there was no more prairie, there was no more flax. The land became infested with a fungus that grew into the ends of the roots and kept water from reaching the body of the plant.

But in the twenties from North Dakota there came a new flax that wouldn't wilt. Fields had been found where less than 5 per cent of the flax grew and matured seed. Here the healthy seeds had been collected, and planted on the same ground that was infested with the wilt fungus. Year after year the flax was planted, the best seeds saved and replanted. In the end only the plants that could take it survived. From these seeds a sturdy crop was grown, and it didn't wilt.

But something else was wrong with flax. When the seedlings were very young, a fungus in the soil would grow into the plant just below the soil line. That area would die, and the plant would fall to the ground. Scientists in Iowa discovered that this disease, called "damping off," could be prevented by treating the flax seed before it was planted. That, with the new flax that wouldn't wilt, meant that farmers all over America could grow flax again.

MELONS

Southeastern Iowa soil had been ideal for watermelon growing. In 1900 watermelons grew on five thousand acres of the sandy loam in that district. Much of that land had been mortgaged and many of the farms lost. The new owners of the land weren't either using or renting it, and they were too far away to know what was happening to their newly acquired property.

When farmers saw their melons wilt, therefore, in a soil infested with disease, a few furtively planted test plots on the nearby foreclosed land that was lying idle. If the test plot proved successful, they planted the land to watermelons, reaped a highly profitable crop, paid for their own farms. And the donors of the watermelon crop were never the wiser. But eventually new land ran out, and by 1926 the watermelon acreage had dropped to one-tenth its all-time high.

To combat watermelon wilt, plant breeders in Iowa gathered seeds from all over the world—China, Africa, Japan, Yugoslavia. They crossed the plants until by 1939 they had developed a super melon, Dixie Hybrid, that brought watermelons back to Iowa.

So it has been with nearly every crop grown in Iowa. For a time it has flourished. Then when the diseases that parasitize the crop have become well established, the yield has been cut—not greatly in some cases, but enough to warrant investigation, and development of a preventive or cure. In the case of oats, corn, potatoes, watermelons, and many garden crops like cucumbers and tomatoes, a great deal has been done to solve the problem.

No longer do farmers watch with dread and despair their crops "running out." Nor do they try magical cures for plant troubles. Instead they see a plant disease as it is—something that may be prevented through research for its causes and application by the farmer of the results of research. For after all, the research is worth nothing except as it is put to use by the practical farmer.

In the case of crops like wheat and barley, as well as those where greater progress has been made, the search continues.

The locust, the grasshopper, the chinch bug, the European corn borer, and others have challenged the Iowa farmer. But he refuses to give in, and continues to produce bumper crops.

7. Man and Nature Battle Injurious Insects

CARL J. DRAKE, *Entomology*

NO DISASTER OF THE FRONTIER WAS DREADED SO MUCH as the visitation of an insect—the locust. Floods, drouths, tornadoes, Indian tomahawks, and even sweeping prairie fires were less feared than the vast flying swarms of locusts.

As the ominous cloud descended, locusts beat against every animate and inanimate object, entered open doors and windows, and heaped about the feet of the settlers. Green fields of corn and ripening small grain bent with the weight of their numbers. The ground in places was blanketed two, three, or more inches deep with the living, crawling, biting creatures.

Locusts that found their way into the dwellings ate holes in clothing and blankets and utterly devoured mosquito bars on the windows. Harnesses and baskets lying on the ground and shovel and hoe handles left outdoors were badly chewed. Weather-beaten siding on buildings and fence boards were so gnawed that within a few hours they looked like newly-erected structures.

Locusts are merely certain kinds of grasshoppers in the migratory phase. The grasshopper proper is solitary, does not migrate, nor move about in swarms. Indeed only a few species have the true migratory or locust phase. One of these is the Lesser Migratory grasshopper, which in both its solitary form and its migratory phase (when it is called the Rocky Mountain locust) is the most destructive species. This species, and three others, have caused from 90 to 95 per cent of all grasshopper damage to crops and pastures that has occurred in Iowa since pioneer days.

The swarms usually departed a few days after they came, but behind them they left the whole countryside devastated. Standing corn, grain, and potato vines were all devoured. The locusts started

on the tops of turnips and onions and ate right down into the ground, leaving holes where the roots had been. Pastures were ruined, and small streams and ponds were contaminated with dead locust bodies and excrement. Drinking water often became an acute problem for humans, and it was a daily task for someone of the household to remove dead and drowning locusts from the wells during invasions. Not every green thing was consumed, however. Foliage of castor beans, some canes or sorghums, broom corn, and older trees were only nibbled at. Occasionally swarms alighted, then suddenly took flight again without doing serious damage.

In the cool of the evening, locusts climbed trees and shrubs to roost for the night in such great numbers that branches became overloaded and broke under their weight. When they crawled in great numbers on the railroad tracks, the rails became so slippery from crushed locusts that locomotive wheels spun around and around on grades. Only by shoveling locusts from the tracks, sanding the rails, and taking a running start could the crew get the train up a grade.

Iowa settlers gathered in prayer meetings. In 1876 the Omaha Locust Conference recommended that churches in ravaged states and territories pray for relief. Some clergy, however, deemed the locusts an expression of divine wrath for the people's wickedness and went so far as to implore their congregations not to destroy the locusts, since the Almighty had sent the plague.

In devastated areas, committees were appointed to go to eastern states and appeal for contributions. The Iowa Legislature in 1874 appropriated fifty thousand dollars to purchase seed and vegetables for those made destitute by the raids of 1873. During the worst epidemic many farmers in northwestern Iowa deserted their homesteads and headed west, or plodded eastward to their former homes.

Quotations from letters of old-timers verify the devastation. J. S. Lane, of Modale, wrote:

I went with my folks from Wisconsin through northwestern Iowa by covered wagon in August, 1875. We came through a strip of fifty or sixty miles that had been cleaned out by grasshoppers. The next summer on July 15 we were harvesting spring wheat when the 'hoppers came. In two hours there was nothing left on the corn but a stub. In two or three days the corn was as yellow as it ordinarily is in December. . .

In 1876 they came in August. A neighbor boy and I were swimming when we saw a black cloud in the northwest like a storm—'hoppers. . . In the spring of 1877 they hatched and there wasn't a spot you could put your finger but what there were little 'hoppers. No one expected to raise anything, but the forepart of May came two or three inches of snow and killed every 'hopper.

In like fashion, W. F. Cox, of Farragut, related that:

About 11 a. m. June 13, 1875, we first noticed the grasshoppers. . . Corn was shoulder high and small grain was in shock. What was not in shock, they cut the heads off before night and what was in shock was eaten badly, good for chicken feed and stock bedding. . .

Corn was stripped of all leaves by night and some stalks cut off. By evening of the second day all stalks were eaten and by the third night nothing remained but the roots, and the 'hoppers went down and got them. . . All winter, along the hedges there were piles of dead grasshoppers like small snow banks.

The *Manson Journal* carried this account:

In 1876 the 'hoppers arrived just at noon, when harvest hands were on their way to dinner. We noticed that the sun was not shining so brightly as it had been, but as when we have a partial eclipse of the sun. At first none could understand why, but in a moment the 'hoppers began falling like hail. . . Settlers saw their crops ruined and knowing how the 'hoppers would lay their eggs and furnish another crop the next year, many gave up the battle and moved back East to their wives' folks.

The next summer there was a spell of unusually warm weather the last of March and early in April and 'hoppers hatched out by the million. Then there came a hard freeze followed by two weeks of cold, stormy weather and Mr. 'Hopper was eliminated for that year.

Herman Knapp gives this personal account:

In 1880 when I was a freshman at Iowa State College, several students became interested in a man and his wife and two children who were camping for the night near the west entrance of the college campus. Being a little more curious than the other students, I asked him why he was headed eastward. The man pointed to a calf about a year old tied to the hind end of his covered wagon and said, "See that calf? Well, it has an interesting story. I traded 160 acres of good Iowa land for that calf and when the buyer wasn't looking I slipped another 160 acres in the deed. You see, it is impossible to make a living in northwestern Iowa on account of the grasshoppers. We are on our way back to my wife's folks in Indiana."

Such tales, that it was impossible to make a living in northwestern Iowa because of the locusts, prevailed for a number of years.

Although the last great invasions of locusts in Iowa appear to have been in the seventies, such invasions seem to have been frequent before the first settlers came to Iowa. Indians in Minnesota have a tradition that locusts once took possession of the country, holding it for many years. Vast hordes appeared in the Red River area in 1818-19, covering the ground in some places to a depth of three or four inches. Swarms came too late in the autumn to do much harm to crops and after filling the earth with eggs, died. The young 'hoppers did little harm next spring and soon left after reaching the winged state. An Indian chief is credited with saying that grasshoppers in west-central Iowa were so thick in 1833 that no pasture was left for Indian ponies and the ground looked black as if there had been a prairie fire. Every

vestige of a green plant, cultivated or wild, in more than twelve thousand square miles east of the Rockies was consumed in 1856. This infestation reached across Nebraska and the Dakotas deep into central Iowa.

The *Saint Paul Press*, June 21, 1865, quotes from a letter from General Sully, who was then camping in the vicinity of Sioux City as follows:

The only thing spoken of about here is the grasshoppers. They are awful; they have actually eaten holes in my wagon-covers, and in the 'paulins that cover my stores. A soldier on his way here lay down to sleep in the middle of the day on the prairie. The troops had been marching all night. His comrades noticed him covered with grasshoppers and woke him. His throat and wrists were bleeding from the bites of these insects. ~~This is no~~ fiction.

The years 1867-68 and 1873-77 are usually regarded as the worst locust years in the history of the state. But from 1864 until about 1890, scarcely a year passed that locusts did not appear in devastating numbers somewhere in Iowa. In contrast, from 1890 until the outbreak of 1931, these insects were of little importance.

SPECIES

The Rocky Mountain locust made up the immense swarms of locusts that devastated the state in pioneer times. This phase has for more than fifty years generally been considered "extinct." Nevertheless, there is some evidence that if conditions should ever become right for its development, swarms of such locusts might be seen again, although perhaps on a much smaller scale. During the prolonged grasshopper outbreak of the thirties, the solitary phase of this insect was seen flying high in the air. At other times, as in 1941, thin cloud-like formations of nearly the typical locust phase came in from the northwest. In the locust days of the pioneer times, the swarms often came from the upper plateau and plain regions of Montana, Wyoming, and Colorado east of the Rocky Mountains. Some of these swarms were known to travel as far as 1,500-2,000 miles—into Iowa, Missouri, Minnesota, and Texas.

Next in importance to the Lesser Migratory species, which leads in both its grasshopper and locust phases, are the Differential and the Two-Striped grasshoppers. Both are major crop-feeding species and they generally occupy second and third places, but not always in the same order. The Red-Legged grasshopper, ranking fourth, is usually much less important.

Eggs are laid in the soil in clusters of 25 to 100 each. They remain dormant throughout the winter. The Lesser Migratory and Two-

Striped 'hoppers hatch in late April or early May. The Differential grasshopper is a little later and the Red-Legged 'hopper is the last to hatch.

The Differential grasshopper was abundant in scattered areas in 1883, when Osborn reported larger numbers of the species dying from a fungus disease. In 1886 the Secretary of the State Agricultural Society reported that the Red-Legged grasshopper "so denuded portions of Louisa County of its grass as to compel the removal of cattle to other pastures. . . They ate the silk from the ears of corn, stripped young orchards of their leaves, and cut off bunches of grapes, not eating them but letting them fall to the ground. On September 4, however, they were almost entirely destroyed by flooding rains and accompanying reductions of temperature in southwestern Iowa." Although little injury was done to crops, grasshopper numbers remained threatening until greatly reduced during the wet summer of 1896.

Two-Striped and Red-Legged grasshoppers again appeared in 1910 and 1911, causing considerable damage. Farmers reported "They clipped all my oats. . . I saved less than one-fourth my grain. . . The second cutting of clover was entirely stripped." Others told how 'hoppers concentrated ahead of the binder, cutting the heads off the oats, until farmers had to abandon the fields. Scarce after 1911, grasshoppers did not threaten until in 1917 and 1918, when they caused some damage in more than half the counties in the state. One farmer collected and dried fourteen hundred pounds of grasshoppers for chicken feed. In 1921 and 1922, ten or twelve southwestern counties had an outbreak, but this was cut short by unfavorable weather, and an abundance of parasites and predators.

CONTROL ATTEMPTS

The early settlers were unprepared to cope with flying swarms or dense mass-formations on the ground of grasshoppers of the locust type. Hand collection and ingenious homemade machines to catch or trap the insects were about the only control measures. Desperate attempts to drive locusts out of crop fields by smokes and smudges, or by beating cultivated plants with branches of trees were entirely futile. Others tried by dragging long ropes over the tops of maturing heads of small grain, but failed. Newcomers who never before had encountered locusts covered the more valuable garden vegetables with blankets or canvas. The famished locusts simply ate holes through the covers, or crawled in under the edges.

The most recent grasshopper outbreak began in 1930, was somewhat held under check from 1933 to 1935, then broke out again in 1937-39.

Since 1846 farmers have resorted to an endless number of methods to control grasshoppers. During the seventies, several Iowans were granted patents on machines designed for trapping, crushing, and burning grasshoppers. Some of the better of such "hopperdozers" were used for a considerable number of years.

During the last half century, poison baits have come into almost general use. Airplanes spread two hundred thousand pounds of poison bait in 1932, and from 1933 to 1935 local infestations were checked by timely baiting, diseases, parasites, and unfavorable weather. The spring and summer of 1936 were unusually hot and dry. Wild vegetation was scant and hordes of young 'hoppers soon denuded fence rows, pastures, and uncultivated areas. They then congregated on cultivated fields. Small grain, corn, alfalfa, clover, and pastures were severely damaged. Orchards, shrubs, forest trees, and nurseries suffered heavily. However, severe drouth, hot winds, and shortage of green plants shortened their lives and reduced the number of eggs laid. Fifty-two county mixing stations prepared nearly nine thousand tons of wet poison bait, one-half of which was applied in Pottawattamie, Shelby, Crawford, Audubon, Woodbury, Monona, Harrison, Ida, and Cass counties.

In the spring of 1937, two hundred to five hundred or even one thousand 'hoppers per square yard were not uncommon. Heavy rains during hatching, fungi, parasites, and baiting kept the 'hoppers out of crop fields, but favorable weather during the fall led to the heaviest egg deposition of any year since 1930. During 1939 little more than a thousand tons of bait were used, and in 1940 less than two hundred tons. In 1941 only two hundred farmers found it necessary to bait their fields.

On September 16, 1941, western Iowa saw a light flight of the Lesser Migratory grasshopper. The flight extended from the Missouri River south of U. S. Highway 30 and as far east as U. S. 69. Twenty counties recorded the flight. All reports stated that the grasshoppers were flying in a southeasterly direction and extended in the air as high as the human eye could see. The insects, viewed through smoked glasses as they flew against the sun, were said to appear as millions of white flecks, resembling snowflakes. Omaha reported that at noon there were so many grasshoppers in the air one could look directly at the sun without hurting his eyes. Nevertheless, the clouds of grass-

hoppers were very thin and in no way comparable to the enormous swarms of locusts during the Nineteenth Century. A field survey disclosed that as a result of the flight, grasshopper numbers increased from 30 to more than 200 per cent in Clarke, Union, Adams, Montgomery, Page, and Fremont counties. Near the eastern limits of the flight, in more lightly infested areas as at Ames, numbers increased from one or two grasshoppers a square yard to four or five.

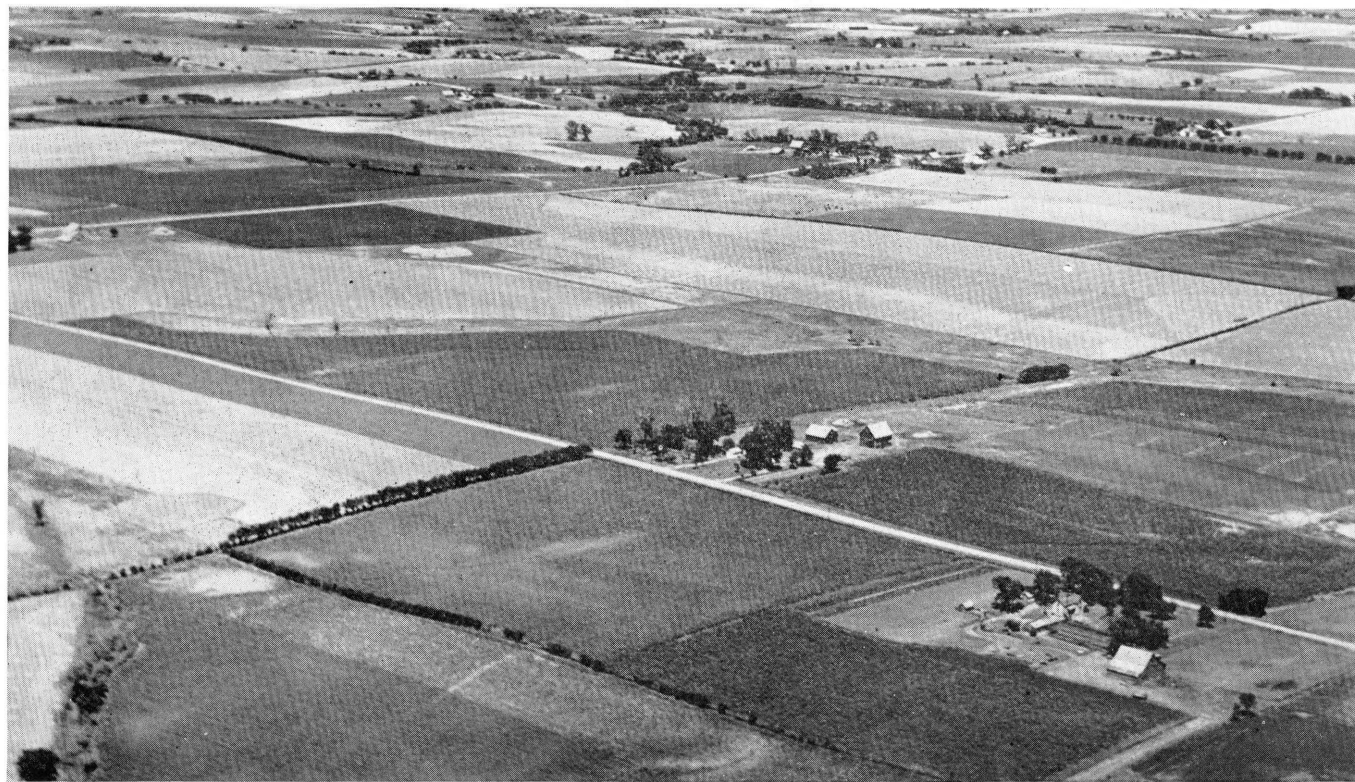
Poison baits now used consist of two components—a carrier and a poison—and are more attractive to the young 'hoppers and fledged adults than their normal green food plants. The most widely used carrier consists of a three to one mixture of sawdust and mill run bran. Sodium arsenite solution is one of the more widely used poisons. When the bait is properly prepared and thinly broadcast, there is no danger of killing grazing farm animals or wild animals. The wet bait is broadcast by hand as grain is sown, or by means of endgate seeders, bait spreaders, or airplanes. Funds for the purchase of the bait ingredients were from federal and state appropriations. County stations mixed, poisoned, wet, and sacked the bait. Except for a small county service charge of five to ten cents per bag, the bait was free. The farmers baited their own fields.

During the past decade many changes have been made in the bait formulations and methods of spreading baits. New poisons, such as hexachlorocyclohexane, may replace the arsenicals and fluosilicates. Recent investigations indicate that this compound and others may eventually be applied as dusts or concentrate sprays by aircraft and new types of spray-dust turbines.

Efforts are now being made by federal and state research entomologists to develop methods for the prevention of grasshopper outbreaks. With the aid of new chemicals and rapid methods of treating large areas, it is felt that the young 'hoppers of the economic species may be killed in their breeding areas before their numbers attain outbreak proportions. Such a program would require annual surveys and close co-operation between state and federal agencies.

THE CHINCH BUG

The chinch bug is a native American insect and attained a wide distribution in the United States long before the first white man trod the prairies. Neither the Indians nor the early settlers were much concerned about the chinch bug's feeding upon the vast stretches of wild prairie grasses. Infestations were of a local nature until the acreages of small grains and corn greatly increased.



Those who have seen present-day Iowa from the air are impressed by the regular patterned areas of productive farm land. They sense the strength and independence of Iowa as they see the individual farmsteads which dot this landscape as far as the eye can reach. The Iowa prairie has been made into 213,000 farms enclosing 95 per cent of the state's area into productive fields, pastures, and farmsteads.—

CHAPTER I, STRUGGLE FOR FARM OWNERSHIP.



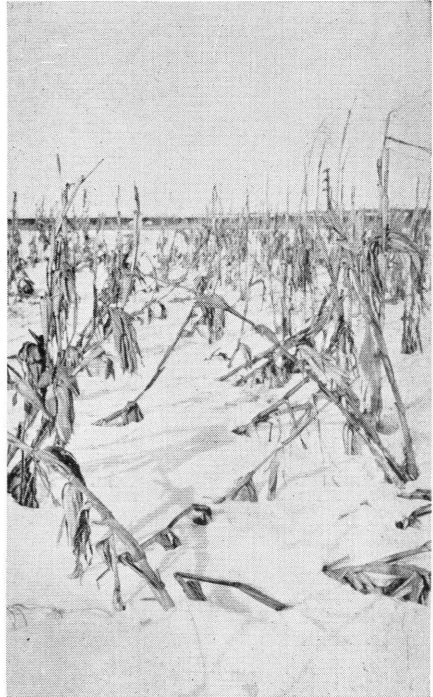
Iowa soils are productive. That fact is proved by the value of farm produce—a higher value than that of any other state in the Union. One-fourth of all Grade A land in the country is contained within the state's borders.—CHAPTER 2, THE SOIL THAT GROWS THE CROPS.



Iowa farmers are conscious that with hard work and vigilance, the fertility of Iowa soils can be maintained and the state remain sure of her leadership in agricultural production. Among the points of which they are aware is that rolling fields call for more contoured cultivation, and an end to "square farming on a round country."—CHAPTER 2, THE SOIL THAT GROWS THE CROPS.



By 1943, 99 per cent of Iowa's corn acreage was planted to hybrid corn. The varieties are many, but originate from specialized fields such as shown above. This is a double-cross seed-production field after detasseling was completed. The ratio of female rows to male rows was four to one.—CHAPTER 3, PRODUCING THE BUMPER CORN CROPS.



Different hybrids differ as much in their characteristics as do different people. These pictures of two hybrids in the same field were taken on the same day. Notice the difference in strength of stalks and roots.—CHAPTER 3, PRODUCING THE BUMPER CORN CROPS.



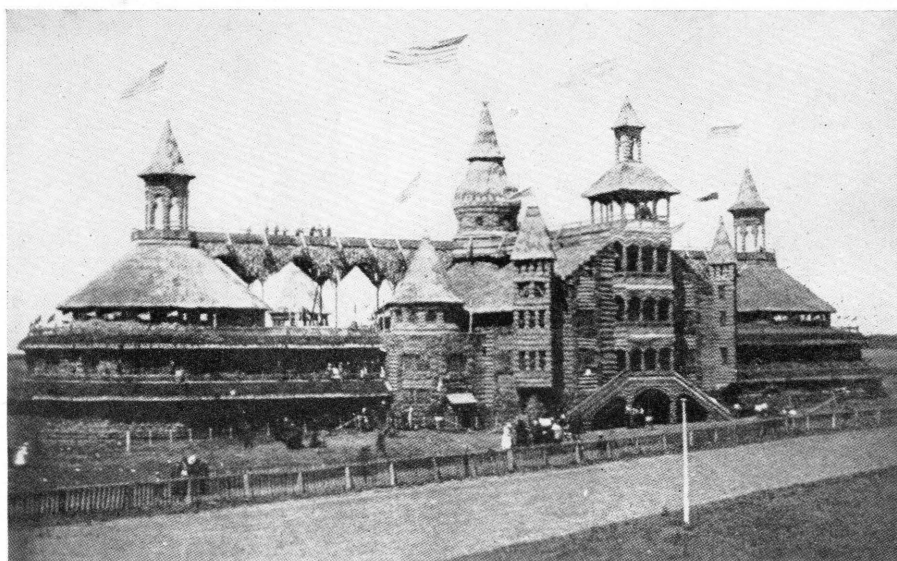
"Uncle" Asa Turner was a devout man. He was also keenly interested in corn improvement—more so than some of his fellow churchgoers thought desirable. One Wednesday he attended prayer meeting at Maxwell, in a little village church which was later named for him. The congregation was small. One old lady bowed her head in deep concern and prayed, "Oh God, help Brother Turner pay a little more attention to the Lord's work and a little less attention to corn."—CHAPTER 3, PRODUCING THE BUMPER CORN CROPS.



The marked superiority of the rust-resistant varieties of oats—Boone, Tama, Control, and Vicland—is indicated by the rapidity with which Iowa farmers in the 1940's replaced previously grown varieties. The men responsible for the varieties that by 1945 were planted on over 95 per cent of the Iowa acreage are shown here in one of the increase plantings at the Iowa State College Agronomy Farm. Left to right, they are T. R. Stanton, H. C. Murphy, L. C. Burnett, and F. A. Coffman.—CHAPTER 4, THE FIELDS OF WAVING GRAIN.



Brome grass has been found one of the best grasses for use in combination with alfalfa on the more rolling lands of Iowa. Farmers using the recognized southern strains of Fischer, Lincoln, and Achenbach obtain stands easily with good production the first year or pasture year. Show above is Ida Fischer in 1943 in the field of brome grass seeded on her farm in Page County approximately thirty years earlier. Plantings with seed from this field proved this strain so superior that it was increased generally throughout the state under the name "Fischer brome."—CHAPTER 5, FORAGE CROPS THAT FEED THE LIVESTOCK AND SAVE THE SOIL.



The "Bluegrass Palace," erected on the fair grounds near Creston in the fall of 1889 and enlarged in 1890, was 265 feet long and 130 feet wide. The main tower of the building was 120 feet high, with 90-foot towers on the wings and a 100-foot tower over the main entrance. Baled hay was used for gateways, for all projections and towers, and for the horseshoe arch at the main entrance.—CHAPTER 5, FORAGE CROPS THAT FEED THE LIVESTOCK AND SAVE THE SOIL.



Treating seed potatoes with hot formaldehyde, a process devised by I. E. Melhus at Iowa State College, did in one minute what it formerly had taken four hours to do in whipping fungi attacking the tubers.—CHAPTER 6, WINNING THE FIGHT AGAINST PLANT DISEASES.



If oats were to be grown in Iowa, it meant a kind must be found that would be strong enough to withstand the common oat ills of rust, smut, blight, and scab. Oats breeding at Iowa State College began to attract national attention. Through selection and breeding, rust- and smut-resistant varieties were produced and widely adopted. The plot on the left is resistant to both stem and leaf rust, the one on the right is susceptible.—CHAPTER 6, WINNING THE FIGHT AGAINST PLANT DISEASES.

During the early settlement period, agricultural promoters and newspapers often suppressed news items and reports that would tend to create unfavorable impressions in the minds of prospective settlers. For this reason, chinch bug records prior to the epidemic outbreak of 1886-88 are very incomplete.

The chinch bug feeds and breeds solely upon plants belonging to the grass family, which includes small grains, corn, pasture and forage grasses. Since the cereal and grass crops furnish most of the food supply for man and farm animals, serious raids on these crops greatly affect the welfare of mankind.

Not much is known about chinch bug depredations during the early settlement period. The prairies were practically unoccupied in 1825, and less than ten thousand white settlers then lived in the territory of Iowa. During the pioneer days, chinch bugs sometimes became locally abundant and seriously injured grasses in the virgin prairies far from the nearest settlement. Losses were first reported in Linn County in 1846, the year Iowa was admitted to the Union. I. Julian wrote in the *Prairie Farmer* of May, 1847, that the chinch bugs first appeared in Linn County in 1846 and materially reduced the spring wheat and corn.

The second outbreak occurred in 1858 in Wayne County, near Geneva. From 1860 to 1865, the chinch bug spread over most of the southern half of Iowa. Two counties reported losses in 1860, eight in 1861, and more than twenty in 1862. Farmers reported, "Many fields plowed up, others left uncut. . . Spring wheat destroyed. . . Prospect for wheat poor. . . We must quit growing wheat until we get rid of the chinch bug."

Although of only three years' duration, the outbreak of 1866-68 was one of the most serious in the history of the state. The summer was very dry. From May to September there were no general rains and only a few local showers. Spraying with kerosene emulsion to control chinch bugs on corn was tried at Ames. A disease of chinch bugs, commonly called white fungus, was cultivated at the Experiment Station and widely distributed to farmers. Experiments since have shown, however, that this attempt was worthless. The fungus thrives only in wet weather. Since it is naturally present in the fields, during wet weather the fungus will spring up of its own accord.

An outbreak developed very rapidly in 1894-96, doing most damage in southeast Iowa. During 1914 and 1915 light infestations occurred in Lee and Des Moines counties. From 1920 to 1924, increase in chinch bugs developed slowly and losses were confined

generally to the two southern tiers of counties. Calcium cyanide was used, first in experimental line barriers and then for gassing bugs in furrows and postholes. In 1924, wet weather at the end of the hatching period almost wiped out the young bugs.

1931 OUTBREAK CYCLE

The longest and most severe outbreak of chinch bugs in Iowa history began in 1931 in two southernmost counties, Van Buren and Ringgold. Favorable growing conditions extended the infested area to sixteen counties in 1932, twenty-two in 1933, and ninety-three in 1934, the height of the outbreak. Almost every field of spring barley was wiped out before the plants reached a height of six inches. Overwintered adults in small grain ran from fifty to more than two hundred bugs per stool of winter wheat and rye. Destruction was so complete that a large number of small grain fields were not harvested. Mass movement of the first brood from wheat and rye to corn began on June 1. More than three million gallons of creosote were used to make barriers around corn fields in the forty-seven hardest-hit counties. From 1935 to 1938, winter mortality was high, averaging around 50 per cent, and timely rains hit the first brood. Nevertheless, bugs destroyed nearly half the small grain in five east-central counties in 1935.

The infestation in 1938 was heavier than in the previous year and covered most of the three southern tiers of counties. Migration started soon after harvest and considerable damage occurred in corn bordering small grain fields. In 1939 the heaviest losses extended from Polk and Marion counties west into Guthrie, Cass, and Montgomery counties. Approximately one thousand miles of chinch bug barriers were constructed. Guthrie County, most heavily infested, used 14,191 gallons of creosote. Again, late summer and fall weather was favorable for the chinch bug increase and large numbers of them entered hibernation.

The spring of 1940 was the most favorable since 1934 for the establishment and multiplication of chinch bugs in small grain. A total of 1,400,000 gallons of creosote was used in the construction and maintenance of more than seventy-five hundred miles of barriers in fifty-eight counties. Heavy infestation extended clear across the southern half of the state and a number of counties used several 10,000-gallon tank cars of creosote oil. Pottawattamie County alone used more than 128,000 gallons. In the central part of the state the infestation extended farther north into Sac, Webster, Hamilton, and Hardin counties. As in previous years the creosote was provided free

by the federal and state governments and shipped largely in 10,000-gallon tank cars.

For the next three years, moderately heavy to heavy chinch bug population entered hibernating quarters in the fall, particularly in the southwestern section of the state. Winter mortality and timely rains during the hatching period of the first brood reduced the population below migrating numbers in a large number of counties, except in the western counties. The heaviest population in 1941 occurred in Audubon, Monona, Crawford, Montgomery, Harrison, Cass, and Pottawattamie counties. The infestation was a little more widespread in 1942 and included nearly twice as many counties. In 1943 and 1944, the infested areas were light to moderately heavy, small and widely scattered in the southern and western parts of the state. Timely rains cut down their numbers during the hatching period. In the three most heavily infested counties—Mills, Woodbury, and Fremont—about ten miles of barriers were erected between small grain and corn fields. No barriers were erected in 1945, the bug population in grain being much below migrating proportions.

Considerable advancement has been made in the methods of fighting chinch bugs during the past decade. Creosote oil, first used in Illinois in 1914, has entirely replaced dust barriers, which were only moderately effective during dry weather.

Since 1933, creosote-treated paper fence barriers have proved to be much more effective than the creosote-line furrow. The development of machines to cut the heavy paper into four-inch rolls and erect the treated paper fences has materially lowered the cost of control. A late development in Iowa is the toxic-dust barrier lines. This work was started in Iowa by George C. Decker and Carl J. Drake in 1939, while studying the effect of several dinitrophenol dusts on grasshoppers. Since then Decker and O. E. Tauber have published the results of the Iowa Station field tests, and have shown that several toxic dusts are highly effective in killing the migrating chinch bugs. These dust lines do not stand up satisfactorily during heavy rains, but when applied in thin layers at intervals on the ground in front of the paper fence or creosote line, they are more effective than postholes for destroying the migrating bugs.

HESSIAN FLY

The Hessian fly is the most important insect pest of wheat in Iowa. It is a native of the Caucasus of Russia and was probably carried in straw bedding into the United States by the Hessian troops. The

first specimens were found on Long Island about 1779 in the vicinity of Lord Howe's old encampment site. The fly spread rapidly westward and it is now established in all major wheat-growing areas of the United States.

The first occurrence of the Hessian fly in Iowa was in 1860. In 1896, Herbert Osborn reported the finding of the fly in spring as well as winter wheat. Since then, several outbreaks of major importance have occurred.

Wheat is its principal food plant, although barley and rye are attacked to a slight extent. It also has been taken in small numbers on a few wild grasses. Winter is passed in the full-growth maggot stage within a brown puparium, commonly called "flaxseed" stage. There are two main broods during the year—spring and fall broods. Wheat plants infested in the fall are stunted and become yellowish in color. Heavily infested plants are killed by the maggots.

The adult Hessian fly is smaller than the common mosquito and easily overlooked in the field. The female lays from 250 to 300 eggs, which are usually placed in rows of two to a dozen, in grooves of the upper surface of the wheat leaves. The eggs hatch in about two weeks and the maggots become fully grown in two to three weeks. The adult flies live only one or two days, rarely as long as four. If there is no wheat above ground during the egg-laying period in the fall, very few of the young will survive.

Control is based solely on the biology of the Hessian fly. Losses may be avoided entirely by observing the "safe seeding date" so as to escape the fall generation of the fly. This date is publicly predicted by the Iowa Experiment Station by means of the "flaxseed count" in the old wheat stubble fields in the fall. Complete co-operation of all farmers growing winter wheat is necessary to check commercial losses. No serious fly losses have occurred in Iowa during the past twenty years, largely because the farmers have observed the safe seeding date.

COLORADO POTATO BEETLE

The potato plant is a native of America, as are most of the insects attacking it. The Colorado potato beetle was described from specimens taken in the upper Missouri River region. Buffalo bur, its original host, is a tropical plant, and was carried northward through New Mexico, Texas, and Arizona into the plateau and great plains states by Spanish pack trains, caravans, and human trade. This weed thrives in areas where cattle, horses, and burros congregate, especially about drinking places. Since the seed pods are armed with spines and

hooks, the burs often become entangled in the coats of farm animals and thus are often carried long distances without becoming dislodged. The Colorado potato beetle followed the dispersal of the buffalo bur, wherever soil and climatic conditions were favorable for its development.

Settlement of the great plains and prairie states gave the beetle a new and accepted food plant, the potato. The advent of the potato for the first time enabled the beetle to migrate eastward.

In 1859 the Colorado potato beetle was found feeding on potatoes in Nebraska, one hundred miles west of Omaha, along an old emigrant trail leading to Denver, Colorado. This seems to have been the real beginning of its rapid eastward spread.

At that time farmers of the Midwest had become greatly concerned and viewed with apprehension the coming of the potato beetle. As the insect spread eastward into more densely settled areas, its new food plant, the potato, became more abundant—much to the liking of the beetle.

The beetle first appeared in Iowa at Gravity, Taylor County, in 1861. J. Edgerton wrote:

They made their appearance upon the vines as soon as the potatoes were out of the ground, and there being a cold, wet spell about that time they devoured them as fast as they came up.

As this published report by Edgerton represents the first ravage of the insect in the state, it seems quite certain that the first beetles must have crossed the Missouri River into Iowa at least two or three years prior to this date, perhaps around 1858 or 1859. Emery records the presence of the Colorado potato beetle in Crescent City, Pottawattamie County, in 1862. Reports in the literature in 1862 and 1863 clearly indicate severe damage and that a considerable portion of the state already had been overrun with the beetle.

In 1865, losses were so heavy that many farmers were discouraged from planting potatoes, and the potato crop was reduced to half the usual amount. During the short time of four or five years, the potato beetle traveled across Iowa and became dispersed generally over most of the state. The beetle spread from Omaha, Nebraska, to Rock Island, Illinois, in six years—a distance of 360 miles. During the next decade it spread eastward from Iowa to the Atlantic seaboard.

Prior to 1860, the control of insect pests by spraying or dusting was unknown. Paris green was first used as a dust against the Colorado potato beetle in the Midwest sometime between 1860 and 1870.

Since 1943, DDT has proved so effective against the potato leaf-

hopper, flea beetle, and Colorado potato beetle that growers are now advised to use this insecticide in preference to any other. The vines are treated at ten-day intervals after the leafhoppers appear.

EUROPEAN CORN BORER

In the short space of four summers, the European corn borer became the most important corn insect pest in Iowa. It spread from eastern Illinois across Iowa into Nebraska, proceeding at the rate of from 75 to 150 miles a year. This dispersal was much more rapid than elsewhere in the United States or in other Cornbelt states.

The first corn borer was taken in Iowa in an early planted field of corn near Clinton, August 10, 1942, by H. M. Harris. Scouting during the rest of the summer revealed the presence of the borer in a total of nineteen eastern counties. Infestations were found in fifty-six counties in 1943 and eighty-eight counties in 1944. Although no scouting was done in 1945, the borer was found in one more county.

As the corn borer migrated across Iowa during 1942-44, its numbers increased most in the counties with the more extensive corn acreages. In general, the increase has been most pronounced from Jackson County south into Muscatine County and westward into central Iowa. As the borer has been found for only two years in the western half of the state, this area is too lightly populated to indicate population trends.

Field data show that nearly 90 per cent of the corn borers passed through two generations in 1943 and that 60 to 80 per cent did so in 1944 and 1945. The late, wet springs of those two years seemed to account in part for the decrease of the two-generation form. Very early planted corn suffers most from the attack of the first brood, and late corn from the second generation.

In co-operation with the Bureau of Entomology and Plant Quarantine, the State Department of Agriculture liberated 133,091 parasites of the borer in 1944, 64,610 in 1945, and 159,422 in 1946. These parasites were represented by four species in 1944 and six species in 1945 and in 1946. Every effort was made to liberate the parasites in the more heavily infested fields of eastern Iowa where borer populations and biotic conditions seemed to be most favorable for the establishment of the parasites. As damaging populations of the corn borer build up farther west, the parasite program will be extended westward.

For a long time a farmer's weeds were considered his own business. But eventually Iowans came to realize that since weeds spread from one farm to another, they were the concern of everyone.

8. Weeds that Challenge Iowa Crops

A. L. BAKKE, R. H. PORTER, E. P. SYLWESTER, *Botany*

WHEN IOWA PRAIRIES WERE UNFENCED, WEEDS WERE OF little importance. Grazing cattle, free to roam at will, could choose good grazing country and leave untouched areas of less inviting plants. As land passed into private hands and fences were built, however, cattle were less free to move about. Poisonous and harmful plants became a problem. In 1884, for instance, Dr. Bessey, professor of botany at Iowa State College, reported that "rattle box" was common in western Iowa as a cause of death among horses. Porcupine grass, the fruit of which became buried in sheep's wool and cattle hair, had become a serious concern.

When farmers shifted from grazing cattle to growing crops, trouble was caused by more than only poisonous plants. In a wheat field, any kind of plant other than wheat is unwanted. Such plants, which do not fit into the economics of a country, we call weeds.

At the same time that the farmer became particular as to which plants should grow in a given field, he introduced new varieties of weeds by importing seed. As early as 1888, Byron Halsted, successor to Professor Bessey, listed 297 species of weeds and noted that the large majority had been introduced to the state. Undoubtedly most of these came to Iowa from Europe by way of the eastern states. Iowa State College's plant collection had 1,484 species in 1929, of which 263 had come into the state from elsewhere. Most of them, 210, or 80 per cent, had come from Europe. The bulk of human immigrants also came from there, of course. Sources of the other weed species were: Asia 11, Tropical America 11, Mexico 1, Eastern United States 3, Southern United States 9, Western United States 18. Of the primary noxious weeds, not a single one is native to Iowa and only one, horse nettle, is native to the United States.

The most important way in which the pioneer introduced weeds was through having weed seeds mixed with crop seeds. In several clover patches on the State Farm in 1891 L. H. Pammel, professor of botany, found oxeye daisy, rib grass, hawkweed, Canada thistle, dodder. Horse nettle already had been reported from Taylor, Ringgold, and Greene counties.

Professor Pammel, R. E. Buchanan, and Charlotte M. King provided evidence in 1907 that agricultural seeds were an important medium for the distribution of weed seeds. One hundred and thirty samples of red clover seed were examined for impurities and adulteration. The average per cent of impurities ranged from 1.93 to 33.2, and only two samples consisted of pure seed.

It was clear very early that the best way to get rid of weeds in Iowa was by making sure the seeds one planted were free of weed seeds. From 1892 to 1906 the Department of Botany at Iowa State College, under the leadership of Professor Pammel, tested a small number of seed samples each year for farmers and seedsmen. From 1906 to 1932 a small seed laboratory was maintained by the Department of Botany, where from one thousand to two thousand samples of seed were tested annually. Prior to the establishment of a small laboratory by the State Department of Agriculture in 1922, the seed samples collected by seed inspectors under the provisions of the Iowa Seed Law passed in 1908 were tested in the Botany laboratory. In 1914 the Farm Crops Department of Iowa State College, under the leadership of H. D. Hughes, established a small laboratory to test corn for moisture and germination, and later undertook the testing of grass and clover seeds. These two laboratories tested from three thousand to four thousand samples per year.

In 1932 the two small college laboratories were combined into one. This was designated the Iowa State College Seed Laboratory under the sponsorship of the Agricultural Extension Service, the Agricultural Experiment Station, and the Divisions of Agriculture and Science. This laboratory was placed under the direction of R. H. Porter. Research, teaching, and service phases of seed work were co-ordinated into the one unit. These phases increased rapidly until by 1940 more than forty thousand samples of seed per year were received and analyzed. The laboratory now is one of the best equipped stations in the United States. Extensive research has been undertaken there, and three college courses and one annual short course for the training of seed analysts have been developed.

Since 1940 the demands for seed testing have been so great that

assistance has been given by the college laboratory to teachers of vocational agriculture for the establishment of seed-testing facilities. Private laboratories also established indicate a growing appreciation of the need for seed testing. Thousands of samples of oats, soybeans, and clovers now are tested each year in Iowa by local testing stations. This relieves the central laboratory and brings the value of testing closer to the farmer.

The State Department of Agriculture in Des Moines has also maintained its seed laboratory since 1922, primarily for the purpose of checking the labeling of seed offered for sale in Iowa. Tests for farmers and seedsmen also are made there.

For a time, while people were learning the seriousness of weeds, only voluntary inspection of seeds for weeds was accomplished. Farmers wanted assurance before they bought from seed companies that the seeds were reasonably free of weeds. This became more important, of course, as farmers produced less and less of their own seed. In 1846 nearly every farmer saved a part of his harvest to provide seeds for the following year. Today probably less than half the Iowa farmers raise their own clover seed, for example. Every time a new variety is introduced, such as oats, the weed situation is improved for a while at least, since farmers must buy their seed from those who produce certified seed.

SEED AND WEED LAWS

The first seed law, demanded by farmers and agricultural leaders, was passed by the Iowa Legislature in 1907. It required that seed offered for sale be labeled. It listed those species of weeds that were considered noxious. It did not regulate the sale of seed by one farmer to another. Later the law was revised to the extent that sale of seed containing seeds of quack grass or Canada thistle in excess of ninety per pound of crop seed by any citizen of the state was unlawful. The first law and its subsequent revisions helped to improve the quality of seed sold in Iowa, but it did not go far enough, in that seeds of noxious weeds still could be distributed in crop seed.

In 1940 the Secretary of Agriculture and the head of the college seed laboratory organized the Iowa Seed and Weed Council, which recommended the repeal of the old seed law and enactment of a new law. The Legislature in 1941 heeded both recommendations, and it became necessary for farmers to test seed before sale and to furnish information to the purchaser showing percentage germination and hard seeds, percentage of secondary noxious weed seeds, and freedom from primary noxious weed seeds. The law made it illegal for anyone

to sell seed containing seeds of primary noxious weeds or seed containing more than 3 per cent total weed seeds. Another important provision was that if a seed inspector found primary noxious weed seeds in a lot offered for sale or found the seed mislabeled, he could issue a stop-sale order. This law marks a real advance in seed legislation, and the State Department of Agriculture through its seed laboratory and its system of inspection has raised the quality of seed sold in the state to a high degree.

One important feature of the present Iowa Seed Law is that it classifies noxious weeds into primary and secondary. Though not a single primary noxious weed is a native in the state and only horse nettle is a native in the United States, all are perennials with creeping roots or stems which crowd out crop plants under ordinary methods of tillage. The spread of these weeds is shown in Table 7. Records are from specimens deposited in the herbarium of Iowa State College.

TABLE 7
SPREAD OF WEEDS IN IOWA

Weed	County and Time of First Recorded Collection	Counties Now Reporting Weed
Quack grass	Story, 1871	82
Canada thistle	Howard, 1892	99
Perennial sow thistle	Polk, 1895	18
Leafy spurge	Story, 1907	27
Russian knapweed	Sioux, 1932	17
Buckhorn	Story, 1890	99
Horse nettle	Story, 1891	94
Perennial pepper grass	Carroll, 1920	30
European bindweed	Fayette, 1892	92

For a long time a farmer's weeds were considered his own business. If he were wise, he would destroy them. If not, it was his own hard luck. But eventually Iowans came to believe that, since weeds spread from one farm to another, weeds on one farm were the concern of that farmer's neighbors and of the community. So laws were passed concerning some of the more serious weeds.

The first weed law in Iowa was passed in 1870. It placed the responsibility for weed control on the road supervisors. This law accomplished little, because a supervisor either hesitated to enforce a law among his neighbors or he had so many noxious weeds on his own farm that he had no influence. In later years the law underwent several changes. The first change provided for a trustee to serve as township

weed commissioner, but, since he had to be elected by the other two, it was usually difficult to obtain willingness for one to serve. A second change placed the responsibility for weed control on the county board of supervisors and required that the board appoint one trustee from each township as weed commissioner. This change was not too successful, because the commissioners were usually farmers and they were hesitant about enforcing a law on their neighbors. A third modification made in 1934 permits the county board of supervisors to appoint a county weed commissioner who is authorized to enforce the weed law in his county. The counties with a county commissioner have made the greatest progress in the development of a weed control program, but too often they have been limited by funds.

The present law is weak, in that weed control work must be financed from the county general fund, which too often is inadequate. A special levy for weed control work is needed, as well as state or district commissioners with power to enforce the provisions of the weed law in each county. One of the valuable provisions in the law is that land owners or tenants or both can be required to adopt a long-time program of control on large areas infested with primary noxious weeds. It was possible to include this provision in the law because of the important demonstrations by the Agricultural Extension Service of Iowa State College which had shown that cropping systems could be employed to eradicate large areas of weeds and bring in a fair return. Subsequent tests by the Agricultural Experiment Station corroborated these findings and provided additional information on cultural practices which have further aided in effective weed control.

DESTROYING WEEDS

Weeds became established, of course, despite the growing use of seed testing. The first method developed for destroying them was that of cultivation, by which weeds were pulled up or plowed under. Then farmers found they could destroy some weeds by planting crops which would smother them. Most recent of all destruction methods has been the development of sprays and weed-killers which destroy the weeds without injuring crops, and the introduction of chemicals that temporarily prevent plant growth.

From 1890 to 1914 Prof. L. H. Pammel was exceptionally active in his efforts to acquaint the people of Iowa with the losses caused by weeds, the danger of allowing noxious weeds to become established, and the importance of destroying weeds by good cultural practices. He invited people to send weeds to him for identification, provided in-

struction for students interested in weeds, and published bulletins and books to acquaint farmers with weeds and their habits. His book, *Weed Flora of Iowa*, published in 1913, was widely used in later years by county agents, farmers, and teachers of agriculture. From 1914 to 1918 farm help was insufficient to do the necessary farm work and destroy patches of bad weeds. The net result was a marked increase in the areas infested with such perennials as quack grass, Canada thistle, and horse nettle. Annual weeds also gained the upper hand. By 1920 weeds had become recognized as a serious farm problem.

In 1921 R. H. Porter, the representative of the Department of Botany, initiated a project which linked weed identification and control with the Agricultural Extension Service. The educational program consisted of weed identification meetings and method demonstrations for the control of quack grass and Canada thistle.

This type of program was continued until 1927, when a new method of weed control was introduced into the United States—the use of sodium chlorate. Porter, who had returned to Iowa after four years' absence, began field tests with chlorates on quack grass, Canada thistle, and horse nettle. Other chemicals to kill weeds were introduced and demonstrations for the control of small patches of perennial noxious weeds were conducted in practically every county of the state.

Porter also introduced demonstrations of cropping systems for the control of large areas of perennial weeds, and planned programs of weed control on a county-wide basis. Control of perennial weeds by cropping systems became urgent by 1930 because areas of 40 to 160 acres of tillable land had become infested with such weeds as quack grass, Canada thistle, European bindweed, and horse nettle. It became necessary to develop methods of eradication which provided a reasonable crop return at the same time. The methods employed included (1) use of such smother crops as alfalfa, sorghum, and sudan grass; (2) summer fallow in combination with fall seeding of rye or wheat for two or three seasons; (3) surface cultivation between rows of drilled sorghum, corn, or soybeans; and (4) a combination of these methods. Records of the cost of cultivation and crop returns showed definitely that by adopting a cropping system a farmer could eradicate bad weeds and realize a fair financial return from the land. These practical demonstrations became common throughout the state and remain one of the important features of weed control in Iowa. Since 1940 E. P. Sylwester has been in charge of the Extension work in weed control.

These tillage control methods made it possible to interest county

farm bureaus and county supervisors in weed control programs. Meetings were held with county boards of supervisors, weed commissioners, and farmers, and definite plans were made, not only to show farmers how to destroy weeds, but to require them to do so when persuasion failed.

WEED RESEARCH

Prior to 1927 research in weeds in Iowa was largely confined to a study of the vitality of buried seeds, the detection of weed seeds in crop seed, and surveys for new weeds or new areas of noxious weeds. In 1929, when the extension botanist was holding a district weed conference with the county agents in northwest Iowa, a petition was drawn up and sent to the Agricultural Experiment Station requesting that experiments for the control of European bindweed be undertaken. A. L. Bakke was detailed to set up a field laboratory at Hawarden in Sioux County. Experiments with herbicides, summer fallow, and smother crops were initiated on areas infested with European bindweed and leafy spurge.

A regional weed committee was formed in 1935, with representatives from Minnesota, Nebraska, South Dakota, Wisconsin, and Iowa. The committee called on Congress to appropriate funds for weed research, especially for the control of European bindweed. Congress responded and has maintained an appropriation annually for weed research. A portion of the funds has been continuously allocated to Iowa, making it possible to expand field work which has moved to the State Hospital Farm at Cherokee. Eighty acres, practically solid with bindweed, were turned over to the Experiment Station and the United States Department of Agriculture for experimentation.

The life history of the plant, along with its environmental reactions, had been worked out at Hawarden. By sowing winter rye or millet in fields infested with bindweed, researchers found that spraying with sodium chlorate or Atlacide could be done more effectively. For large areas the use of soybeans drilled solid proved to be an effective eradication procedure. Cultivations made every ten to fourteen days proved as effective in reducing the stored food material in the roots of the European bindweed as cultivations made twice a week. Considerable attention also has been given to means of eradicating Canada thistle, horse nettle, and annual weeds. The results of the experimental work at Hawarden and Cherokee have greatly aided the Extension program in weed control by supplying information on the use of herbicides and smother crops.

Seasons since 1943 have seen considerable interest in the experi-

mental work on selective sprays—sprays that will kill the weeds in a crop but will not materially affect the crop itself. Sinox will kill mustard and many other annual weeds in oats, peas, and flax. A mixture of sodium chlorate and Santobrite effectively cleans up weeds along fence rows and ditch banks. Furnace oil at the rate of one hundred gallons per acre has proven to be a good spray to kill annuals in carrots.

It was found in 1944 that a growth-promoting compound, 2,4-D, could be used as a weed eradicator. A .1 per cent solution was sufficient to kill dandelions without hurting bluegrass. A research committee of weed control workers in thirteen North Central states set up in 1945 a number of uniform experiments to test these 2,4-D compounds.

It is evident that 2,4-D is still in the experimental stage. It has been found to be toxic to young onions, carrots, peas, tomatoes, poison ivy, but members of the grass family are generally resistant. It has been possible to control annuals in oats by using a dilute application of one of the commercial forms. Canada thistle is resistant, but in the case of the European bindweed the results look promising. At any rate, such weeds as dandelion, plantain, and many weeds of lawn and turf are on their way out.

Weeds that are easily killed by 2,4-D are the mustards, buckhorn, burdock, ground ivy, mallow, pepper grass, ragweed, pigweed, marsh elder, shepherd's purse. In addition to Canada thistle, weeds that are resistant are the following: barnyard grass, buffalo bur, crabgrass, corn cockle, dock, mullein, night-blooming catchfly, Russian thistle, squirrel tail grass, yarrow.

The 2,4-D compounds act slowly; in some cases no action is noticed for several days. The susceptible plant will then twist and turn and after two to three weeks will be dead. The material is noncorrosive, nonirritating to the skin, and is not inflammable. The United States Department of Agriculture fed one-fifth of an ounce of 2,4-D to a cow for two months with no apparent ill effects.

The agricultural engineers of Iowa State College also have made an important contribution to weed control by developing improved machines. They have shown that disc harrows, spring tooth harrows, rotary hoes, and weeders may be used most effectively in tillage to control weeds.

Marked advances in our knowledge of weeds and in methods of control have been made within the past two decades, and it is probable that within another ten years Iowa will have its worst weeds well under control.

Iowa is a hog-raising state. Hogs are the outlet for a large portion of the corn crop, as they convert it into pork products bringing in from 25 to 40 per cent of the total Iowa cash farm income.

9. Hog Raising—A Big Business

W. A. CRAFT, *U.S.D.A.*, and
ARTHUR L. ANDERSON, *Animal Husbandry*

HOG PRODUCTION BECAME IMPORTANT IN IOWA IMMEDIATELY after settlement of the state began. There was demand for pork and lard in the eastern part of the country and abroad. Corn was a staple crop in Iowa from the beginning. It was produced immediately in quantity in excess of the demand at prices profitable to the pioneer farmers. Usually hogs profitably converted corn to pork and lard. Accordingly hogs found a permanent place in Iowa agriculture, and for many years have accounted for from 25 to more than 40 per cent of the total farm cash income.

Most early settlers brought hogs with them. With access to almost boundless forest prairie, the hogs were raised with little trouble, feeding on grass, roots, and acorns. Most of the pigs were farrowed in the spring and allowed to run in the woods or on the prairie during the summer. Each owner had his own mark, made by cropping and splitting the ears of the pigs. In the fall, the owners would hunt their hogs from the free range. Shoats were penned and fed corn through the winter, and when spring came they were usually turned to the woods and prairie for a second summer. Under these conditions hogs grew slowly. Many farmers fed corn lightly to their hogs through the second summer. In the fall they would be penned near the homestead and fed corn until fat enough for the market. Hogs were fifteen months to two years old when marketed.

Slaughter on the farm during the winter provided the farmer with a meat supply that he spread throughout the year by curing the pork and rendering the lard. If there were more hogs than the farm family could consume, they were driven to market. Often a dozen men and boys, some on horseback and others on foot, would gather with clubs and whips and start the hogs across country to the market. Many

drives required several days, and wagons loaded with food for the journey followed the drivers, picking up hogs crippled in the drive. In some cases it was necessary to slaughter and dress the cripples on the road to save the carcasses. Members of the crew took turns watching the herd when it was necessary to camp over night en route. After the hogs had been sold, the drivers rode home in the wagon.

In 1865 a drive was made from Monona County to Yankton, South Dakota—approximately one hundred miles. Other drives are reported from eastern Iowa to Chicago and from Delaware County to Ft. Atkinson, Wisconsin. In some cases ox teams went ahead to leave corn for feed at suitable stopping places. Stories relate that hogs would not cross bridges but swam streams or crossed on the ice. Sometimes the ice broke and there were casualties from cut throats among hogs swimming amidst the broken ice. Not all hog driving was done by farmers, for there were men who made buying and driving hogs to market their business.

EARLY DEVELOPMENTS

Corn thrived on the new land. Although markets at which corn could be sold were established, first along the Mississippi, then along the interior rivers and later along the Missouri, corn had to be hauled to them in wagons, carts, and sleds. Many farmers were more than a day's journey away, and the price of corn was only 8 to 10 cents a bushel, so that an acre's production would bring only \$4 to \$5. As a result farmers fed the corn to hogs. The value of corn as hog feed had been demonstrated long before, and pork had become a staple food of most people in Europe and the New World. It could be cured and shipped long distances, retaining its flavor and nutritional qualities. Lard was used extensively for shortening and, until displaced by kerosene about 1870, for illumination as well. Many writers praised the hog highly for bringing farmers through hard times following the panic of 1857. By 1859 two towns in Iowa, Muscatine and Keokuk, were packing about one-fourth as many hogs as Cincinnati, pork-packing capital of the period. Hogs marketed in the early days averaged by various counties from 175 to as high as 400 pounds.

Hog production expanded during the Civil War, and interest in improved practices mounted. The manner of fencing for hogs, breeding, disease control, and methods of feeding were topics of discussion everywhere when a few farmers got together. Essays on hog raising were published by the State Agricultural Society and the farm press. During this period many city markets paid a small premium averaging

about one cent per pound for choice, fat, clean hog carcasses weighing 80 to 150 pounds. This intensified interest in the question of the kind of hogs to raise. Farmers often asked, shall we raise large or small hogs? Hogs weighing three hundred to four hundred pounds had been preferred generally at the packing centers.

By 1865 there were few communities that did not boast having some hogs of an improved breed. The hog population in the state then exceeded a million head. Clover also had become established as a crop in the state. It was to play an important part in hog raising in later years by providing pasture of high quality. In the decade following 1860 many farmers had begun to make a speciality of the hog enterprise.

In the 1870's, hog numbers on farms in Iowa were approximately doubled while the increase was only about 1.5 times in the United States during that decade. This marked the beginning of rather intensive hog production in Iowa, coincidental with expansion in farming. The numbers increased from 4.5 million head in 1880 to 6 million in 1890. Numbers of hogs on farms in Iowa, January 1 of each year, from 1890 to 1920 varied from about 5.5 million to more than 10 million head. During the years 1920-34 the numbers were less than 9 million in only three years. Numbers dropped in the drouth year of 1935 to 6.3 million head, the lowest number since 1897, with but one exception. Recovery began in 1936, however, and at the beginning of 1939 there were 8.2 million hogs on Iowa farms. Expansion of the hog enterprise occurred during World War II. Nearly 15 million head were reported on Iowa farms January 1, 1944. The all-time record of production was in 1943; Iowa raised approximately 21 million of the 122 million hogs produced in the United States that year.

The numbers of hogs in Iowa have varied in accordance with the favorableness of the feeding ratio. When corn became high priced, farmers raised fewer hogs. With cheap corn, hog production expanded. The profitableness of marketing corn through hogs is indicated by the hog-corn price ratio, which is the number of bushels of corn that is equal in price to 100 pounds of live hogs. The figure 12.0 has been used for many years as a base below which hog production is apt to be less profitable than selling the corn. That base is when 12 bushels of corn sell for as much as 100 pounds of live hog. For the past twenty years the yearly ratio has ranged from 8.1 to 19.6, with an average of 12.06.

Expansion occurred in World War I and World War II when there was an acute demand for more human food and hog prices were more favorable to the producer than the price of corn.

BREEDING

Not many of the hogs in Iowa prior to 1860 were of any recognized breed. In this respect Iowa was behind the older states. Its hogs were mixtures to which all the various kinds of hogs brought in from the older states contributed. With the coming of the railroad the type of hogs began to change to a more profitable form than the "prairie-rooters," "hazel-splitters," "razor-backs," "wind-splitters," and "dog-fennel-grazers"—names commonly used for native hogs. "Uncle" Henry Wallace is credited with the statement that the railroad shortened the nose, shortened the legs, removed the bristles, put a more lovely kink in the tail, and changed the color of hogs from mixed white and black to black, white, or red.

Farmers in the various communities observed that hogs of improved breeding which latecomers brought into Iowa from the older states and from Europe were more suitable to the improved practices which were increasing, than were the native stock. The imported hogs had shorter legs, wider and thicker bodies, shorter heads, and finer hair than the native hogs. They also matured earlier and fattened more readily than the "prairie-rooters." These traits became more important to the farmer as it became necessary for him to restrain the hogs from his neighbor's fields and feed them continuously.

From 1860 to 1870 one of the problems was that of fencing. The population during the preceding decade had increased from 192,000 to 675,000 and appeals were being made to the legislature to enact measures which would stimulate immigration. One of the measures stressed was a law requiring each man to keep his livestock under fence. Although such an act was not passed for ten years, some counties set up "hog-laws" of their own before that time. Black Hawk County, for example, had a "hog-law" as early as 1857 and Iowa County as early as 1859. It was argued that if pastures were fenced it would not be necessary to fence the fields. Such practices, it was claimed, would be cheaper than fencing the fields and allowing the stock to range in unfenced territory.

IMPROVED BREEDS

In England, pure breeding as a means of improving stock was well under way soon after the beginning of the Nineteenth Century. Accordingly, settlers who came from the British Isles after 1800 usually brought some improved stock with them, and by 1850 numerous importations had been made to the eastern states. By about 1850 improved breeding practices became well established in Ohio, Kentucky, Pennsylvania, Virginia, Indiana, Illinois, and other eastern

states. Many herds were bred "pure" and served as sources of seed stock, particularly boars. It was about 1860 that farmers in Iowa began to become breed conscious.

The Suffolk was among the first of the improved breeds to be introduced and used extensively in Iowa. Reports from the county agricultural societies reveal that use of the Suffolk in crosses on native stock greatly improved maturity and feeding quality of hogs. By 1860 hogs called Polands introduced from Ohio and Illinois, the Chester White from Pennsylvania and other states, and the Berkshire from England and eastern states had begun to contest the lead established by the Suffolk for crossing with native stock.

Each of the breeds had strong advocates, but for some reason the Suffolk, Essex, Cheshire, and some other breeds did not become permanently established in Iowa. The Yorkshire and Tamworth breeds became established but have not been produced so extensively as some other breeds. One historian tells us that the battle of the breeds that had divided English stockmen into rival groups was transferred from England to the United States at about this time. Adherents of some breeds stressed early maturity, shortness of legs, fineness of hair, plumpness of body, and smallness of head and ears. Others stressed with equal zeal large size or weight at market age of twelve to eighteen months, with large bones and ruggedness being the characteristics that made hogs profitable. Many farmers emphasized length of body and large frame for sows, and medium size with compact body for boars.

In 1869 the Secretary of the State Agricultural Society reported that breeders who had pigs of improved breeds were sending them all over the country by express and were getting enormous prices. Throughout the state interest was high regarding hogs of improved breeding.

Hogs exhibited at the first State Fair in 1854 totaled eleven head, but the breeds are not known. However, in 1856 there were eight different breeds and crosses reported. These included Suffolk, Cheshire, Essex, Suffolk crosses, Irish Grazier, Berkshire, Poland (often called Magie or McGee breed and later named Poland China), and crosses of China hogs. During the first two or three years of operation of the county fairs, only three or four hogs were exhibited and these were usually not "full-blood."

A visitor to the 1856 Iowa State Fair reported:

The lovers of the noble horse, in heavy ranks, ranged along the stables, where the busy grooms were at the morning toilet of the steeds. Groups were scattered here and there over the extended grounds, watching the operation and listening to

the explanation of some new machine. Next came the swine pens, and being no great admirer of this class of stock in any other shape than well cured, well broiled, and flanked by fresh eggs, hot coffee, and warm rolls about seven o'clock, A.M., we shall not enlarge much upon the varieties on exhibition.

Pure breeds were not formally established in the United States until after 1870. But some farmers selected their stock with great care, using "full-blood" boars and grading up their herds. It was through the efforts of these men that stock was improved by selection and breeding and that the value of improved breeding practices was demonstrated for producing "seed stock" for crossing on native "razor-backs," "prairie-rooters," "hazel-splitters," etc.

Until the State Fair of 1860 all breeds and crosses of hogs were shown together, but in that year they were divided into two classes: small breeds (forty head exhibited) and large breeds (twenty head exhibited). Small breeds mentioned were Suffolk and hogs from Chester County, Pennsylvania. It is presumed that the latter were Chester White. Hogs shown in the class for large breeds included Poland China and Berkshire.

The premium lists for the State Fair in 1868-69, for the first time did not include small breeds. Entries in the class for large breeds included Berkshire and Chester White. A special award was given by pork packers of Keokuk for the best boar and the best sow for packing purposes. Both were won by exhibitors from Illinois. Illinois exhibitors were winners in some of the other classes, and complaints were registered against out-of-state exhibitors.

In the seventies immigration to Iowa was heavy and much interest prevailed in improving the quality of hogs through the importation of breeding stock. It was reported by the Secretary of the State Agricultural Society that "hog culture is a mania." It had, he stated, seized the people like an epidemic and enormous prices were paid for hogs claimed to possess desirable qualities. He pointed out also that it would be of tremendous advantage to know definitely which of the breeds was best for packing, and that steps were being taken to obtain such information.

In 1871 some importations of breeding animals were made from Europe. The diffusion of improved breeds through the state, resulting from the influence of showing the breeds at the State Fair, and a change from small to large hogs resulted in greater income from hogs than formerly.

The Suffolk breed had been removed completely from its position of favor by 1870 and had been replaced largely by the Berkshire,

Poland China, and Chester White. A new breed, the Jersey Red, later Duroc Jersey, was exhibited at the State Fair first in 1878.

Poland China breeding was present in approximately one-third of Iowa's hogs in 1885. Ten years later approximately half the hogs exhibited at the State Fair were Poland Chinas. West Liberty proclaimed itself the world center of Poland Chinas. Breeds exhibited at that time included Berkshire, Poland China, Chester White, Duroc Jersey, and Victoria. The Duroc Jersey breed had been introduced in most of the counties by 1885. Hampshire hogs were first exhibited at the State Fair in 1908, with seven exhibitors showing 150 head. Hereford hogs, the newest breed, were exhibited in 1931, but a class was not provided for them until 1939. Suffolk, Victoria, Cheshire, and Essex breeds were smothered under the avalanche of Poland China and the rise in popularity of other breeds. Yorkshire and Tamworth breeds persisted to a limited extent.

The old question, Which is the best market breed? was still a matter of concern even after 1900. The Iowa Experiment Station and those of other states studied the performance of breeds beginning about 1890, and many farmers conducted trials of their own. Experiments have not yet answered the question as to the best breed in every respect, but they have served to indicate that breeds differ in regard to certain functional characters. Some breeds appear to excel in growth rate, others in size of litters, and still others in desirability of carcasses.

Leaders in agriculture in Iowa assembled in 1873 and formed a Fine Stock Breeders' Association. Annual meetings were held and the various aspects of improving the livestock in Iowa were discussed. Some years later associations, organized to represent the various classes of livestock, took over the functions performed by the former association.

Breed associations, usually national in scope, were organized beginning in this decade. The first was for the Berkshire breed, in 1875. These associations soon began publication of record books containing pedigrees of registered animals, but publication of the books was suspended in the 1920's. The breed associations have served to establish and maintain standards of characteristics, register animals whose pedigree was acceptable, and promote the sale and distribution of stock.

TYPE

Type in hogs has been a matter of controversy from the beginning of man's effort to improve hogs through selection and breeding. Be-

ginning about 1870 attention in Iowa was focused on two types, so-called lard type and bacon type.

Under influences of a rising demand in cities for cuts from hogs of light weight, and preference for light hogs in foreign trade, controversy increased during the decade regarding merits of various breeds and the most desirable weights of marketed hogs. In earlier years highest prices had been paid for heavy hogs. This problem of most desirable market weight still perplexes the hog producer. The change to less fat and more lean was caused by the expansion of the number of foods in the diet and the lessened demand for calories from pork and a decreased demand for lard.

Boars of bacon-type breeds have been used at various times in the state to improve the carcasses of pigs farrowed by lard-type sows. Since 1900 the Iowa Experiment Station and many others have conducted trials comparing lard- and bacon-type hogs as to performance and carcasses. Breeds of bacon type yielded a higher percentage of first rate bacon carcasses than the breeds of lard type. Likewise crosses of lard type and bacon type produced carcasses superior to those of lard-type hogs. But hog markets in this country have not consistently paid enough premium for superior bacon carcasses to overcome the Iowa hog producer's preference for so-called lard-type hogs. Accordingly the breeds regarded as lard type still prevail in Iowa.

Within the lard-type breeds, type varies from a small, early-maturing, excessively fat hog, such as the Suffolk of early days, to a large, heavy-boned, late-maturing, and rangy type that must be fed to weights of 250 pounds or more to show enough finish to yield carcasses with desirable quality. These variations, together with several other factors, gave rise to designation of three types—small, intermediate, and large, particularly within the Poland China breed. Many experiments have been conducted with respect to the virtues of the three types. One of the earliest of these began at the Iowa Station in 1917. Results agree in general that hogs of intermediate type are more suitable to producers and consumers than those of the extreme types.

The question of type, however, is still one of much concern. History of shifts in type in the pure breeds of hogs would be a study within itself. There appears to be a tendency to move from one extreme to the other. Such shifts are made more rapidly with swine than with larger farm animals. The tendency to shift type is so great that since 1939 several of the hog breeders' associations have sponsored "type conferences" annually to discuss the problem. Likewise, for several years Iowa State College, and the Iowa Swine Producers' Association

with the co-operation of packers, have held hog type and carcass demonstrations at various points in the state. The purpose of these conferences and demonstrations is to keep attention of breeders, judges, field representatives, market hog buyers, and others focused on the type of hog seemingly most suitable to hog producers and to the markets.

Even today a difference of opinion exists in the matter of size. Reasonably large-sized parents are needed to produce fast-growing pigs. However, when size is carried to the extreme, the market pig produced may be unfinished at the desired market weights. The desirable goal is high productivity of sows, rapid gain of pigs combined with sufficient finish to insure desirable quality at a market weight of about 225 pounds.

PRACTICES

Optimistic predictions that breeding had reached its limits were not unheard of before 1900.

The Secretary of the State Agricultural Society reported in 1885: "It may be safely stated that the race of native, ill-shapen and profitless hogs of a quarter century ago, has disappeared." He pointed out also that hogs at that time had enough admixture of the blood of some recognized breed to bring them to a high standard. And in 1891 the secretary suggested:

Perhaps the ideal of perfection has been reached in the production of the hog. The limit of all these points as early maturity, economy in preparing, size, symmetry, etc., appears to be reached. The skillful breeding and raising of swine is so general that the standard is practically uniform. There are preferences by the individual or the neighborhoods for special varieties or crosses; and packers have a choice for various meats for different markets. But the end of improvement is attained and there remains only the duty of maintaining it, and obviating all cases of degeneracy.

The value of purebred boars for producing market hogs has been emphasized continuously since the breeds were formed. The advantages commonly ascribed to the purebred over the scrub or nondescript hog were: greater size or weight for age, proper finish for the market at a younger age, more efficient conversion of feeds into gain, more desirable carcass, and the sow excelling in fertility and suckling ability. Farmers generally have used boars of a pure breed during the last half century. Experiment stations have compared the performance of pigs by purebred boars with pigs by nonpurebred boars at various times since 1890. The results were favorable generally to the purebred boars.

Crossing of stocks from different localities was practiced in Iowa

(and elsewhere) long in advance of the pure breeds. Some farmers used a boar from one breed and then one from another breed the next year on the sows produced the preceding year. It was one of the methods used in forming and improving the pure breeds. Farmers have insisted generally that crosses exceed purebred stock in performance. Experiments conducted at the Iowa and other stations comparing crossbred and purebred hogs have shown that the differences were small but the results usually were favorable to the crosses.

Grading and crossing were practiced objectively and extensively. Reports indicate that it was common practice to cross to a breed with a definite purpose in mind, and then backcross the progeny to the favorite stock. Packers often expressed preference for crosses. Crossing of breeds for market hog production was found generally advantageous because of the hybrid vigor attained.

Hogs and other classes of livestock have been brought to their present degree of perfection by efforts of breeders applying their skill through trial and error. They have tried crossing stocks of various breeds and types, inbreeding, linebreeding, outcrossing, outbreeding, and selection. The most recent development is sow testing. This is based on weights of litters at weaning, and the information gathered is used in making selections for increased productivity.

In many purebred herds the use of moderate inbreeding was practiced for a time, which helped in purifying the stock. Linebreeding was practiced in many herds, usually for short periods only, to increase the relationship of a herd to a noted animal, usually a sire. A decline in vigor was often observed among inbred or linebred animals. Accordingly, hog breeders have not consistently used these methods. Outcrosses within a breed have served a useful purpose in swine improvement by bringing in new inheritance and remedying declines which resulted from inbreeding. Changes in certain characteristics were sought usually through the use of a boar not related to the sows with which he was to be used. Often a breeder would get a boar from a herd with the idea that such an individual would impart something such as increased gaining ability to the herd.

Not until after 1900 did experiment stations begin to explore the possibilities of extending purebreeding principles. In 1930 the Iowa Experiment Station started an experiment to develop and test the usefulness of inbred lines. Some other stations are conducting similar experiments. Early experience in these experiments made it clear that large numbers of animals would be necessary to test application of the principles which have been used in corn breeding with marked

success—that is, developing and crossing inbred lines. In 1937 the experiment stations in the Corn Belt, in co-operation with the United States Department of Agriculture, established the Regional Swine Breeding Laboratory with headquarters at Ames, to explore possibilities of using new methods in hog breeding.

In 1941 a plan of recognizing outstanding hog raisers of the state was initiated by the Iowa Swine Producers' Association, Radio Station WHO, and the Iowa State College Extension Service. Each year twenty-five market hog producers are selected and awarded a certificate of merit, as Master Swine Producers. The award is based upon the number of pigs raised per sow to market weights and the approximate average daily gain made by the pigs.

CLEAN-GROUND SYSTEMS

As the hog population of Iowa increased it became more difficult to raise crops of pigs free from parasites and infectious diseases. Several practices have been developed for controlling parasites through swine sanitation. The clean-ground system is one of these. In 1919 two representatives of the United States Department of Agriculture went to McLean County in Illinois to demonstrate a system of hog sanitation. A few farmers became interested in trying this plan in the fall of 1919, and by the spring of 1920 many more hog men in that county became interested. Tours were conducted and the effectiveness of the method demonstrated. Subsequently this clean-ground system was widely adopted in Iowa and other hog-producing sections.

The four essentials of this system are: 1. Thoroughly cleaning the farrowing pen and scrubbing with scalding water and lye; 2. Washing the sows with warm water and soap, especially the udder, before they are put in the farrowing pen; 3. Moving the pigs to clean-ground pastures equipped with houses that have been thoroughly cleaned and disinfected; and 4. Keeping the pigs on the clean-ground pasture until they are four months old or weigh about one hundred pounds.

A modification of this system developed in Iowa, the confinement system of raising pigs on concrete floors, has been widely publicized. It has become increasingly important as hog production continues to follow practices which keep the young pigs away from old contaminated hog lots.

FEEDING

Today from two-thirds to four-fifths of Iowa hogs are farrowed in the spring. In 1945 about 33 per cent were farrowed in April, 20

per cent in March, 15 per cent in May. September, with about 10 per cent, led fall farrowings. August and October followed with approximately 5 per cent each. For many years, heaviest marketings have been in November, December, January, and February.

In the early years of statehood most sows were bred as now, to farrow in the spring. Such feed as the hogs could find on the prairie and in the woods enabled the farmer to maintain his herd at little expense of money or labor. Feeding became more of a problem with spring farrowing.

Sows farrowing in the spring were fed corn, supplemented with oats and such waste as was available around the farm, until the pigs were weaned—a period of from eight to twelve weeks. Creeps were used by some farmers for pigs during the suckling period. The pigs after weaning were kept often in a pen or small lot and fed corn, oats, wheat shorts, and such waste as was available until summer. Then they were turned to the woods or prairie, or into wheat or oats fields after the crops were harvested. Finally in the fall the shoats were placed in small pens or lots and fattened so that they could be marketed some time during the winter. Some farmers turned the shoats into corn fields to “hog-down” the corn, but this practice was not general.

After weaning, pigs farrowed in the late summer or early fall were wintered in a small pen, lot, or a wood lot when such was available. They were fed corn, oats, potatoes, pumpkins, wheat shorts. On many farms some skim milk or buttermilk was available for the pigs. In the spring the shoats were turned out to forage on the prairie or in the woods until fall when they were brought in and fattened with corn for market in the winter. On farms where a herd of cattle was raised or steers were fed for market it was a common practice to let fall pigs follow the cattle. Corn supplied additional feed needed.

By 1865 improvements in feeding practices were sought. Many essays were written and many talks given as to the best feeding practices. Soaking or cooking of corn, potatoes, pumpkins, and oats was advocated by many of the best hog raisers. Because of the extra labor the cooking of feeds was not practiced as extensively as soaking feeds. Grinding corn and other grain was advocated by many farmers but the cost restricted its use. It was a general practice, however, to feed sows during the suckling period and pigs for a month or so after weaning some sort of slop or gruel made by mixing a ground feed with water or skim milk.

A feeding practice recommended in 1859 for profitably making pork included the following: “Put pigs on pasture in the summer.

Shut them up in September and feed cooked swill made of pumpkins, potatoes, beets, and carrots, adding two bushels of corn and oatmeal to the barrel. Increase the meal gradually, eliminating roots the last six weeks of feeding." In general, reports indicate that farmers calculated about thirty bushels of corn were necessary to produce a hog weighing 200–250 pounds. Some farmers maintained that thirty bushels of corn would produce a hog weighing 300 pounds or more.

There were a few farmers who conducted feeding trials to measure the amount of feed required by pigs of different weights and the rate of gain when the pigs were fed well. In 1867 such gains as the following were reported:

1. A 55-pound boar pig gained 32 pounds in 17 days.
2. A 98-pound boar pig gained 17 pounds in 7 days.
3. A 66-pound sow pig gained 14 pounds in 7 days.
4. A 198-pound boar pig gained 44 pounds in 21 days.
5. A 186-pound sow pig gained 52 pounds in 21 days.

These gains would be considered favorable today for pigs being fed a well-balanced ration.

Wood ashes, lump coal, and salt were used by many farmers to supplement the other feeds. Some farmers as early as 1865 claimed that pigs got something in following cattle that was of healthful value to them. Trials at the Wisconsin Experiment Station in recent years have shown that cow manure contains certain essential vitamins. After clover became established about 1865 and fencing permitted, sows, and particularly pigs, were allowed to run in clover pastures and were fed corn. This practice was followed by the best hog producers because the results were good and free range was becoming scarce. Furthermore, the legislature after 1870 restricted the use of free range by requiring animals to be kept under fence. By about 1870, farmers whose success with hogs rated them as authorities on the subject advocated full feeding from the time that the pigs began eating.

It was not until agricultural colleges and experiment stations demonstrated the value of supplements to grain and industry made such by-product supplements available that feeding practices underwent further changes. Cereal processing, the extraction of oil from seeds, meat packing, and other industries provided a vast number of useful feeds.

Iowa farmers have long appreciated the need for supplements to corn in feeding hogs. Some farmers in northwest Iowa trapped fish and fed them with corn to the hogs in the early days, getting favorable

results. Scientific checking of supplementary feeds proved to be one of the most fruitful fields in swine investigation.

EXPERIMENTS UNDER OBSERVATION

In February, 1888, the Iowa Legislature accepted grants authorized by the federal Hatch law and placed the organization and management of agricultural experiments under the board of trustees of the Iowa Agricultural College. Swine investigations, however, did not begin immediately.

R. P. Speer, director of the Iowa Agricultural Experiment Station, said in 1890, "We will not promise many experiments in breeding or in feeding the domestic animals, because thousands of skillful breeders and feeders are conducting such experiments in all parts of the West."

In the first twelve bulletins issued by the Iowa Agricultural Experiment Station from 1888 to 1891, the only reference to hogs mentioned the occurrence of hog lice in the college herd, and the use of kerosene emulsion as a control measure.

The first hog experiment is that reported in 1891. A Poland China sow and a litter of four pigs were the experimental animals. It was found in this initial experiment that every bushel of corn or equivalent fed produced 17.3 pounds of growth. This experiment demonstrated, according to the investigators, "what great possibilities are locked up in the Iowa hog. He is eminently the great corn condenser of the state. His torpid nature and fat-forming function enable him to burn the carbohydrates of corn into bacon. His omnivorous appetite prompts him to gather up all the waste food products of the land and convert them into gold."

The second experiment reported concerned the winter feeding of hogs. Three old Chester White sows were compared with six cross-bred Chester White and Poland China five-month old shoats. From this feeding trial it was concluded that younger hogs will yield greater profit than old hogs. In discussing the results it was observed that there is no doubt that many a lot of fattening hogs have been carried so far beyond the ripened period as to greatly reduce the profit.

In 1892 an experiment was made on the feeding of buttermilk to pigs. The authors stated that Iowa corn is nearly a balanced ration for hogs and needs only a small addition of protein to bring out the highest nutritive value.

An experiment was conducted on the use of cottonseed meal in swine rations in 1895. High feed prices followed the drouth year of 1894 and as a consequence much cotton seed meal was brought to Iowa

for feeding. This prompted the swine feeding trial which demonstrated that cottonseed meal is fatal to hogs when fed in quantities of 27 to 33 pounds per hog. Subsequent investigations have demonstrated that limited quantities of cottonseed meal can be used with safety for swine.

A series of experiments was started in 1896 on comparison of breeds and crosses, the demands of the market, and a comparison of bacon- and lard-type hogs, on many of the leading features connected with the production and consumption of pork. An outbreak of cholera in 1896 interrupted the series but it was continued in 1897 and 1898.

A swine feeding trial in which tankage and other supplements fed with corn were compared with lots fed corn alone was first tried in 1902. It was concluded that in fattening young hogs, a ration containing more protein and ash than corn alone gave better results than a sole corn ration.

Comparative swine feeding trials similar to those conducted currently were first reported in Bulletin 91 of the Iowa Agricultural Experiment Station in June, 1907, which reported results of rather extensive feeding trials in which various feeds were compared. In 1909 a somewhat similar publication was issued dealing with the preparation of corn for hogs.

In recent years the swine herd used in the various investigations numbered over one thousand head. Outstanding have been the research on feeding and management, development of the self-feeding method, requirements of growing, fattening pigs and brood sows, mineral and protein requirements, efficiency of various grain and protein feeds, and carcass yields.

Early settlers had but few cattle, and used them for both work and milk. Beef-making got its start, and gained in importance. The trend in Iowa beef production has been to finish cattle for market at lighter weights and at younger ages.

10. Iowans Feed Beef Cattle for Market

P. S. SHEARER, *Animal Husbandry*

CATTLE GRAZING, TODAY ASSOCIATED WITH THE ranges of the West, has been a sign of the pioneer throughout the history of the United States. Cowboys once herded dogies in Virginia. As settlers moved across the continent, the cowboy and his cattle moved ahead of them. When Iowa became a state in 1846, cattle grazing was just beginning in its southeast corner. Fifty years later the enterprise had passed through the state to northwest Iowa, across the Missouri, and had disappeared into the West.

Iowa's first cattle were brought into the state by settlers from Illinois, Wisconsin, and Missouri. The census of 1840 shows that Iowa territory had "cattle other than milk cows" numbering just over thirty-eight thousand head. Nearly all of them were located in an area two or three counties wide along the Mississippi River from the Missouri border north to what is now Clayton County, with the heaviest concentration in the three southeastern counties, Des Moines, Lee, and Van Buren. The year 1850 found the number of cattle nearly doubled with most of them located south and east of a line running from Mills County to Winneshiek. The westward advance was more rapid in southern Iowa because of the Mormons who crossed the state from Nauvoo, Illinois, to Council Bluffs in 1846, and also because of the settlers coming in from Missouri.

Not much information is available concerning the characteristics of Iowa's early cattle. It is certain that there were not at that time highly specialized types of beef and dairy such as we know them now. We know that the stock from which they came was made up of cattle from numerous European countries, brought in by the early settlers

all along the Atlantic seaboard. By 1840 improved Shorthorns from England had been used enough in the states farther east, notably Ohio, Kentucky, and Illinois, to have left their impression on the cattle there. Devons and a few Herefords also had been introduced west of the Allegheny Mountains to improve the so-called native stock. Cattle from Missouri seem to have descended from stock brought westward from the Carolinas through Tennessee and southern Illinois. These southern cattle are described, as they first entered Iowa, as inferior in size and beef qualities when compared with the stock which came in from states directly east. A combining of these two somewhat different stocks provided the foundation for Iowa's beef-raising industry.

The earliest settlers had but few cattle and generally used them for both work and milk. As numbers increased beyond those for such needs, beef-making increased in importance. This led in many cases to the use of improved stock. A statement by a Muscatine County cattleman published in the annual report of the State Agricultural Society for 1858 indicates the mixed characteristics and poor quality of the cattle stock twelve years after Iowa became a state:

The practice of suffering male animals of our native breeds, of all colors, shapes and sizes, many of them the meanest that could be raised, to run at large is, to say the least, reprehensible.

The annual report of the secretary ten years later indicates that, while some improvement had no doubt been made, much remained to be done:

Yet the fact is apparent that raisers of cattle are too easily satisfied with present attainments. The mass of farmers are content to follow the old routine; and in most cases the process of rearing cattle is excessively primitive. Many of them eke out their living on prairie pasture and prairie hay. But all the testimony is in favor of careful crossing, rearing, feeding, and a knowledge of the breeds best fitted for the butcher, the yoke, or the dairy.

Beef cattle numbers increased steadily and rapidly after 1850, reaching over three million head by 1890. This represented an increase in density from a little over one head per square mile of farm land to approximately sixty-one head per square mile. During this period settlement progressed to the west and north, continually opening up large areas of good grass land. Drove of cattle were pushed out ahead of the plow. Cultivation and cropping of more land in the older areas reduced the grazing available there. Cattle numbers were increasing beyond the needs of the settlers for milk and work. Sending out herds along the fringe of the more thickly settled part of the

state became the common practice. These herds were usually made up of cattle belonging to several owners and were in charge of hired herders. Some owners had enough cattle to make up herds of their own, but this was the exception.

The transition from grazing to farming along this western fringe was accompanied by much serious controversy over fencing and the right to free grazing. In 1870 the legislature enacted a law which made the owner of cattle liable for damages done by his cattle to cultivated crops. The enforcement of this law was left to individual counties and later to townships as a matter of local option. In most parts of the state cattle herding did not persist long in any given area because settlement and cultivation constantly were catching up. It prevailed longer and was practiced on a larger scale in northwest Iowa than in any other section. From 1850 until past 1890 cattle grazing somewhat comparable to that on the range reached its greatest development in Iowa. After 1890 cattle grazing moved on west into Nebraska and South Dakota. Iowa, except for isolated spots, had become a state of diversified farms.

Commercial beef production stabilized on the basis of two distinct types of enterprise. One was the maintenance of cow herds with the production of calves sold as feeders or fed out for beef by the grower. The cow-herd enterprise is adapted to the use of low-grade roughage and pasture land that is too rough and erosive for cultivation. The second enterprise, cattle feeding, involves the purchase of thin cattle and fattening them for the slaughter market. As compared with the cow-herd enterprise, cattle feeding requires more grain and less roughage but roughage of better quality. Some farms are adapted to combining both enterprises and both are found in all parts of the state. Calf-raising predominates, however, where there is more rough pasture land, and cattle feeding predominates where more grain is produced. Total numbers have fluctuated. On January 1, 1946, Iowa had 3.6 million "cattle other than milk cows," a figure comparable to the 3.3 million reported in 1890.

INTRODUCTION OF PUREBREDS

When the first purebred beef cattle were imported into Iowa is not a matter of clear and indisputable record, but it seems quite certain that the first of the recognized beef breeds to enter was the Shorthorn, or Durham, as it was often called in those days. The 1857 report of the State Agricultural Society says: "In 1840 Charles A. Hatfield brought a Shorthorn bull to this country which was a very

superior animal. He was from an imported cow and sired in England." Sanders' *History of Shornhorn Cattle* states, "There is a record of a purebred bull having been taken into Muscatine County by Charles A. Warfield in 1841." While there is some discrepancy in name and date, these statements probably refer to the same bull, the first purebred beef animal, on the basis of available records, to enter the state.

Timothy Day, a farmer of Van Buren County, is generally credited as the earliest Iowa breeder of purebred Shorthorns. His foundation animals were purchased in Kentucky and came to Iowa in 1850. Other early breeders of Shorthorns were H. G. Stuart, of Lee County, and Judge T. S. Wilson, of Dubuque. These three men exhibited their pedigreed cattle at the early state fairs and contributed in other ways to an appreciation of the value of Shorthorn blood.

The Civil War, which caused a rapid expansion in sheep raising in Iowa, temporarily retarded the spread of the Shorthorn. After the war, interest in sheep raising subsided, and improved Shorthorns experienced a boom which brought prices to excessively high levels but gave them a wide distribution throughout the state.

The Agricultural Society Yearbook for 1879 states that Shorthorn cattle were reported in seventy-nine counties and that only nine counties reported having only grades and natives. Iowa assumed leadership early in the production of Shorthorn cattle, and during recent years has been the leading state in numbers of purebred Shorthorns and in the number of breeders producing them. Both the beef and the milking types of the breed have been popular. Iowa also has played an important part in the development of the polled strain of Shorthorns.

Uncertainty also obscures the date of entry of the first Hereford cattle into Iowa. A class for Herefords was inserted in the State Fair prize list for 1856 after the opening of the fair, on the recommendation of the cattle committee. The herd shown in this class may not have been purebred, however, as grades were also exhibited at that time. In 1860 a herd of Herefords composed of one bull and four females was exhibited by George F. Devereaux in the herd class where any breed could compete. Here again it is not clear whether the cattle were purebreds or grades.

Sanders was unable to find any record of purebred Herefords brought into Iowa previous to an importation by John H. and Gilman S. Burleigh in 1869. This firm exhibited at the State Fair in 1871 and a Hereford classification appeared regularly thereafter. During the eighties, Iowa became an important center for Hereford breeding

cattle, a position which it has held to the present day. Iowa also played a leading part in development of the Polled Hereford.

Devons were brought into the state during the forties and were reported by twenty-nine counties in 1879. From what is known of their early type it seems probable that they contributed fully as much to the improvement of dairy qualities as to beef-making when crossed on native stock.

The Aberdeen Angus was the last of the beef breeds to make its appearance in Iowa. The State Fair first offered a class for polled Angus in 1881 but there were no entries. In 1882 Farwell Brothers, of Montezuma, exhibited eight cattle in the polled Angus class and in 1883 twenty-eight head were exhibited. Abner Graves, according to Sanders, was among the first to establish a breeding herd in the state. Numbers increased rapidly during the later eighties and Iowa soon led the nation in breeding Aberdeen Angus, as it still does.

The Secretary of the State Agricultural Society in 1857 expressed the following opinion concerning the status of the breeds introduced up to that time:

The different families or breeds of cattle are all represented in our state, and many of them are in such hands that they will have a fair trial of their adaptation to our soil and climate. In the matter of which is the best breed, every man will have his own opinion, and, as in older states, we may expect a war of words and opinions as to the comparative merits of the Shorthorns, Devons, and Herefords, that will not end for many years, if ever. They are all good, and, just in the proportion that the natives give place to them, or their crosses, in that proportion will the wealth of the state be increased.

The purebred census of 1885 gave the number of the various breeds in Iowa as: Shorthorns, 28,336; Herefords, 2,802; Black Polled, 394; and Devons, 192. There is abundant evidence that in the early years the rank and file of beef cattle raisers were slow to make use of these improved breeds. Systematic improvement by the use of well-bred sires was difficult and results of early attempts were discouraging when herds ran at large on unfenced land. As cropping increased and fencing became general this situation changed, and from 1885 on the use of improved sires increased rapidly.

FEEDING PRACTICES

Feeding methods have undergone a gradual evolution since Iowa became a state. The early cow herds were fed largely on prairie grass in the summer and prairie hay in the winter. As herds were pushed westward this method continued on the frontier as long as open prairie remained available. Back of the frontier, bluegrass

pasture began to replace prairie pasture as early as 1870. Timothy and clover, which had come into use as hay crops somewhat earlier, were followed by alfalfa. These hay crops largely replaced prairie hay as a source of winter roughage. Corn fodder and more recently corn silage have also been extensively used as winter feeds for breeding herds. With increasing competition from other kinds of livestock and from cattle grown on the range, commercial cow herds since 1900 have largely been kept to utilize crop residues, low-quality roughage, stalk fields and pasture. Feeding practices have changed accordingly.

CATTLE FATTENING

Previous to 1850 few cattle in Iowa were fattened for the market. Corn had not become plentiful and surplus cattle were either sold for feeders in Illinois or driven east for slaughter with only a grass finish. As corn production increased it became profitable to feed cattle, although for thirty years or more grass cattle raised in Iowa continued to go to Illinois and east for further feeding. Cattle fattening in Iowa also was encouraged by the coming of railroad transportation in the fifties. Freight rates and price relationships were favorable to marketing corn as beef.

Until after the Civil War most of the cattle fattened in Iowa were raised in Iowa. The first range cattle to come into the state were from Texas and were unsatisfactory as feeders. In the eighties some thin cattle from the western range country began to come in. As grassland was plowed for cropping and corn production increased, the demand for these cattle developed rapidly. From this beginning the fattening of range cattle has become one of the important livestock enterprises in the state. Shipments of feeder cattle from the range country were not recorded in early days but the *Iowa Year Book of Agriculture* reports that three hundred thousand head were shipped into the state in 1910. In the seven years ending in 1945, in-shipments have averaged more than one million head each year.

The first cattle fed in Iowa were not started on feed until they were three years old or older. Grass was plentiful and cheap, and size and frame were wanted before grain feeding began so that each steer would carry the maximum amount of corn to market. After 1890 cheap grass was no longer available. Corn became relatively higher priced and the cost of fattening steers rose in terms of feed and labor. Consumer demand for lighter cuts also began to be felt about this time. Under these changed conditions experimental work demon-

strated that feeding younger and lighter weight cattle was more profitable. As a result the trend in beef production for the past sixty years has been to finish cattle for market at lighter weights and at younger ages. The great bulk of the beef steers and heifers fattened in Iowa, both native and range, are now put on the market as yearlings and two-year-olds instead of three- and four-year-olds as in the early days.

Corn has always been the basis of the fattening ration but methods of feeding it have changed. It was first fed as corn fodder by scattering it on the ground. Later, snapped corn was extensively used and during the sixties husked corn fed in bunks began to be used. Shelling and grinding and the use of crushed ear corn were later developments. Corn silage feeding has developed since 1900; silage has been used most in areas where roughage was needed in addition to the available hay.

The protein supplement feeds, now so widely used in cattle-fattening rations, were used by few feeders, and then only in small amounts, previous to 1900. As feed costs became increasingly important and Experiment Station feeding trials demonstrated the value of such supplements to corn, their use increased rapidly. Clover, alfalfa, and other legume hays also have largely replaced the timothy and prairie hay of the early days.

Cattle shelters also have undergone a marked change in the one hundred years since Iowa became a state. The United States Department of Agriculture report for 1862 said, "The only barns, with few exceptions, are poles or boards, forming a skeleton, covered with heavy masses of straw, from the interior of which nearly all light and air is excluded. The business of stock raising will never be properly remunerative until some attention, some expense is bestowed upon barns and cattle sheds." Capital to invest in improvements was not plentiful in those days and probably yielded greater return when used for other things. While experience through the years has shown that elaborate and expensive barns and sheds are not needed for beef cattle, those in use today bear little resemblance to the meager shelters of one hundred years ago.

STOCK-IMPROVEMENT MOVES

Many organizations have been active in improving beef cattle stock and methods of beef production in Iowa. One of the earliest was the Iowa Improved Livestock Association, organized in 1873 as the Fine Stock Breeders' Association and renamed in 1875.

The Corn Belt Meat Producers' Association, organized in 1903, also was an important influence in the development of the beef cattle industry. By 1903 such matters as freight rates, livestock marketing, animal health and disease control had assumed increased importance and this organization took an active interest in these problems.

As livestock numbers increased, the need developed for organizations representing each branch of the livestock industry. The Iowa Beef Producers' Association, organized in 1912, has actively co-operated with the Iowa State College Extension Service in promoting 4-H baby beef clubs, cattle feeder organizations, and other agencies interested in improving beef production. The training received by members of the 4-H clubs as to beef types, methods of feeding, management and marketing has had a profound influence on the entire industry.

State breed associations have been organized for each of the beef breeds and have been active in promoting the interests of their respective breeds. The Iowa Shorthorn Association was organized in 1915, the Iowa Aberdeen Angus Association in 1916, the Iowa Polled Hereford Association in 1917, the Iowa Hereford Association in 1937, and the Iowa Polled Shorthorn Club in 1941.

During 1944 and 1945, thirty-three district breed associations were organized to sponsor field days, sales, and 4-H baby beef activity. There are thirteen Hereford, thirteen Aberdeen Angus, and seven Shorthorn associations.

Average production per cow in some Iowa dairy herds has gone up to more than 8,500 pounds of milk, 340 pounds of butterfat per year.

11. The Development of Iowa's High-Producing Dairy Cattle

C. Y. CANNON, *Dairy Husbandry*

FROM 1850, WHEN A COW PRODUCED 147.9 GALLONS OF milk, dairymen of Iowa have improved their cattle until the 1940 census reported average production for the state of 555.8 gallons. And this was only an average. Superior quality cows enrolled in herd-improvement associations produced an average of 947 gallons.

This increase is largely due to more extensive use of purebred dairy cattle, especially high quality dairy bulls, and to the elimination of unprofitable animals.

In 1850 Iowa had fewer than forty-six thousand cows being milked, twenty-two thousand working oxen, and sixty-nine thousand other cattle. There was about one cow for every four persons in the state. Both numbers of cows and gallons per cow increased steadily. The increase in numbers was especially rapid from 1870 to 1890 when the number of cows per one hundred persons more than doubled (Table 8).

Increased interest in dairying was due principally to the change of cheese and buttermaking from farm to factory. This move improved the quality and increased demand for these products.

An Iowan's winning of first prize for butter at the Centennial Exposition at Philadelphia in 1876 gave great impetus to dairying in the state. A large foreign trade was being established for United States dairy products, especially in Great Britain, which took 96 per cent of American cheese exports in 1880. Other factors of importance in turning the farmers toward dairying included wheat crop failures and improved transportation facilities.

After the turn of the century, dairy cattle no longer increased in numbers faster than the human population. Foreign trade had declined until by 1899 export prices of butter reached 16.3 cents and cheese, 8.6 cents. Government methods of counting the cattle popu-

lation changed in 1920, but it is probable that up until 1920 the number of dairy cows increased only about as rapidly as the population, but that since 1920 they have increased in number somewhat faster.

During the sixties the sharp rise in cattle prices in Iowa, especially for cattle of improved breeding, brought sharpers and swindlers of all

TABLE 8
DAIRY COW POPULATION AND PRODUCTION*

Year	Number of Cows per 100 People	Average Gallons per Cow
1860.....	28	195
1870.....	31	229
1880.....	53	215
1890.....	67	325
1900.....	64	376
1910.....	63	348
1920.....	46	330
1930.....	57	462
1940.....	59	556

* Population based on Iowa state census, number of milk cows based on United States census. Figures before 1900 represent "milch cows"; in 1900, "cows kept for milk 2 years old or over"; 1920, "dairy cows and heifers 2 or more years old"; 1930, "cows and heifers born before 1928 kept mainly for milk production." This change in classification probably accounts for the marked drop in milk cows between 1910 and 1920 figures.

kinds who took advantage of the farmers' ignorance. Because many farmers were unaware that it took thought and daily care as well as fine pedigrees to reap full benefit from superior stock, they bought stock in hope of making a fortune without too much work. A mania swept the country for unfamiliar breeds of supposedly superior quality. Many an honest Iowa livestock dealer would advertise the sale of improved livestock, then would find the market ruined by some unscrupulous dealer who had rushed worthless mongrel stock into the area and sold it as purebred to unsuspecting farmers.

Unprincipled dealers would go into Illinois and Wisconsin to the large dairies where it was unprofitable to raise calves and buy one or more carloads from four to ten days old, stuff the calves with condensed milk and rush them into Iowa where they were sold at a large profit. These calves were sold mostly on color. If they were black and white they were Holsteins; if they were deep red they were Devons. One writer said, "If anyone was so unsophisticated as to want Jerseys, they were supplied from the little, ornery, scrawny things left after the rest were selected."

BREED ASSOCIATIONS

By the early seventies the desire for good cattle among Iowa farmers had gained such strength that a number of them banded together to organize the Iowa State Improved Breeders' Association. During the years following, improvement was rapid so that in 1885 C. M. Moninger, the president of the association, was able to say:

When our society was organized there were in Iowa a few herds of purebred Shorthorn cattle, Jerseys, and Devons; but the Herefords, Holstein, Friesians, Aberdeen, Angus, and Galloways we had none. Now there is scarcely a county in the state but can make a good showing of purely-bred representatives of two or more of these breeds.

Because of the great wealth of grass, hay, and corn on the farms of this state, the early breeders for the most part used Shorthorn blood in the improvement of their cattle. Even though this was true, a great many of them were still mindful that dairying was a productive enterprise. In 1885, C. F. Clarkson, of Des Moines, said, "The farmers of Iowa want a breed of cattle superior both for milk and beef and no matter how much ignorance may hoot, or interest oppose, it will come. . . . Much harm has been done by neglecting and ignoring the milking qualities of cows belonging to beef breeds." At that time the raising of calves by putting two to a cow was widely advocated by farm leaders and was practiced by many farm people. "So that one half of the herd raises the calves; the other half they milk and make butter or sell cream. In this way they get an additional profit from the herd."

Among the earliest published sources of information on dairying in Iowa are the proceedings of the Improved Stock Breeders' Association which published such material as an article entitled, "The Relation of the Creamery to Iowa Farming," written in 1880 by Henry Wallace, then editor of the *Madisonian* at Winterset.

PREFERENCES

The first improved dairy cattle introduced were dual purpose—Devon, Shorthorn, and Red Polled. The Secretary of the State Agricultural Society reported in 1858 that several herds of Devons had been introduced, Muscatine, Johnson, and Scott counties leading in this breed.

The Devon's short legs and compact body made it a good draft animal and it was used for this purpose extensively by Iowa farmers until horses became plentiful. Early breeders in Iowa also recommended it for its milking qualities.

Shorthorn cattle were highly esteemed by the early settlers of

Iowa, for they usually were good milkers as well as good beef cattle. This breed increased on Iowa farms faster than any other, and has maintained considerable popularity. Leslie Carl, federal statistician for Iowa, estimated in 1932 that about 35 per cent of the cattle in Iowa which were listed as being kept for milking purposes were of Shorthorn breeding. Since 1932 specialized dairy breeds have become somewhat more numerous in the state and have pushed the Shorthorns into a less prominent position as milk cows. By 1945 cows of this breed constituted only about 21 per cent of those kept for milk on Iowa farms. In 1930 a Milking Shorthorn Society was organized under the leadership of such men as R. R. Clampitt, of New Providence, Frank Holland, of Milton, and Roy Cook, of Independence, the society's first secretary.

Red Polled cattle also have furnished a fair share of the milk handled by the Iowa creameries. The first importation directly into Iowa was in June, 1886, when General L. F. Ross, of Iowa City, imported one bull and William Huake, of Iowa City, brought in two bulls and sixteen cows.

As time passed Iowa farmers became more dairy minded and a demand arose for such breeds as Ayrshires, Brown Swiss, Guernseys, Holsteins, and Jerseys.

A few Ayrshires were brought into Iowa by the early settlers and a class of Ayrshires was established at the Iowa State Fair in 1863 but no entries were made until Iowa Agricultural College's entry in 1869. The College entered Ayrshires for four years and in 1872 was awarded five prizes. The first entry by Iowa farmers was that made by C. C. and E. W. Horton, of Muscatine, 1873. An outstanding event in the history of this breed in Iowa has been described by Tom P. Whittaker, of the Ayrshire Breeders' Association:

The one incident which stands out most conspicuously in the records of the Ayrshire breed in Iowa occurred on June 12, 1919, when C. H. Peverill, of Waterloo, paid the highest price ever bid for an Ayrshire cow at auction when he secured Lotus Jean Armour 3rd for \$8,100. This great cow had an Advanced Registry record of 17,411 pounds of milk and 609 pounds of fat at 7 years.

Iowa had a population of 1,220 Ayrshires in 1941 and was twelfth among the states in number registered.

Brown Swiss cattle were brought to Iowa by Governor William Larrabee in 1882. They were exhibited as the first Brown Swiss herd at the Iowa State Fair in 1885 and awarded a silver medal. Governor Larrabee owned the first Brown Swiss animal to be registered by an Iowa breeder—Valentine, 334, born February 14, 1885. The first

Brown Swiss bull to be recorded from the state also was registered by Governor Larrabee—Shiloh, 226, born April 6, 1885.

The Larrabee herd, later known as the Mooney and Larrabee herd, and the herd owned by Dr. C. F. Osborne, of Hampton, had great influence on the growth of the breed in Iowa. A cow owned by Dr. Osborne—June's College Girl 11,427—produced in 1926, when five years old, 24,571.6 pounds of milk and 1,062.30 pounds of fat.

The secretary of the Brown Swiss Cattle Breeders' Association reported that during the year ending September 30, 1945, 3,113 Brown Swiss animals were recorded by Iowa breeders. This was 16.5 per cent of the national total registered and ranked Iowa first among the states.

The first prizes awarded for Guernseys at the Iowa State Fair were received by S. G. Livermore, Cedar Rapids, in 1877. Information from the American Guernsey Cattle Club shows that the earliest transfer of a registered Guernsey to an Iowa breeder was in 1880, when William Niles, of LaPorte, purchased Nance 2nd 515 from Le Graut Cannon, of Burlington, Vermont. In 1882 he registered the first Guernsey in Iowa, Cromlech 427.

C. W. Wilcox, of Des Moines, and W. W. Marsh, of Waterloo, were outstanding among early Iowa Guernsey breeders. Wilcox, together with his sons-in-law, operated under the name Wilcox and Stubs and at one time had a herd of about two hundred Guernsey cattle. Marsh became widely known for the high records produced by his Guernseys, of which the outstanding animals were Dairymaid of Pinehurst and Glencoe's Bopeep. In recognition of his outstanding record as a breeder of dairy cattle, the National Dairy Association awarded him the honor of Master Breeder, the first such honor ever bestowed by this association.

Guernsey cattle have become popular with dairy farmers in Iowa and their numbers have increased nearly 50 per cent in the last fifteen years.

The Holstein is the most numerous dairy breed in Iowa. Iowa's climate, the broad, level fields, and plentiful feed resemble conditions in Holland, the birthplace of the breed.

When Holsteins first came to Iowa is not known, but as early as 1880, Cary R. Smith told a meeting of the Iowa State Improved Stock Breeders' Association:

I believe the coming cow will be a cross between the Shorthorn and the Holstein. I have a Holstein which averaged 81 pounds of milk per day for a month; some days she gave 91 pounds. . . My Mink, a Holstein, has given over 10,000 pounds, and it is now only six months since she calved. I may say I have known of a Holstein cow giving over 16,000 pounds of milk in a year.

Among the early breeders of Holsteins in Iowa was Thomas B. Wales, Jr., who moved his cattle from Massachusetts to Iowa City in about 1882, and established them as the Brook Bank Holstein herd. Wales was an active importer of Holsteins until 1884 and is recorded as having brought from Holland almost three hundred head. Although he sold his farm and dispersed his herd about 1891, many of his cattle remained in Iowa.

Wales became vice-president of the Holstein Breeders' Association in 1875 and was made secretary and editor in 1881. The headquarters of this association were established in Iowa City in 1882 and remained there until 1891 when they were moved back to Boston.

There is no record giving the first importations of Jerseys into Iowa, but in 1867 four Jerseys were exhibited at the State Fair under the name of Alderneys, three by Stillman Stockwell, of Lyons, and one by a Milo Smith.

A herd of Jerseys was exhibited at the Muscatine County Fair in 1868 by B. Husby. The committee considered this herd to be equal to the cattle imported from Europe, and Husby was congratulated and awarded a special prize of fifty dollars.

The first registered Jersey cow in Iowa was Newport Beauty 2,509, dropped May 16, 1864, and purchased by Judge Walter I. Hayes, of Clinton. Other registered Jerseys were imported by Judge Hayes, including the bull, Faust, imported in June, 1870. The first Jersey bull recorded as owned in Iowa was Prince Frederick William 583, purchased by Rev. G. M. Porter, of Garnavillo, although it is not possible to determine whether this bull or Faust actually reached Iowa first.

The man deserving the most credit for popularizing the Jersey breed in Iowa is undoubtedly Colonel J. J. Richardson, of Davenport. Richardson served six terms as a director of the American Jersey Cattle Club. He took charge of the dairy cow demonstration at the Louisiana Purchase Exposition at St. Louis in 1904 where the Jerseys won the first four and the seventh to fourteenth places, inclusive, for production.

Interest in the Jersey breed has gradually increased. The American Jersey Cattle Club reported that 141 new Iowa breeders started with Jerseys during the fiscal year 1944-45.

COW-TESTER ASSOCIATIONS

Largely responsible for elimination of unprofitable cows and subsequent increase in milk yields have been Iowa's dairy herd-improve-

ment associations, although fairs, breed associations, the Improved Stockbreeders' Association and the State Dairy Association also deserve credit.

Dairy herd-improvement associations, then known as cow-testing associations, first started in Iowa in 1909, in Black Hawk County. The Pioneer and the Benson Associations operated that year with a total of fifty-one herds containing 877 cows on test. Average production per cow was 5,260 pounds of milk and 207.1 pounds of butterfat.

Associations have operated in the state ever since (Table 9). Average milk and butterfat production per cow has risen, reaching its highest point in 1941 when cows averaged 8,567 pounds of milk and 340 pounds of butterfat.

TABLE 9
RECORDS ON DAIRY HERD-IMPROVEMENT ASSOCIATIONS

Year	Number Associations	Number Herds Tested	Number Cows Tested	Average per Cow	
				Pounds Milk	Pounds Butterfat
1909*	2	.....	.....	.....	.....
1910.....	5	.....	.....	.....	.....
1915.....	13	.....	.....	.....	.....
1920.....	14	.....	.....	.....	.....
1925.....	56	.....	.....	.....	.....
1926†.....	61	1,895	27,176	6,997	272
1930.....	101	2,431	44,326	7,307	289
1935.....	52	1,113	24,453	8,306	321
1940.....	66	1,627	35,481	8,337	331
1945.....	47	1,212	27,308	8,151	324

* Year Dairy Herd-Improvement Associations were started in Iowa.

... No information available.

† First year for which complete records are available.

DAIRY CATTLE SHOWS

Exhibitions of the Dairy Cattle Congress have been held at Waterloo annually since 1910. Because of World War II, the exhibition was suspended from 1943 until 1946. However, during the war years statewide 4-H Club dairy cattle shows, 4-H judging contests, demonstrations, exhibits, and entertainments were held. The Dairy Cattle Congress has drawn exhibits of dairy cattle and Belgian horses from all sections of the United States and Canada.

The Iowa Jersey Cattle Club originated the parish or district shows in Iowa in 1933, when 106 owners exhibited 300 Jerseys at seven

shows. Approximately 1,750 breeders and their friends attended. That same year the Iowa Jersey breeders, with the assistance of the Cedar Rapids Chamber of Commerce, started the All-Iowa Show, at which only winners of the parish or district shows were eligible to exhibit.

The Iowa Holstein Breeders' Association divided the state into ten districts in 1936. They planned to hold a district meeting and show in each one, but most of the shows were postponed until the following year. In 1937, renewed effort was put into this program, with the assistance of the Dairy Husbandry Extension Department of Iowa State College. Ten shows were held the first two weeks in June. A total of 123 exhibitors showed 446 Holsteins and about thirteen hundred people attended. All ten of the districts took their first and second prize animals to the state show held at Waterloo.

The Iowa Guernsey Cattle Club held parish shows for the first time in 1936 in eight districts of the state. Winners were exhibited in the All-Iowa Dairy Show.

The Iowa Brown Swiss Association did not organize district shows until 1937, when several summer picnics were held and cattle shows were set up in two areas or cantons. Both of these cantons had herds in the All-Iowa Show that year. Later the state was divided into six districts with winners going to Cedar Rapids.

The Iowa Milking Shorthorn Breeders held seven district shows in 1937, in connection with county fairs.

The year 1938 established the previous work in district and state shows as a sound part of breed extension work. The Ayrshire Breeders held one district show. Other shows included: Brown Swiss 6, Guernsey 3, Holstein 9, Jersey 7, and Milking Shorthorn 8.

The Holstein breeders held a state show at Waterloo, and the Ayrshire breeders held one at the Iowa State Fair in 1938. All of the other breed associations participated in the All-Iowa Dairy Show at Cedar Rapids in September. The Chamber of Commerce at Cedar Rapids co-operated in sponsoring the All-Iowa Show and paid premium money to owners of all animals exhibited, in proportion to the distance traveled. Only animals winning first or second place in the district shows are eligible to go to the State Show at Cedar Rapids.

In 1942 the district and state shows were discontinued as a war measure. In 1946, all of the dairy breeds resumed the shows, which culminated in the All-Iowa Show at Cedar Rapids.

Sheep feeding has developed from a now-and-then practice to a regular phase of farm production on many Iowa farms. From the early type, kept to provide wool for home uses, the shift later was to the mutton type.

12. Sheep Production in the Livestock Enterprises

W. F. LA GRANGE, *Animal Husbandry*

EARLY DEVELOPMENT OF THE SHEEP INDUSTRY IN Missouri influenced the introduction of sheep into southeastern Iowa during the forties and fifties. As early as 1840 Missouri had more sheep than any other state west of the Mississippi and it held this position until 1860 when California took the lead.

The Mormons, who established more or less permanent camps or settlements on their trek through Iowa in the forties, drove many sheep and no doubt some were left in these settlements.

The early pioneers came into Iowa with meager equipment. A yoke of oxen or a team of horses, a cow to furnish milk for the family, numerous dogs, and a few sheep generally made up the livestock inventory. Many of the dogs could well have been left behind, for they soon became a serious menace to the sheep industry in the state.

For several decades the value of sheep was in their wool. Mutton was little known or appreciated. The wool was used almost entirely in clothing made in the home, where carding, spinning, and weaving were all done by women. A spinning wheel was found in every home, though one loom might serve several families.

MERINO

Early sheep were of nondescript breeding but Merino blood appeared early. Originating in Spain, this breed had accompanied the pioneer from Vermont and other eastern states. Today the Rambouillet, a French version of the Merino, dominates range flocks. Merinos were selected and bred for generations as wool producers, with little if any attention given to mutton qualities. Later, in the

eighties, American breeders developed a type of Merino, called the Delaine, that had more mutton and still sheared a fine fleece. This dual type of Merino gradually replaced the early type bred primarily for wool. The Merino was well suited to its job on the frontier. It was hardy, adaptable, and sheared a heavy, fine fleece, but like all members of its race, then and now, it needed man's help and protection.

For many years the Merino dominated the sheep population in Iowa. Many so-called "full-blood" Merino flocks were established after the close of the Civil War. They were purebred, but not as we think of a purebred today. The registry associations for purebred sheep were not started until 1878. Prior to the organization of the sheep associations, private flock records were the only evidence of breeding. Several long-established flocks have been maintained in southeastern Iowa.

One of these flocks, started well over a hundred years ago, is still maintained there by a descendant of the original owner. A veteran of the Civil War, A. J. Blakely, Sr., settled on a farm near Grinnell in 1868. A fortunate sale of 3,000 pounds of brook-washed Merino wool in 1865, sheared from his own flock, and sold at one dollar a pound, made the down payment on his farm.

Blakely brought a carload of Merino ewes and a choice ram to his Poweshiek County farm from the old homestead in Vermont. The ewes were descendants of a flock purchased by his father in 1835. These sheep were the foundation of a present-day flock of Merino sheep, still grazing on the old Blakely farm two miles south of Grinnell. It is one of the leading purebred Merino flocks today. A. J. Blakely, Jr., and his son are now the owners. Rams and ewes have gone to many flocks in Iowa and into other states. It is doubtful if one can find elsewhere in the annals of livestock breeding in the United States, as long a period of improvement of one breed of livestock.

At the first State Fair at Fairfield in 1854 two types of sheep were exhibited, long wool and fine wool. Only two classes were provided for sheep, one for best ram and another for best pen of ewes. Sheep at fairs were not classified by breeds until after 1860.

Not much hope was held out for sheep raising in Iowa from 1855 to 1860. County agricultural societies reported:

Iowa is not yet a sheep-raising state. . . Few farmers raising sheep. . . Wild grass probably has a tendency to make wool coarse. . . Rearing of sheep sadly neglected. . . Worthless dogs in large numbers a menace. . . Wool raised only for home use. . . Most sheep have been harassed and killed by dogs and wolves. . . Every farmer investing has lost money. . . No flock of any size left. . . Fatal mistake made in management. . . Farmers without experience and knowledge.

CIVIL WAR: BOOM AND SLUMP

The Civil War, however, was a great stimulus to sheep raising in Iowa, for trade with the South was cut off and cotton became scarce. Until then, wool had received little attention in Iowa except for home consumption. Now interest rose in the production of wool, not alone for family use but for "export" as well. At the close of the war wool was selling at one dollar a pound, although prior to the war it had sold for twenty to twenty-five cents a pound.

As a result, the number of sheep increased from 258,228 in 1860 to 600,000 in 1863. The next year numbers had reached 900,000 and the 1867 census reported nearly two million head. This was the largest sheep population in the history of the state, before or since.

County and state Agricultural Societies then reported:

Wool growing is receiving increased attention in many portions of the state. . . One of the sources of the future wealth in Iowa will be from sheep. . . Wool is much more profitable than pork or beef.

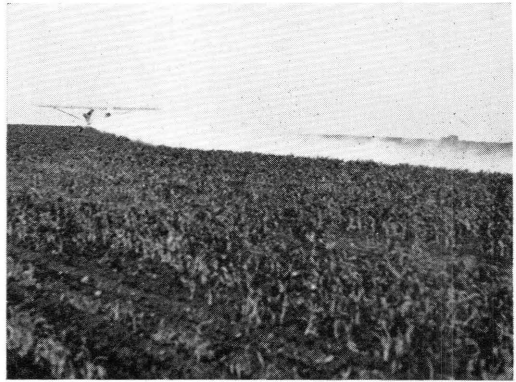
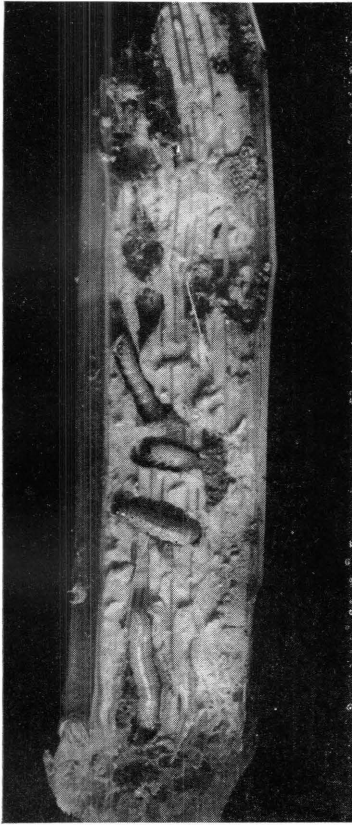
J. B. Grinnell, a man after whom an Iowa city and college were named, saw a great future for wool production in the state.

During this period more county fairs were organized. Representatives of breeds other than the Merino began to be exhibited. A Southdown ram, from England, was exhibited at Muscatine in 1857. A few Southdowns were reported in Tama County in 1860, and that same year a Southdown and a Leicester were exhibited at the State Fair. The first Hampshire mentioned in the State Agricultural Society reports was exhibited at the Cedar County Fair in 1862 by G. B. Sargent. Southdowns, Leicesters, and Cotswolds, in addition to Merinos, were on display at this fair. It was not until 1868, however, that the Southdown, Cotswold, and Leicester attracted sufficient attention for the State Fair Board to provide separate classes for them. By 1870 they had more entries at the State Fair than did Merinos.

Oxfords were given a separate class at the fair in 1874, Shropshires in 1883. The latter breed appeared in Iowa in the early eighties and by 1891 had gained so in popularity that half the total sheep entries at the State Fair were Shropshires. They continued to make phenomenal progress before and after 1900.

Cheviots were given a class at the 1889 State Fair and the next year Hampshires made a strong show and were given a classification. Hampshires came later than some of the other medium wool mutton breeds, but their progress, especially since 1910 and particularly in the Midwest and in western states, has been phenomenal.

Few farmers realized that the high prices for wool during the Civil



Just at the end of Iowa's first one hundred years, the European corn borer appeared and in the short space of four summers became the most important corn insect pest in the state. The damage is indicated by this piece of corn stalk (left) from the surface of a plowed field, cut open to show larvae. Among control measures, Iowans fought the onslaught by airplane dustings of their fields (right). Here a hybrid seed corn field is being dusted with 3 per cent DDT in talc.—
CHAPTER 7, MAN AND NATURE BATTLE INJURIOUS INSECTS.



When the ominous clouds of locusts descended, green fields of corn and ripening small grain bent with the weight of their numbers. The swarms usually departed a few days after they came, but behind them they left the whole countryside devastated.—CHAPTER 7, MAN AND NATURE BATTLE INJURIOUS INSECTS.



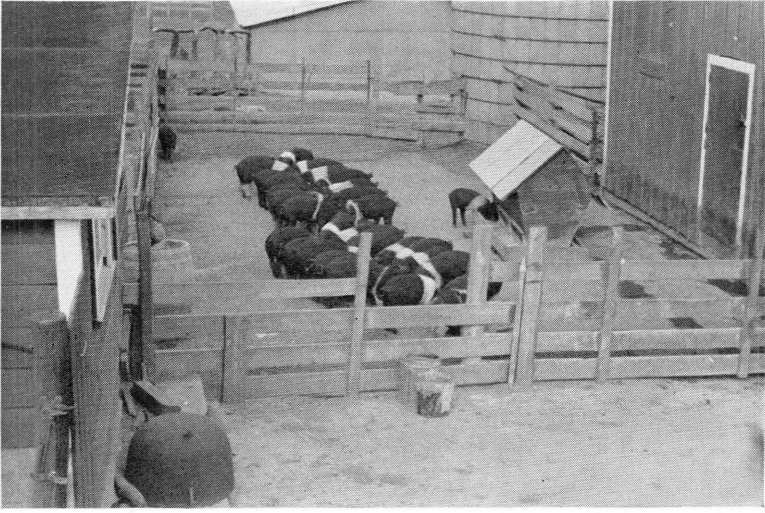
Although no satisfactory method has been devised for protecting small grain from the attack of chinch bugs, the timely construction and proper maintenance of good barriers will protect 95 per cent of the corn crop from first generation bugs migrating from small grain to corn. In this field in southern Iowa in 1939, about half the corn field had been destroyed by the bugs before the barriers were constructed. Their effectiveness is shown, and would have served just as well at the edge of the field if erected in time.—CHAPTER 7, MAN AND NATURE BATTLE INJURIOUS INSECTS.



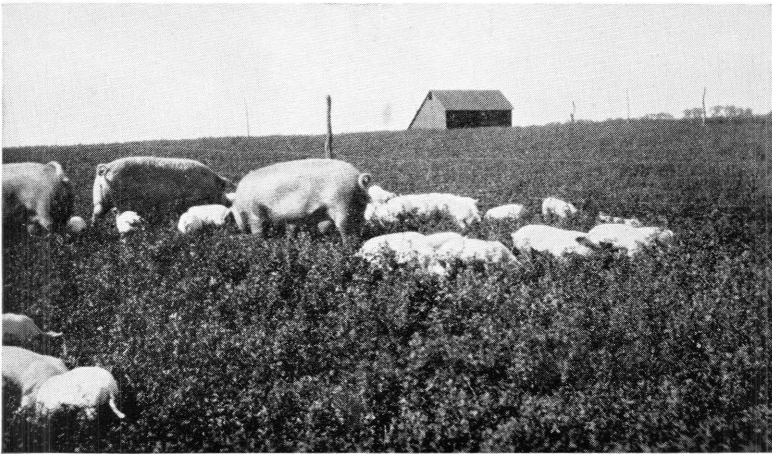
A new method of weed control was introduced in 1927—use of sodium chlorate. This large power sprayer, county-owned, is typical of the type in service to treat European bindweed and other perennial weeds with the chemical.—CHAPTER 8, WEEDS THAT CHALLENGE IOWA CROPS.



In 1891, James Wilson, C. F. Curtiss, and D. A. Kent reported on an experiment which demonstrated "what great possibilities are locked up in the Iowa hog. He is eminently the great corn condenser of the state. His torpid nature and fat-forming function enable him to burn the carbohydrates of corn into bacon. His omnivorous appetite prompts him to gather up all the waste food products of the land and convert them into gold."—CHAPTER 9, HOG RAISING—A BIG BUSINESS.



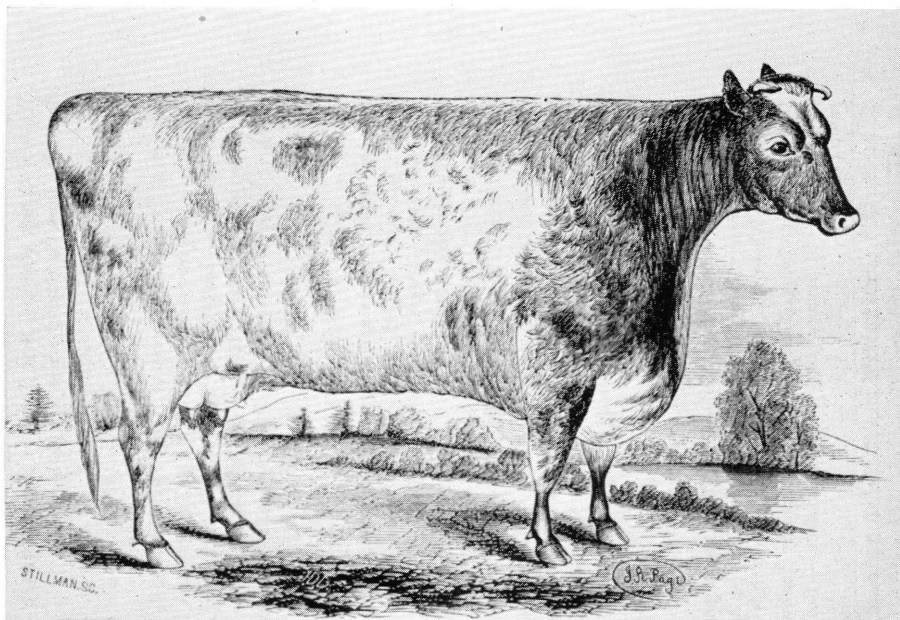
The clean-ground system of raising hogs on concrete floors is a modification that has been developed in Iowa. It has become increasingly important as hog production continues to follow practices which keep the young pigs away from old, contaminated hog lots. As shown above, protected areas between buildings can be used for feedlots when paved with concrete.—CHAPTER 9, HOG RAISING—A BIG BUSINESS.



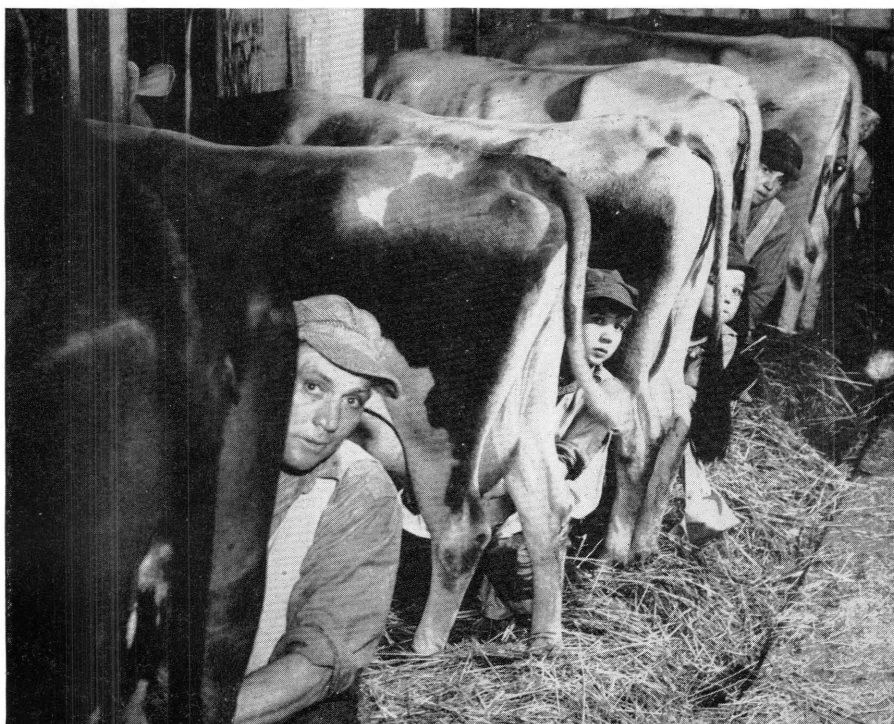
One of the features of the clean-ground system for raising hogs is the moving of the pigs to clean-ground pasture and keeping them on it until they are four months old, or weigh about one hundred pounds. These pigs shown above are getting off to a good start on alfalfa, which furnishes excellent pasture for hogs.—CHAPTER 9, HOG RAISING—A BIG BUSINESS.



Commercial beef production stabilized on the basis of two distinct types of enterprises. One was the maintenance of cow herds with the production of calves sold as feeders or fed out for beef by the grower. The second enterprise, cattle feeding, involves the purchase of thin cattle and fattening them for the slaughter market.—CHAPTER 10, IOWANS FEED BEEF CATTLE FOR MARKET.



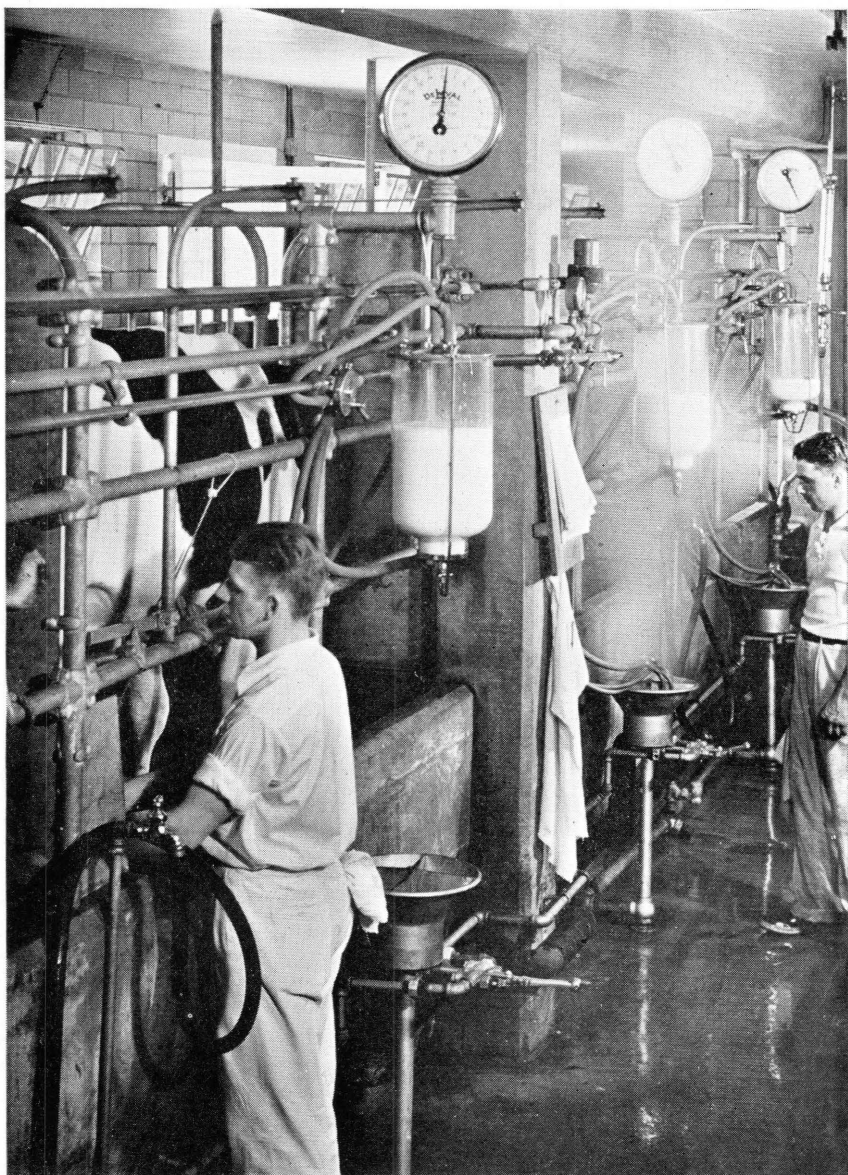
The first cattle fed in Iowa were not started on feed until they were three years old or older. (This 1856 picture shows a four-year-old Shorthorn cow, calved April 22, 1852—and typical of the type developed in that period.) Then after 1890 consumer demand was for lighter cuts. Experimental work demonstrated that feeding younger and lighter weight cattle was more profitable. As a result the trend in beef production for the past sixty years has been to finish cattle for market at lighter weights and at younger ages.—CHAPTER 10, IOWANS FEED BEEF CATTLE FOR MARKET.



By the early seventies the desire for good cattle had gained strength among Iowa farmers. In the passing of time, Iowa farmers became more dairy minded and a demand arose for such breeds as Ayrshires, Brown Swiss, Guernseys, Holsteins, and Jerseys.—CHAPTER 11, THE DEVELOPMENT OF IOWA'S HIGH-PRODUCING DAIRY CATTLE.



Largely responsible for elimination of unprofitable cows, and subsequent increase in milk yields, have been Iowa's dairy herd-improvement associations. Originally known as cow-testing associations, the first was started in Iowa in 1909, in Black Hawk County. The exhibit shown here was displayed at the 1919 State Fair.—CHAPTER 11, THE DEVELOPMENT OF IOWA'S HIGH-PRODUCING DAIRY CATTLE.



From 1850, when a cow produced 147.9 gallons of milk, dairymen of Iowa have improved their cattle until the 1940 Census reported average production for the state at 555.8 gallons per cow. Greatly removed from the old pail-and-stool days is this present-day milking process shown above in the model set-up at Iowa State College. The cows are milked by machine in the most sanitary method possible, and are elevated so the attendant does not have to stoop to do his work. The milk is drawn into glass buckets and is removed from them through sanitary pipes by vacuum to the milk room, where it is quickly cooled.—

CHAPTER II, THE DEVELOPMENT OF IOWA'S HIGH-PRODUCING DAIRY CATTLE.

War period were only temporary and would fall as soon as the war was over, when cotton again would be available from the South. Two years after the close of the war, wool prices dropped to twenty and thirty cents a pound. Farmers went out of the sheep business nearly as rapidly as they had gone into it. By 1870 the sheep population had dropped to 855,943 and by 1872 was down to 521,826 or a little less than it had been in 1863—a decrease from the high point of 1867 of nearly one and one-half million head.

Other factors in addition to low prices for wool contributed to the decline in numbers of sheep. Crude shelters against Iowa winters were not sufficient. Fences were few and gave little protection against wolves and mongrel dogs. Foot rot, scab, grub, and other maladies decimated flocks. The lack of experience, care, and knowledge in the management of sheep caused severe losses. The rank prairie grass was not adapted to sheep. Even the Vermont-bred Merino did not thrive.

Cattle prices had improved and many farmers replaced their flocks with herds of cattle. The collapse of the sheep boom was responsible in part for the boom in cattle that followed the war.

Settlement of the prairies in central, northern, and western Iowa came after the Civil War. Many immigrants followed the Mormon Trail to western Iowa. Extension of the railroads through the state to the Missouri River brought new settlers. Sheep were taken to the prairie farms by the settlers, but not in as large numbers as in southeastern Iowa. By this time the cattle industry was expanding and the prairie farmer was not much interested in sheep. From the beginning, cattle did well on the prairie. Grass was abundant, well suited for summer pasture and for winter feeding. Although the prairie grass was suitable for summer grazing, hay made from it was not good enough for sheep in winter. The prairie offered little protection against storms, cold weather, wolves, and dogs. Good fences and adequate shelters were yet to come.

The growing of corn soon followed the settlement of the prairie country. In the fall it was cut and shocked, then fed to cattle along with prairie hay during the winter. Hog raising increased. Corn was cheap and in general the only market for it was through cattle and hogs. Very little corn was fed to sheep, except small amounts to the breeding flocks in winter. The sheep industry in Iowa had to change from a wool industry to a mutton industry before the grain feeding of sheep became common.

Hay crops other than prairie hay were necessary before sheep

could be well fed during the winter months. Timothy was first grown as a hay crop, followed by Hungarian grass and then clover. Since farmers had trouble in obtaining a good seeding of clover, they relied extensively on timothy. The progress of clover was slow, but when once established and used as a winter feed for sheep, its value was soon recognized. Clover and other legume hays are considered by good sheep men as essential to winter rations for breeding flocks.

As early as 1860 farmers interested in sheep urged the state legislature to encourage the raising of sheep and wool in Iowa by discouraging the breeding and keeping of dogs. In 1862 the legislature passed a measure taxing dogs from \$1 to \$3 each and ordered county police officers to kill dogs running at large without collars. Owners were held responsible for losses caused by their dogs. When the legislature was called into special session that fall on matters pertaining to the Civil War, however, much of its time was spent discussing the law pertaining to dogs and much of the law was stricken from the statutes.

By 1872 Iowa had about eighty-five woolen mills. There had been a strong plea for Iowa and other states to raise wool, manufacture cloth, and "establish independence of foreign countries in this regard." The demand for cloth made in Iowa woolen mills steadily increased. One writer in the State Agricultural Society report stated that by producing their own cloth Iowans could "cease paying tribute to eastern manufacturers and English looms." Yet Iowa sheep were producing only enough wool to permit the woolen mills in the state to operate half time. By 1879 there were only fifty woolen mills in Iowa, with a consumption per mill of but 15,000 to 250,000 pounds of wool annually. Each decade following found fewer woolen mills in the state. Today only a few mills operate.

SHIFT TO MUTTON SHEEP

In the eighties a demand developed for a longer, more lustrous wool than the Merino could supply. The Merino, popular in Iowa since Civil War days, produced an exceedingly fine fleece, but one that lacked length of fiber. Cotswolds and Leicesters, producing longer wool, gained considerable prominence, but, like the Merino, lost popularity with lower wool prices. Although Iowa was not quite ready to shift from wool production to mutton, these long-wool breeds did help attract attention to English breeds possessing better mutton qualities. L. G. Ireland, a noted sheep authority, declared in 1880 that farmers could "greatly increase the value of our wool clip by judicious crossing of Cotswold upon our Merinos and nondescript

or mixed bloods, of which class are at least nine-tenths of our sheep. This will . . . improve the mutton quality of our sheep as well as the quantity and quality of the wool."

A. J. Blakely, Sr., of Grinnell, questioned this policy. He stated his flock of Merinos averaged 10.72 pounds of wool per head, while "crossbred Cotswolds shear less." The Blakely flock of Merinos had been carefully selected and managed for many years, with emphasis on quality and quantity of fleece, while the average flock sheared less than five pounds of wool per head. The controversy between producers of Merino wool and producers of wool from the mutton breeds continued until nearly the Twentieth Century, when mutton types gained a sound footing in Iowa.

Eastern cities were growing rapidly at this time, and consumers began to develop a taste for mutton. The refrigerator car had been developed, making it possible to bring in mutton from the West, and Iowa farmers began to furnish some of the supply. From 1878 to 1885 the number of sheep shipped east from Iowa increased from 55,332 to 254,917.

Much of the mutton produced in Iowa was inferior, however. Some of the reasons are suggested in the State Agricultural Society report of 1887:

Mutton is considered incidental to wool. . . Sheep are expected to live on poor land where other stock would starve. During winter their food is straw, corn fodder, and roughage while cattle get oats and timothy hay and hogs the corn. Both hogs and cattle are adequately protected; if sheep manage to live at any season they are thought to be doing well.

Improvement in mutton qualities of Iowa sheep was slow, but the mutton breeds were on their way to the state and before 1900 large numbers of Southdowns, Shropshires, Oxfords, and other mutton breeds came into Iowa. Their popularity increased over the years to such an extent that today mutton blood dominates Iowa flocks as well as the flocks in other states east of the Missouri River. From their beginning, attention was paid to mutton qualities with wool of secondary consideration. The so-called parent breed, the Southdown, early became a model of mutton perfection. It shaped the form of the other medium-wool, mutton breeds like the Shropshire. These two breeds have won a majority of the championships in the fat and carcass classes at the livestock shows in America.

PUREBREDS APPEAR

The term "purebred" was not used until about 1880 in fair classification and reports. Pure Merino Sheep, Pure Mutton Sheep, and Purebred Middle Wool Sheep were some of the early terms

used for sheep of superior breeding and type. It was in this period, 1879-91, that Purebred Sheep Associations were organized in the United States. They played an important part in promoting the establishment of purebred flocks of sheep in this and other states.

Purebred sheep gained the attention of farmers in eastern states and eastern Canada long before Iowa farmers were ready for this highly specialized industry. A few so-called "purebred rams" were brought to Iowa in early days, and a few flocks of pure breeding were established. Owners of purebred flocks advertised extensively in farm journals and exhibited at leading fairs. Iowa farmers became interested in the mutton breeds and turned to the established purebred flocks for their foundation stock. Purebred mutton rams were brought into the state by the carload and sold to farmers to cross on common ewes.

Purebred flocks of sheep were established at the Iowa Agricultural College in the eighties and were increased in 1891 by an appropriation to expand the college livestock. Among the purchases were "seven or eight more breeds of sheep." Professor C. F. Curtiss bought 5 Cotswolds, 2 Shropshires, 4 Southdowns, 5 Oxford Downs, 4 Hampshire Downs, 5 Dickinson Merinos, and 5 Dorsets. These sheep were bought from what were then prominent flocks in eastern states. Through the years the college has maintained purebred flocks for instructional purposes.

In 1891 and 1892 the trend toward a mutton-type sheep was growing stronger in the state. Professor James Wilson of Iowa State College declared in 1892 that sheep were paying better than other farm animals. He observed:

Mutton must be of prime consideration and wool only secondary to pay on the valuable farming lands of the state. Fine-wooled sheep may pay best where large flocks are desirable on broken hilly lands. The time is coming when Iowa will send spring lambs to market as regularly as butter is now sent.

It took another decade or so to see this realized. Today a high percentage of all sheep bred or fed on Iowa farms are marketed as lambs. The editor of the *Breeders' Gazette* two years later questioned the wisdom of continuing the annual Iowa sheep shearing festival "in states with a pronounced mutton environment like those of the state of Iowa." Henry Wallace in 1896 emphasized, "No state in the Union is better adapted for the production of mutton sheep than is the most of Iowa. I know of no business that has a more prosperous future than the business of growing the mutton sheep in the state of Iowa." George W. Franklin in 1897 stated that, "For success in

the sheep business in Iowa, the breed must be a mutton breed and they should be liberally fed."

The county reports of agricultural societies from 1895 to 1900 tell of the increasing interest of farmers in sheep. The breeds mentioned as popular for the most part were Shropshires, Southdowns, Oxfords, and Cotswolds. Merinos were only reported by a few counties as being the popular breed. These reports stated that farmers were finding sheep of mutton breeding profitable, even more so than hogs and cattle. If attention was given to selection, feeding, and management of flocks, excellent lambs and mutton could be produced that would sell for high enough prices to offset lower prices of wool. Contributing to the renewed interest in sheep were the serious losses in hogs due to cholera. As yet no treatment for it was known and as a result some farmers turned to sheep production.

FEEDERS APPEAR

The feeding of western sheep and lambs by Iowa farmers probably started in a small way in the eighties. The range country had to establish flocks before feeders were available to Cornbelt farmers. In the early days of the range industry, sheep were kept to four or five years of age for the annual clip of wool before they were disposed of. At first there was little demand for mutton, for consumers did not relish mutton from sheep four or five years old. Cornbelt lambs and sheep were coming to market after being grain fed. Such mutton was superior to range mutton. Hence, it was found desirable to ship younger range sheep to the Corn Belt for a feeding period before they were marketed.

Sheep feeding in Iowa gradually changed from feeding older sheep to a lamb-feeding operation. In the first decade of the Twentieth Century there was a gradual shift on the range to the ewe and lamb basis of production. In the late nineties the market receipts of sheep were principally older sheep: 75 per cent were yearlings and two year old wethers, 15 per cent were ewes, and the remaining 10 per cent were lambs. Today the reverse is the case. A high percentage of the market receipts are lambs.

In 1890 a Mr. Rice, of Bremer County, fed ten thousand sheep during the winter months. Andrew Jackson, of Tama County, purchased 525 sheep from Texas in 1892. That fall Wash Reed, of Adair County, purchased four carloads of sheep from Colorado. J. Carpenter, of Grinnell, fed fourteen hundred Colorado lambs for the spring market. Two men from Whiting brought a special train of four thousand sheep from New Mexico for winter feeding.

In 1895 the *Breeders' Gazette* told of the development of wool production in the range areas. It was thought production costs would be much less than in the Corn Belt. Attention was called in the same issue to the interest Cornbelt farmers were showing in feeding western sheep for market. This Cornbelt industry was then in its infancy. Several years were required before it became an important farm enterprise in Iowa.

Sheep and lamb feeding in Iowa increased rapidly from 1900. The *Breeders' Gazette* for January 27, 1909, states that the Iowa purchasers of feeders at the Omaha market had doubled in the past five years. In 1904, Iowa feeders bought 174,000 head at this Missouri River market. In 1905 the purchase was increased to 195,000 head, in 1906 to 287,000 head, in 1907 to 306,000 head, and in 1908 to 331,000. This did not represent by any means the total number of western sheep and lambs that went into Iowa cornfields, for other markets than Omaha also furnished sheep to Iowa farms. In that era cornfield feeding of sheep and lambs seemed to be the preferred method of fattening western sheep. The finishing of the sheep and lambs in dry lots, after the feed in the cornfield was gone, was not extensively practiced. Too often sheep were sent to market when snow and cold weather came, even though many of them were only half fat.

In the fall of 1910 the editor of the *Breeders' Gazette* expressed alarm "over so many sheep in Iowa cornfields." He added, "Iowa is not shedded to handle sheep in bad weather." This danger was also cited by J. C. Peterson, of the Peterson Sheep Company. He stated, "The bulk of the lambs fed in the state of Iowa were mostly run through cornfields in the fall of the year, and, after the first snows came, were reloaded and shipped to Chicago where the killers were sorted out and the balance shipped on to Michigan, Ohio, and Indiana for further feeding." Sheep men in those states had been barn-feeding sheep successfully during the winter month for years.

Today Iowa feeders of western lambs have learned to utilize cornfields efficiently. Additional feeds like pasture and legume hay are furnished. When the feed in the fields is no longer adequate, the lambs are finished on suitable rations in the dry lot. Adequate shelter is provided against storms.

The feeding of western lambs has increased rapidly in Iowa over the last two decades. It is carried on particularly in the northern half of the state where feed supplies, especially grain, are more plentiful than in the southern half of the state.

The use of mutton rams on range ewes has changed the type of lambs coming to the feed lots for finishing and to the markets for slaughter. Many range ewes carry fine wool breeding but when bred to mutton rams they produce very desirable feeder and fat lambs.

Sheep feeding has developed from an in-and-out enterprise to a regular phase of farm production practiced on many Iowa farms good years and bad, until today Iowa has developed into a leading lamb feeding state, ranking with Nebraska and Colorado. The business in Iowa is a farm business, where one or two carloads are fed on farms, and few are handled through commercial feed yards. J. C. Peterson has found that Iowa feeders have insisted on the best quality of lambs. He has observed, "It is next to impossible to sell a low-grade car of feeder lambs in the state of Iowa." Successful lamb feeders have co-operated fully to bring about better feeding practices by participation in lamb feeding meetings, demonstrations, and field days. The 4-H Western Lamb Feeding project has been very valuable in spreading useful lamb feeding information.

A large number of both native and western lambs fed in Iowa are marketed at packing plants in Iowa and adjacent states. Formerly many of these packing plants processed only hogs, but, beginning in the late twenties, sheep and cattle slaughter were included. The slaughter of lambs and sheep at these plants was steadily increased. Buyers from these companies purchase sheep and lambs in the feedlots of farmers. Many feeders know the selling price of their fat lambs before they leave the farm. This direct marketing of Iowa lambs has become extensive in recent years. Many lambs fed in Iowa are bought direct from dealers in feeder sheep.

In general, lamb buyers at Iowa packing plants buy lambs on grade. This method allows a higher price on the fat lambs and less for the lower grading lambs. Farmers can observe what it takes in a lamb to cause it to grade high and bring a top price.

The market news service for lambs and sheep has been added to the Iowa market livestock news service. This service furnishes Iowa lamb growers and feeders with information on prices by grades, receipts, and other useful marketing information.

The farmers who maintain farm flocks and raise their own lambs have concentrated in the same parts of the state where they first located one hundred years ago.

The United States Census of 1850 reported 14,805 sheep in Iowa. They were located chiefly in the east-central and southern areas of

the state, which were settled early. No sheep were reported in the 1850 census in the counties west of Fayette, Black Hawk, Marshall, Polk, Madison, and Lucas except for a few in Pottawattamie.

By 1860 all counties in the state reported sheep except the thirteen counties in the northwest. But the heavy sheep populations were still in the east-central and southern counties. The number of stock sheep on farms in Iowa for 1940-45 averaged 1,275,400. The eleven southeastern counties in this period had 23 per cent of the state's sheep. The topography of this area is especially suitable for sheep raising. The land is rolling, with considerable timber and pasture areas and relatively smaller areas suited to cultivated crops. Natural protection for sheep abounds. Sheep can utilize grass on slopes and hills as well as other classes of livestock. The quantities of harvested crops, roughage, and especially grains required for sheep are not as great as for some other kinds of livestock.

PRESENT-DAY PRACTICES

In producing native lambs for today's market, one of two plans is usually followed. Some owners have the lambs born in February or early March and feed and manage the flock so as to market the lambs in June. These early lambs must be fed grain and hay in addition to the ewes' milk. Rapid gain on lambs is necessary in order to have sufficient weight and finish for early marketing. Early pastures are used, but grain feeding is continued until the lambs are marketed. Early lambs are marketed before hot weather, which too often brings on poorer pastures and trouble from internal parasites. Early lamb production requires good shelters and good rations for the ewes. Lambs marketed in early June usually sell on one of the high markets of the year.

Under the second plan native lambs are born in April and early May. The ewes and lambs are turned on pasture and little if any grain is fed before the lambs are marketed in the late summer or fall. If suitable pastures are provided and if the flock is kept free of internal parasites, the lambs are produced economically. Too often insufficient pastures are available, especially because of dry weather. Few preventions against parasites are taken, and lambs make slow growth and do not reach a suitable market weight and finish until fall rains and cooler weather restore the pastures.

Sheep production and sheep feeding are generally one of several livestock enterprises in Iowa. Farmers who own a flock of ewes raise hogs, feed cattle, or milk cows in addition. Crops produced on most

Iowa farms are diversified enough to be used more efficiently by more than one kind of livestock.

While most farms in Iowa raise some pigs and maintain some cattle, at least for milk, sheep are found on fewer farms. According to the 1940 Federal Census, breeding ewes were reported on 41,369, or 19 per cent, of the 212,318 farms in Iowa. The number of farms maintaining breeding flocks has doubled since 1910. Returns on breeding flocks when properly cared for have been satisfactory.

DISEASES

Various disorders in sheep cause considerable loss. Preventive measures generally give better results than curative measures. Internal parasites, especially in the farm flock, cause the most serious losses, not so much from death as from loss of condition, unthriftiness, anemia, and poor utilization of feed in the sheep that survive. The losses from parasites are constant. They are hard to evaluate, however, and do not in general receive the attention they deserve. Parasitism is generally greater in farm flocks than range flocks, since farm flocks remain concentrated on smaller areas for longer periods.

Stomach worms and nodular worms cause much damage to farm flocks. Preventive and control measures must be resorted to by most flock owners if losses from parasites are to be kept low. Good rations and rotation of flocks on pastures are preventive measures. Drenching infested animals with various drugs will control internal parasites.

External parasites like scabies are controlled by dipping the sheep in solutions of lime-sulphur or nicotine under the supervision of federal or state veterinarians. Two dippings are required to cure scab.

The only known practical method of eradicating sheep ticks is to dip the infested sheep in the spring after shearing, in one of several liquids that will kill the parasites, or subject to some of the more newly-developed insecticides in sprays. Since control is easy, there is little reason for having infested flocks.

Another disorder causing considerable loss in farm flocks is the so-called "pregnancy disease." The ailment is primarily one of pregnant ewes carrying twins or triplets. The disease is not presumed to be infectious. Poor rations and lack of exercise appear to be its chief causes. Prevention is accomplished by the use of well-balanced rations containing legume hay, easily digested carbohydrates in grain mixtures, salt, and a good water supply. Regular exercise is necessary. Abrupt changes in rations, in drinking water, and in exercise may cause this disorder.

ORGANIZATIONS

Marketing wool in Iowa was done through wool dealers until 1919. In that year a state-wide group of sheep men met in Des Moines and formed what is now known as the Iowa Sheep and Wool Growers' Association. From the beginning the Association marketed its members' wool on a graded basis. Much of the annual United States clip is marketed at Boston, and the Association has built up a prestige for Iowa wool on graded lines in that market. One of the leading organizers of the Iowa Sheep and Wool Growers' Association and its first manager, C. J. Fawcett, is now manager of the National Wool Marketing Corporation. This national corporation is the parent organization of twenty-five state associations. In 1944 the National Wool Marketing Corporation handled fifty-four million pounds of domestic wool. Its nearest competitor handled seventeen million pounds. The Iowa association has operated solely for the benefit of its members, reducing the cost of marketing wool, helping to maintain a uniform market price each season, and helping to improve the quality of wool produced in Iowa by its educational program.

The Iowa association owns its warehouse in Des Moines. The board of directors consists of prominent Iowa sheep men.

Other county, district, and state organizations aid in promoting the sheep industry in Iowa. The Iowa Purebred Sheep Breeders' Association sponsors an annual stud ram show and sale and co-operates with county and district organizations in conducting purebred ram and ewe sales. The Iowa Lamb Feeders' Association sponsors field days where lamb feeding problems are discussed. The parent of all Iowa sheep organizations is the Iowa State Sheep Association. This organization is financed by legislative appropriation. Representatives of other sheep associations make up its board of directors. Its fieldman works with all branches of the sheep industry in Iowa.

Much of the credit for Iowa's prominence in agriculture goes to its outstanding draft horses. For more than seventy-five years they were the power for every farming operation from plowing to harvesting. Horses still hold their colorful popularity in the state.

13. Horses Pull Iowa Into Prominence

A. B. CAINE, *Animal Husbandry*

THE FIRST WHITE SETTLERS IN IOWA FOUND SOME horses already in the state, probably descendants of animals brought to America by Cortez and other early Spanish explorers. Early pioneers had few horses because they were too expensive. Oxen were used for pulling the prairie schooners and the few crude agricultural implements.

Pioneers recognized the value of horses. They acquired them from east of the Mississippi River and they were soon extensively bred by Iowa's pioneers. By 1850, the census indicated 38,536 horses within the state, most of them in the eastern and southern counties. Ten years later, there were 175,088 with the demand steadily increasing.

Most of these horses have been described in early histories and documents as "horses of all work," suitable for the saddle, driving, and general farm work. One historian states: "Above almost every other form of property the horse had monetary value. Good horses were worth from \$100 to \$150 a head."

Rapidly horses and mules replaced oxen. In 1860, there were 3.2 horses and mules for every ox in the state; by 1880, the ratio was 335 horses and mules to each ox.

Early fair and agricultural reports indicate a wide range of horse breeds, including Thoroughbred, Morgan, Bashaw, Black Hawk, Abdallah, Printer, Hambletonian, Trump, Copper Bottom, Rob Roy, Tuckahoe, Grey Eagle, and Bellfounder. Many of these were not distinct breeds as recognized today, but were merely strains or families descended from certain sires.

INTRODUCTION OF THE DRAFT HORSE

While the Morgan, Black Hawk, and Bashaw were recognized as being the most popular horse breeds in the early days of Iowa, expansion of agriculture, business, and transportation created need for horses with greater power and more weight. Excellent for riding and hunting, the light horse did not have the size and strength for the early agricultural tasks of breaking prairie sod, pulling stumps, and moving stones and boulders—all jobs which had to be accomplished with the slow and sluggish oxen.

As early as 1857, at the fourth State Fair, it is recorded that "an English draft horse, of truly elephantine proportions, was exhibited by F. G. Broughton, of Muscatine County. It was raised in Kentucky, weighs 1,900 pounds, seven years old, and is a jet, glossy black." No other record was ever found on this stallion, so it is not known what influence he may have had on the horses of Muscatine County.

Since there were no draft breeds native to North America, it was necessary for Iowa farmers to turn to European countries for larger horses capable of performing heavy agricultural and industrial work. New agricultural implements were being produced, and heavy horses were required for motive power. This development of machinery before power with which to operate it was available is in direct contrast to the industrial revolution, which resulted following the discovery and application of steam power.

Principal source of heavy draft breeds was in northern Europe, especially France, Belgium, England, and Scotland, and it was from these locations that Iowa horse breeders imported draft stallions to mate with the light and medium-weight mares available within the state.

First Percheron stallion to enter Iowa was brought in by A. W. Cook, of Charles City, in 1869. This horse, Duke of Normandy, weighed approximately 1,600 pounds, and in 1874 was sold to Jacob Erb and Company, of Ames. This same year, Pride of Perche 382 was obtained by the Iowa Agricultural College at Ames. These two stallions were the first of many importations responsible for the widespread expansion of the Percheron and Norman horse business throughout the state. While the Percherons all came from the section known as LaPerche in France, the name "Norman" was generally used to describe any one of the five French draft breeds.

It is believed the Norman horse was imported into Iowa at about the same time or possibly a bit earlier than the Percheron. In the late sixties and seventies, more Iowa counties reported Norman horses

than they did Percherons. Early breeders of Percherons in Iowa were Singmaster and Sons, Keota; J. H. Barnett, Indianola; Humberts, Corning; D. M. Baughman, Pulaski; M. L. Ayres, Shenandoah; and Daniel McCarthy, Ames.

Good, medium-weight draft horses were produced through breeding the native mares of Iowa to these French draft stallions, and the number of grade and purebred Percherons and Normans increased steadily. More Percheron stallions were registered by the Stallion Registration Division of the Iowa Department of Agriculture than any other breed of horses up to 1932, when the Belgian stallions forged ahead in number.

One of the greatest breeding horses in the history of the Percheron breed, both in Europe and the United States, was Brilliant 1899, known in livestock annals as "Old Brilliant." Foaled in 1867, he was extensively used in the stud of Ernest Perriot, Sr., of France, until 1881. Imported to America in 1881 by Leonard Johnson, the Brilliant was taken directly to East Castle Rock, Minnesota. The following year he was sold to P. C. Fockler, of Independence, Iowa, where he was kept at stud until he was almost thirty years old. Although he was never bred in this country to other than grade mares, colts sired by Old Brilliant were sold at remarkable prices, and the Brilliant family is the largest and best known family in the Percheron breed.

There is no official record of Belgians in Iowa until the late eighties but Belgians were found in Illinois as early as 1866. D. P. Stubbs and Sons, of Fairfield, generally are credited with the first importation into Iowa. The Lefebure family, of Fairfax, also was active in promoting this breed. Much credit for the tremendous improvement in type, quality, style, and beauty in the Belgian horse since its introduction into North America must go to the numerous Iowa breeders, who through the years have selected their breeding stock carefully and cultivated desirable characteristics.

Outstanding Belgian stallion in the United States to the present time was Farceur 7,332, bred by Nerinck Brothers, of Hal, Belgium, and imported in 1912 by William Crownover, of Hudson, Iowa. He was purchased by C. G. Good, of Ogden, at the dispersion of the Crownover stud in 1917 at \$47,500, the highest price ever paid for a draft horse in this country. His stud fee was \$200.

Polled in 1937 by the *Chicago Daily Drovers' Journal*, on the question: "What Belgian stallion has contributed most to the development of the breed in America?" leading Belgian breeders throughout the country unanimously answered "Farceur." Farceur and his colts

were and are noted for quality and finish and for correctness of set of the hocks and hind legs. They have consistently won high awards at leading fairs.

No Clydesdales were reported in Iowa previous to 1870. H. Post, of Moulton, obtained a Clydesdale in 1871, and in the following year M. L. Divin, of Des Moines, Owen and Allison, of Lone Tree, and G. Eilers, of Monticello, imported Clydesdales from Scotland. Clydesdale stallions were shown in Kossuth and Lucas counties as early as 1873. By 1881, Clydesdales were recorded in eighty-six counties.

Early records of Iowa agriculture make reference to English draft horses, but not specifically to the Shire breed. Joseph Arnold, of Oto, is credited with importing the first Shire to Iowa in 1876. Other pioneer Shire breeders were W. H. Jordan, of Iowa City, W. M. Fields and Brothers, of Cedar Falls, L. Banks Wilson, of Bedford, Bremer County Horse Importing Company, of Waverly, A. B. Holbert, of Greeley, Peter Hopley, of Lewis, and J. H. Love and Company, of Albia.

While the Suffolk breed was introduced into Iowa in the nineties, it has never been as numerous as any of the other draft breeds mentioned.

THE DRAFT HORSE IN AGRICULTURAL PRODUCTION

Although the automobile, tractor, and truck today are replacing the draft horse as a source of power on many farms, the outstanding draft horses for which Iowa has long been famous deserve much of the credit for Iowa's prominence in agricultural production. It was these heavy horses that for more than seventy-five years furnished the power needed for every farming operation from plowing to harvesting and even for transporting the produce to market.

Growth of the draft horse industry and utilization of the draft horse in Iowa kept pace with the rapidly expanding agricultural and industrial program of the state. It was fortunate that Iowa, dependent almost wholly upon horse power for extensive farming operations, had the climate and available grain, hay, and grass which made possible the economical production of high-quality draft horses. These factors, in addition to the great number of intelligent, energetic, and ambitious breeders, quickly placed Iowa out in front as a draft horse breeding state.

As introduction of additional farm implements increased the demand for horse power within the state, so did the demand from other

states increase. With its central location, Iowa was in a favorable position for breeding and raising draft horses for shipment to both agricultural and industrial centers outside of the state.

There was an almost uninterrupted increase in horses from 1850 up to the depression years of the nineties. Then prices dropped appreciably and the number of horses in Iowa actually decreased for the four years from 1895 to 1899 (Fig. 6). The demand for horses to pull street cars in the cities was growing faster than the supply until

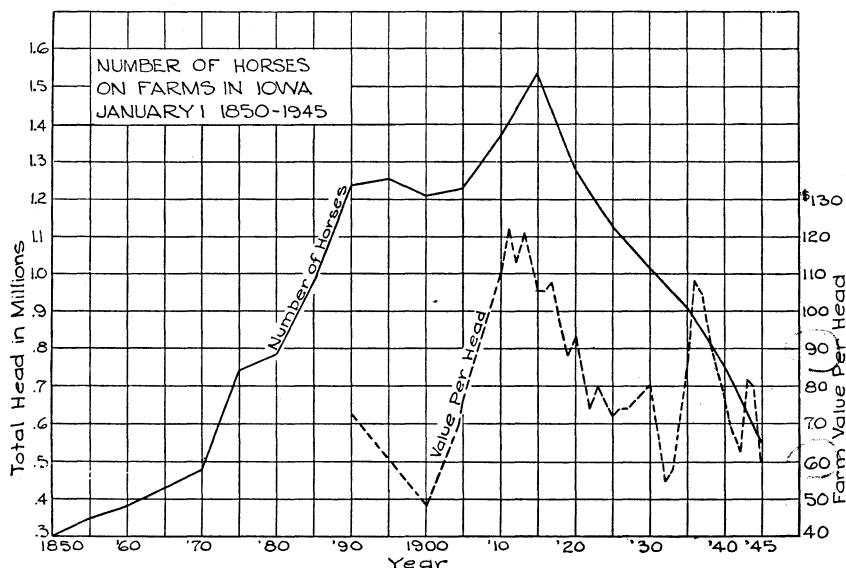


FIG. 6.—Numbers of horses on Iowa farms January first of each year, 1850-1945, with average value per head.

the middle of the eighties. By that time, however, electric street railways had been perfected, and by 1895, electricity had practically replaced the horse on street railways.

Demand from foreign countries for American draft horses increased tremendously in the late nineties, with export rising from less than 3,000 in 1893 to 82,250 in 1901. Further mechanization of agriculture increased the demand for heavy horses. Farmers were using more machinery, all horse drawn, and the machinery was getting larger and heavier. During the period 1850-1900, the number of farms in the Midwest increased 296 per cent, the number of acres of improved land 267 per cent, and the number of horses 291 per cent. Average value of machinery on the Iowa farm increased from \$79 per farm in

1850 to \$253 per farm in 1900. Commenting on this increase, the census of 1900 stated:

Machinery is valueless unless driven by some power other than human muscle. The power of steam and of falling water gives great effectiveness to labor in factories. The corresponding power of the farm at present is principally that of the horse and mule. The horse and mule enable the farmer of this country to produce grain, transport it thousands of miles and sell it in Europe cheaper than it can be produced there.

To supply the demand for horses in cities of the United States, exclusive of providing horses for export, animals must be bred to the number of three hundred thousand annually. To supply the demand for horses on farms and elsewhere, exclusive of cities, one million two hundred thousand more must be bred annually. The demand from cities and towns is, therefore, one-fifth the total for the United States.

A growing proportion of the city and export demand for horses was met by Iowa horse producers. As early as 1863 records indicate horses were being shipped to eastern markets, and later Iowa-bred horses were to be found in all the large eastern cities, throughout New England, and in southern port cities.

Available export markets for more wheat and other cereals increased the demand for horses after 1895, and prices began to improve. They continued an upward trend until the peak was reached in 1911. Iowa continued to gain as a horse-producing state. In 1890 it ranked second to Illinois, and soon took and held the lead in number of horses produced.

Draft horses were not solely responsible for the growth of the horse industry in Iowa, as thousands of riding, roadster, and carriage horses were produced to meet demand principally from the East. Good markets also existed for delivery wagon and express horses, midway in weight between the carriage and draft horse. Because of high priced land, and lack of pastures and grain feeds, it was more economical for eastern buyers to import their horses from the West than to attempt raising them.

Until the introduction of the farm tractor in Iowa, the continued increase in the use of new farm machinery and the increased acreage under cultivation kept the draft horse industry steadily growing. While the advent of the automobile reduced the demand for light and carriage type horses after the turn of the century, the need for draft animals continued to increase until 1914, when the number of horses in Iowa reached an all-time high of 1,667,000. As tractors became cheaper and better adjusted to the needs of the average farmer, with rubber tires, lighter weight, and more maneuverability, the number of horses in the state declined steadily. By 1945, there were 581,000 horses in Iowa, only slightly more than in 1870.

World Wars I and II contributed to the replacement of the draft horse by the tractor, since wars accelerated the development of farm machines designed to save time and labor. During both wars, production of food was paramount in farmers' minds, diverting interest and time from breeding and raising of horses. Conversely, during the depression years more attention was given to horses. The number of colts produced in Iowa showed a steady increase from 25,173 in 1932 to 64,000 in 1938, the highest number produced in recent years.

Despite the adoption of tractor farming in Iowa, the horse still has a prominent role in the state's agriculture. During 1942, a year less affected by wartime conditions than any succeeding year, 45 per cent of Iowa's farms still were dependent entirely upon horse power. In that year, horses were used for planting 90 per cent, cultivating 39 per cent, and picking 53 per cent of the total Iowa corn acreage. Horse power also was used for cutting 40 per cent of the grain, and for disking 32 per cent and harrowing 62 per cent of the cultivated acreage. In addition, horses were used widely for other farming tasks such as haying, threshing, and hauling manure. Horse power still is considered advantageous for certain types of farming operations, especially where the land is rough or fields are small.

DEVELOPMENT OF THE LIGHT HORSE IN IOWA

While the first horses in Iowa were light in weight, suitable primarily for riding and light farm work, they made two important contributions to the people of the state: first, supplying the brood mares for mating with imported draft stallions, and secondly, providing horses suitable for the Iowa and eastern riding and carriage trade. More than either of these contributions, though, these horses were important in that their descendants, improved by breeding and selection, are the foundation of a new horse-producing industry rapidly gaining prominence in Iowa.

In the early history, mention was made of a number of light horse breeds suitable for use under saddle or driving to light buggies, but the coach or heavy harness type did not appear until later. The Cleveland Bay, an English coach breed, was first imported by Captain W. H. Jordan, of Iowa City, in the seventies and was popular in Iowa for a generation. French and German coach horses and Hackneys have been found in Iowa in limited numbers for many years.

Shetland ponies were first shown at the Iowa State Fair in 1880. Eli Elliot, of West Liberty, imported ponies to Iowa in the eighties. Shetlands have always been popular in the state, and there is probably

a greater demand in present years for a good pony than at any previous time.

Early records of the Iowa State Fair do not mention the American Saddle Horse, although there were ladies' riding classes at the Fair as early as 1854. The American Saddle Horse record shows that eight Iowa horsemen owned registered saddle horses in the early nineties, but it seems that representatives of this breed must have been brought to Iowa much earlier, since Missouri was one of the three states in which the breed was developed.

Closely associated with the development of light horses within the state is the story of horse racing in Iowa. Horse racing has been popular in Iowa since the state was first settled, but never has been developed as extensively as in some other states because of Iowa laws prohibiting betting, and the limited number of large population centers.

One of the first breeds to be introduced into Iowa was the Standardbred. Trotting and pacing races have been held in all sections for nearly a century. Today, nearly every county or district fair in Iowa has a race track and holds harness and running races during the fair week. One of the early and important centers of harness horse racing in Iowa was at Independence, where two of the greatest race horses of all time were bred and raced, and the famous "Kite track" was built.

Charley Williams, of Ossian and later Independence, had for some time been interested in trotting horses, but up to the middle eighties had not owned any that were especially outstanding. In 1884 he purchased a Standardbred mare, Gussie Wilkes by Mambrino Boy, from a Dubuque firm for \$75. The same year he purchased another mare, Lou, also for \$75, and shipped the two mares to Lexington, Kentucky, where they were bred to two well-known sires—Gussie Wilkes to Jay Bird, and Lou to William L, both sires being sons of George Wilkes. Trained as two-year-olds, the offspring of these matings, Allerton and Axtell, immediately showed great promises of developing unusual speed. Entered into competition as a three-year-old during the season of 1889, Axtell trotted a mile in 2:15½ at Minneapolis on July 7. At Terre Haute, on October 9, he went the mile in 2:12, a world's record for a horse of his age. On that day he was sold to a syndicate of breeders for \$105,000, and it is doubtful if Iowa has ever produced an animal of any breed that has brought more acclaim to the state than did Axtell.

After Williams sold Axtell, he continued to develop Allerton, and on September 19, 1891, Allerton set a new trotting record for

stallions at 2:09½. Williams, it is said, refused an offer of \$150,000 for Allerton. With a service fee of \$1,000, it is estimated that Allerton earned more than \$150,000 in stud fees. One instance has been recorded of a German horse promoter shipping a mare across the Atlantic to be bred to Allerton.

In the early history of the state the light horse was popular but for a time after the automobile appeared, production decreased. Since 1930 the interest in light horses has been growing steadily in Iowa, as has the number of such horses and the opportunities for exhibiting and demonstrating them. Indication of the trend toward light horses is found in the records of the Iowa State Stallion Show, resumed in 1943 after a lapse of thirty years. Of the 180 stallions and jacks shown in 1944, only 70 were draft stallions. Of 150 stallions shown in 1945, only 50 were of draft type. Of 125 stallions in 1946, only 20 were draft stallions and the balance were light stallions and ponies.

The Iowa Saddle Horse Futurity was organized in 1944. Since the Futurity has had a noticeable effect on improving the quality of saddle horses, the American Saddle Horse Association has served as an important working nucleus for the Futurity organization. Iowa had more licensed American Saddle Horse stallions at public stud in 1946 than any other state.

Vigorous progress also has been made in the breeding and development of the Palomino horse within Iowa. Organized in 1941, the Iowa Palomino Exhibitors' Association has taken an active role in influencing improvement of the breed. With forty-one Palomino stallions registered in the state by 1944, and three state Palomino shows held in as many years, Iowa is rapidly gaining a prominent place in the development of this breed.

Considerable activity also has taken place in the breeding of the Tennessee Walking Horse, Quarter Horse, Morocco Spotted Horse, and Hackney Pony. The harness show pony, "G. I. Joe," bred and developed in Iowa, won the championship at the Chicago show in December, 1945, and sold three times during the show for reported prices of \$10,000, \$13,000, and \$15,200, successively.

Especially indicative of the mounting interest in the light horse in Iowa is the number of horse shows held the past few years. These shows were dominated by light horses and ponies. In 1942, 25 horse shows were recorded in the state. There were 67 in 1943, 152 in 1944, and 176 in 1945. This tremendous increase came despite the wartime handicaps and travel restrictions. In the various shows held during that span of years, it is estimated 49,000 horses were shown before an audience of 772,000. In addition to putting many county fairs back

into sound financial standing, these light horse shows have earned thousands of dollars for charity and created an exceptionally fine market for Iowa light horses and ponies.

With the increase in the number of horses kept in Iowa for pleasure and recreation, horse enthusiasts have organized to promote horseback riding and trail rides. By the end of 1945, there were fifty-eight such clubs in the state. "Trail Rides" are becoming very popular in every section of the state and for several years a 100-mile Trail Ride has been held in Des Moines with trails taking the riders to cities about forty miles away, such as Indianola, Nevada, and Pella.

This interest in light horses has by no means been limited to city residents of Iowa. Many Iowa farmers have found that the well-trained light horse has a definite place on their farms in providing recreation for the family, as a means of travel about the farm, in doing light harness work, in handling livestock, and in the production of colts for both show and sale.

IOWA HORSE ASSOCIATIONS

This history of the horse-producing industry of Iowa is not complete without mention of the extensive association and exhibition activities of horse breeders and fanciers whose work contributed largely to improvement of the various breeds and the widespread use of the horse by agriculture and in cities. Meeting in Grinnell on February 9, 1887, a group of Iowa horse breeders organized the Iowa State Draft Horse Association, the first society of its kind in the United States.

At the first State Fair in 1854, as might be expected, the horse division of the fair was the largest and attracted the most attention. Commenting on this fact, the Secretary of the State Agricultural Society in his annual report for 1856 said: "The horse deserves a prominent place in all our exhibitions. There is no class of animals in the improvement of which the farmers generally are so much interested as the horse. There is no class of animals in Iowa in which so much money is invested as the horse."

All of the state, district, and county fairs in Iowa have been effective in improvement of all classes of horses. When breeders exhibited their animals they could readily compare them with those shown by other breeders and determine if they were progressing satisfactorily in the improvement of the strain or breed. Many horse breeders, encouraged by successes at county fairs, continued improvement of their stock through breeding and selection.

On January 16, 1912, the Iowa Horse and Mule Breeders' Associa-

tion was organized at Ames, because of a widespread desire among the horse and mule men to foster production of better horses and mules. From the beginning, the association has worked toward that goal. The State Assembly of Iowa in 1927 passed a bill creating the office of "field representative" for the association. This representative has aided the production and use of work, saddle, pleasure, and stock horses and mules. In addition, he has worked with 4-H club boys and girls of the state in the selection, feeding, care, and training of colts. First field representative of the association was Harry D. Linn, elected Iowa's Secretary of Agriculture starting in 1942.

The Iowa Saddle Horse Association was organized in 1934 to promote breeding and development of show and pleasure horses, both farm and urban.

In 1943, the Iowa Stock Horse Association was formed. It has established rules and regulations for conducting stock horse shows and has been aggressive in promoting this class of horses before the public.

While competitive and exhibition interest has been kept keen among breeders of light horses through the numerous riding shows and trials, draft horse men have participated for many years in horse pulling contests. First contest of this type was held at the Iowa State Fair in 1923. In the following years, pulling contests became regular events at state and county fairs, attracting many entries and interested spectators. According to the Iowa Horse and Mule Breeders' Association, interest in these pulling contests has revived in recent years, and in 1943 there were fourteen such contests held in the state. During 1944, nineteen contests were conducted, and in 1945 there were twenty-nine with 423 teams competing. The world's record heavy-weight team of pulling horses is owned by L. J. Smith, of Hedrick. This pair of purebred Belgians established a record of 4,175 pounds' tractive pull on the dynamometer at Hillsdale, Michigan Fair, September 26, 1944.

Legislation, too, has done much to foster the breeding of sound horses and mules within the state. The Iowa Stallion Registration Law requires that a stallion or jack must pass a veterinary examination to obtain a license to stand at service, and that a stallion or jack must pass two consecutive examinations to be granted a permanent soundness certificate or license. The law also provides that all stallions licensed after 1924 must be purebred animals registered with a recognized breed association. The result of this law has been the gradual improvement of stallions at public service in Iowa through the elimi-

nation of unsound and scrub stock, and the production of healthy colts, uniform in type, on Iowa farms.

INFLUENCE OF THE HORSE

The horse, as the farmer's principal source of power, had its effect on a great number of industries and individuals whose income was directly or indirectly derived from the widespread use of the horse. Among those directly affected were livery stable keepers, saddle and harness makers, blacksmiths, carriage and wagon manufacturers, saddlers, wheelwrights, draymen, hackmen, and teamsters.

Census figures for the past ninety years graphically portray the rise and decline of these activities and serve as an index of magnitude and importance of the horse industry of Iowa during the century. For instance, 2,609 blacksmiths were listed in Iowa in 1860, with the numbers mounting rapidly to a peak of 6,228 in 1900, and then declining steadily to the 1,665 reported in 1940.

Another enterprise almost as universal as the blacksmith in the "boom" days of the horse was the livery stable, which has become an institution of the past. This type of establishment, where horses could be stabled and fed overnight or for longer periods, once was found throughout Iowa, and in the peak year of 1900, numbered 1,978. This figure rapidly declined to 1,462 in 1910, and with the introduction of the automobile dropped to 434 in 1920. Since then census reports have not listed them.

More than just a "hotel" for horses while their owners transacted business or attended school and church, these livery stables became community centers and clearing houses where hundreds of horses were bought, sold, and traded each year. Horse buyers frequently would make the livery barn their headquarters. Most stable keepers had both saddle horses and horses and buggies for hire. These were widely used by salesmen in visiting clients in the country or in small towns not yet reached by the railroads.

Not to be forgotten, either, is the role of the horse in furnishing transportation to the country doctor in the days prior to the automobile and good roads. First in the saddle and later with a buggy, the doctor made his rounds in both rural and urban communities. Too, we should remember the horse for making possible the heavy attendances at religious and social gatherings, and for transporting rural youths to school.

MULES

Mules have been produced in Iowa for a century. The number increased from 1850 to 1885 when there was a decrease for about ten

years. From 1895 to 1927 there was again a steady increase to a total of 101,000 head. The peak in mule numbers came about fifteen years after the horse reached its greatest numbers (Fig. 7). Since 1927 the decrease in mules has been rather rapid and in 1945 there were less than thirty thousand head in the state. The average price of mules always has been somewhat higher than that of horses and Iowa farmers have found a ready market for their surplus mules. They have

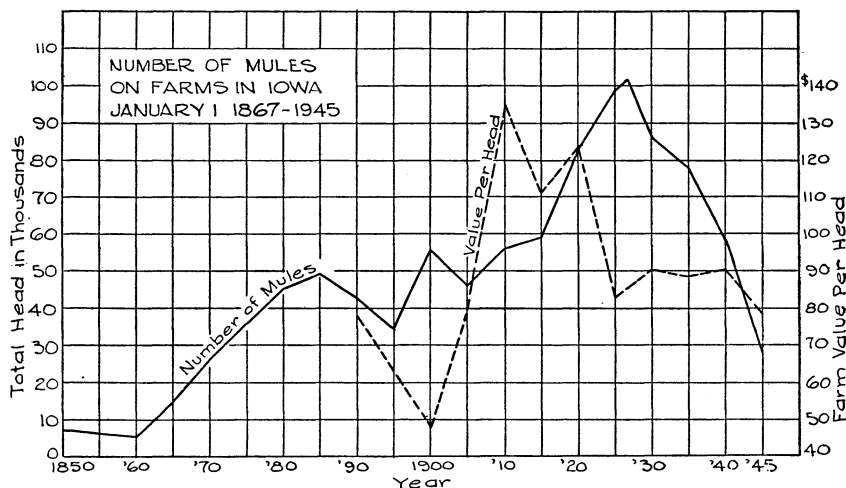


FIG. 7.—Numbers of mules on Iowa farms January first of each year, 1867-1945, with average value per head.

never reached such numbers that they could supply more than a small fraction of the power supplied by horses. Mules found in Iowa are generally larger and more rugged than those of the southern states, where they are more numerous. This has been attributed to the fact that in Iowa they were produced by heavy draft mares.

About 95 per cent of Iowa farms now have some poultry—most of them pin-money or grocery-bill sized flocks.

14. Eggs and Meat From Iowa Poultry

GEORGE F. STEWART, *Poultry Husbandry*

ALTHOUGH MANY SETTLERS BROUGHT A COOP OF POULTRY with them to Iowa, bothering with poultry of any kind must have seemed rather pointless prior to 1850. Nearby woods and sloughs had plenty of wild ducks, geese, turkeys, prairie chickens, and quail. In spring and early summer there were plenty of eggs to be had by robbing a wild turkey nest. Raising poultry, moreover, was no easy task. A pioneer woman describes her difficulties: "Barnyard poultry was a disappearing quantity with us. If an old Dominick biddy succeeded in bringing off her brood, the hawks, buzzards, weasels, minks, skunks, and other varmints made life uncomfortable for them as well as for their caretakers."

But game birds did not remain plentiful for long. After the first few years pioneers had to depend on animals they raised for a constant supply of meat. During summer and fall, lack of refrigeration kept farmers from slaughtering cattle or hogs since the meat was likely to spoil before it all could be used. Poultry became important as a substitute.

Eggs were a welcome staple in the breakfast diet of farming folk, then as now. In the spring they were plentiful; in the fall and winter they were extremely scarce. The hens had the run of the farmstead, ". . . the fowls roosted in the stable or a tree; they wandered, and scratched, and foraged far and near; they hid their nests. . ." When winter came there was little for them to eat and only uncomfortable quarters in which to live. It is small wonder that no eggs were forthcoming then. Already in 1856 articles were appearing in the Iowa farm journals on methods for preserving eggs for winter. Lime water and salt were suggested; the use of waterglass had not yet been discovered.

Until about 1870, most of the farmers kept chickens of nondescript

breeding. It is rather surprising to learn, however, that some purebred poultry raisers did appear on the scene in Iowa in the early fifties. Proceedings of the State Agricultural Society, giving the report of the first State Fair at Fairfield in 1854. includes the following comments on the poultry exhibit:

Class 16 included Poultry; the number of entry tickets amounted to nearly 30. The display was a very creditable one, and gave evidence that we are not behind other states in the importation and breeding of choice qualities of Fowls; the coops of Shanghai, Malay, Black Spanish, Cochín China, etc., etc., were a most attractive feature of the exhibition. The Fowls gave evidence of a most commendable interest in this department of domestic agriculture.

The most significant thing about this account is the fact that two of the breeds mentioned, Shanghai and Cochín, had been imported into the United States from China only a few years previously. Interest in purebred stock grew gradually during the period up to 1870 and the total number of entries of purebred fowls at the State Fair increased significantly.

Farmers generally did not raise these purebred birds. The reaction against them arose out of the belief that "fancy" poultry lacked hardiness. This fear may have been well founded. It was not uncommon, however, for farmers to introduce the blood of some of these purebreds, particularly the Oriental breeds, into their flocks. This practice played an important part in improving the size and meat quality of the rather small and poorly-proportioned barnyard chicken of that day.

Poultry breeding work in Iowa had advanced considerably by the seventies. Already in 1871 D. L. Wilbor, of Boonsboro (now Boone), had achieved such success with his game fowl as to be especially mentioned in *Burnham's New Poultry Book*—a standard text of that time. Several members of the Iowa State Improved Stock Breeders' Association were breeders of fancy poultry in the seventies. In 1881 the president of the Association, Judge Z. C. Luse, of Iowa City, was a poultry breeder of some note.

"HEN FEVER"

The first poultry show in America was held in Boston in 1849. Its primary function was to submit the claims of breeders of fancy poultry to impartial judges for inspection and comparison of the various types shown under similar names (Cochín, Shanghai, etc.) for purposes of determining purity and conformity to type. The show was a great success, and was held in Boston again in 1850. There were fifteen thousand entries in this second show, making it the largest exhibition

of poultry that had ever been held. These shows marked the beginning of the "hen fever" era. People from all walks of life and in every section of the country began raising and breeding poultry for exhibition. The movement "caught on" in Iowa in the late sixties, grew to its peak at about the turn of the century and did not subside until the middle twenties of the present century.

The American Poultry Association, the spearhead of the fancy poultry breeders' movement, was formed in February, 1873. Two Iowans (Z. C. Luse and George Quimby) were charter members of that organization and brought back from the Buffalo and New York City meetings "the message" for poultry enthusiasts in Iowa. On July 11, 1873, the Iowa State Poultry Association was organized in Cedar Rapids. The society held its first show in that city on December 21 of the same year.

Hen fever was most prone to hit nonfarmers. While a considerable number of ministers, doctors, lawyers, etc., were afflicted, farmers were relatively immune. Nonetheless, they were deeply affected by its results, for out of this great movement the American class of poultry breeds was developed and purified. Use of American Poultry Association's "Standard of Perfection" for judging purebred poultry exerted a healthy influence in establishing uniformity of type and purity in breeding in the various strains of poultry then being developed in America.

Realization that the imported races of poultry did not suit the needs of farmers raising poultry and eggs for profit led to the development of the American class breeds such as Plymouth Rocks, Wyandottes, and Rhode Island Reds. These have since found wide favor, displacing the nondescript "dunghill" fowl and the uneconomical foreign importations of the earlier days.

By 1899 the "fancy" poultry show had reached its climax of development in Iowa. Almost every county fair had its poultry exhibit enthusiastically supported by breeders from all walks of life. With few exceptions, the records of the county fair secretaries bring out the growing interest in poultry by farmers during that period. The Plymouth County secretary reported in 1899, "... The poultry house was well stocked with a careful selection of fowls for exhibition. Nearly 300 specimens were shown. . ."

In Iowa the race for honors had settled down to a contest between Plymouth Rocks, Wyandottes, Cochins, and Leghorns. The small, scrawny barnyard fowl was rapidly losing out.

Hen fever was subsiding by 1900, but its effects were indelibly

marked on future poultry raising in Iowa. Almost every farm family raised a hundred or so chickens, to say nothing of the numerous backyard flocks owned by the townspeople. Flocks of from 150 to 300 birds were common enough so as not to attract undue comment in the local press. In fact it appeared that many farmers felt that a hundred hens were about the right number for the purpose of getting a profitable scavenging of the farmstead.

THE WOODEN HEN

In pioneer days the hen "stole out" her nest in spring and hatched her brood. As the interest in poultry raising grew, and with it the demand for larger flocks, more and more attention had to be given to the setting hen. The problem of finding broody hens which would properly care for the incubating eggs and subsequently for the baby chicks became more and more acute. With the improvement in the egg-laying abilities of the hens of the various breeds there came, inevitably, a decrease in broodiness. For a long time a few good sitters, usually otherwise worthless hens, were kept around just so that the chicks could be hatched without fear of excessive losses from improper care by poor mothers.

The development of a simple, foolproof incubator was finally assured by the invention of accurate temperature-regulating devices, about 1885. Because of the obvious advantages offered by artificial incubation, farmers were easily induced to buy almost any reasonably priced unit that was "guaranteed" to hatch eggs. Comments in the farm papers of the day suggest the many disappointments experienced from the use of incubators unworthy of the name.

For ten years the question of natural versus artificial incubation was actively debated in the poultry columns of such Iowa farm magazines as *Rural Life* and *Wallaces' Farmer* before the issue was settled in favor of the incubator. Gradually, after improvements in design were made and combined with a greater experience in their operation, incubators became common on almost every Iowa farm. The merits of such incubators as Reliable, Prairie State, Successful (made in Des Moines), Old Trusty, and Miller's Ideal soon were being discussed whenever farm wives gathered to talk during the late winter months.

Continued improvements in the incubator led to increasing its size beyond that required for an individual farmer's use. By 1905 the capacity had been successfully increased to twenty thousand eggs per setting, and in several parts of the country it had been discovered that chicks could be shipped to points several days distant. In Iowa,

Harry Atkins, of Davenport, was shipping chicks by express regularly in 1911. These two developments heralded the beginning by a new industry in the poultry world—the hatchery industry.

The growth of the hatchery industry was not without its pains. Unscrupulous operators, in an attempt to make quick fortunes, often sold farmers inferior chicks of unknown and often worthless breeding. Then, too, experience in successful management of the incubators as well as in the selection and care of the flocks supplying the eggs came slowly, and to many in the business, too late to assure success.

Buying baby chicks instead of hatching his own had many advantages for the Iowa farmer. While his poultry enterprise was a substantial one, it did not usually rank with his grain growing and hog raising operations. Consequently he was not inclined to give the proper attention to the improvement in his flock or even to the hatching of the eggs. As a matter of fact, then as now, the farm wife usually had the job of handling the poultry enterprise. Care of the flock and hatching the eggs added considerably to her already overloaded schedule. Buying good chicks delivered to her door was, indeed, an answer to a prayer.

Simultaneous with the growth of artificial incubation came the development of artificial brooding. Coal and oil burning stoves with rather simple homemade brooder hovers were already being used by the turn of the century. The discovery and development of thermostatic controls made the workings of the brooder more or less automatic and greatly simplified the job of bringing the chicks safely through the first weeks of life. Installed in a small room or house, these units made the brooding of chicks a relatively easy task. The development of efficient brooders was a simple but necessary adjunct to that of artificial incubation. Together they provided a great stimulus to the growth of the poultry industry in Iowa.

THE BREEDER-HATCHERYMAN

Commercial hatching of eggs took away from the farm poultry raiser not only the incubation of the eggs but also the breeding of the birds. It transferred the control of these matters to the hatcheryman. Whereas the farmer might put up with mistakes in breeding of his own making, he was much less inclined to do so with the hatcheryman from whom he bought chicks. Also, every farmer could raise almost any breed he might wish to, but the hatcheryman had to limit the number of breeds he could handle effectively. This is largely responsible for reduction of breeds in Iowa from dozens to four principal

breeds with the White Leghorn, specialized egg-layers, and White Rocks, raised for both meat and eggs, accounting for 60 per cent of all chickens in the state. Two "red" breeds, Rhode Island and New Hampshire, account for some 30 per cent.

The hatcheryman soon found that he could not himself efficiently produce enough eggs to keep his hatchery operating efficiently and fill the ever-increasing demand for chicks. Nearby farmers were encouraged to keep special flocks to supply the hatcheryman's needs. The successful operator found that these flock owners were one of the keys to his success and developed close business relationships with them. He provided an incentive, usually in the form of liberal premiums for eggs during the hatching season.

While most of these hatchery flocks would not be classed as breeding flocks, they were and are the focal points for the breed improvement of stock reaching the vast majority of poultry raisers in Iowa. Programs for hatchery flock improvement were begun soon after 1910 by individual hatcherymen and by the Iowa State College Agricultural Extension Service. In 1926 the Iowa Poultry Improvement Association was organized. One of its main purposes was to improve the quality of chicks sold by hatcheries. Active improvement programs have since been carried on by these and other agencies. The main points of emphasis have been on hatchery flock selection, fall culling, flock management, housing and disease control (particularly pullorum).

In 1938 the Iowa Poultry Improvement Association became affiliated with the National Poultry Improvement Plan—a federally-supervised plan for breeding and hatchery flock inspection and certification. Its aims include general application of better breeding practices, reduction in losses of chicks from pullorum disease, and improvement in sanitary practices in breeding flocks and hatcheries. Under this plan there has been a marked improvement in the quality of chicks sold to farmers. In addition there has been an increased interest in "Record of Performance" breeding work. By 1945 there were eleven Iowa breeders whose flocks were certified as U. S. Record of Performance.

The key position of the hatchery has made it possible for results of research to take effect more quickly than perhaps in any other field of agriculture. Hatcheries have been able to improve breeds and farmers have insisted that they do so. Certainly the change could never have come so quickly if it had been necessary to sell each individual farmer on improved breeding. Farmers have come to call upon hatchery experts to do their culling for them. This has made farm

poultry raising vastly more efficient. In addition, hatcheries are able to select breeding stock not by appearance, which is deceptive, but by actual performance—something that for many other animals is difficult to move from experiment station to actual farm practice.

DISEASES AND PESTS

In the early pioneer days there were few problems in poultry raising except the ravages of the hawks, skunks, and weasels. As the country became settled and the poultry numbers grew, problems have gradually developed. Today disease is an ever-present problem for the poultry raiser, probably his greatest problem.

First came the lice and mites to plague the hen on the nest and roost. Numerous articles appeared in the farm periodicals of the fifties giving the favorite cures. In the light of present knowledge there must have been little relief for those pioneer hens. It was not until the twenties that Iowa farmers used effective dusting, dipping, and roost treatments. Until these were combined with better housing and improved general sanitation there was little effective control of these pests.

Soon after the advent of artificial incubation, chick diseases became more prevalent, particularly pullorum. Enormous losses occurred, and despite the efforts of the patent medicine industry that started at about this time, no effective cure for pullorum has yet been discovered. In the East, effective control was sought and obtained by persistent testing and elimination of reactors from breeding and hatchery flocks. As a result of this program, pullorum has disappeared there. Such a plan received scant attention in Iowa until the Iowa Poultry Improvement Association started its hatchery flock testing in the thirties. But in spite of this effort, pullorum is still responsible for excessive losses of chicks each year in Iowa.

Bronchitis, colds, roup, and other diseases have troubled the poultryman from the beginning of his attempts to confine the birds to houses. Because of the severe winters, and with them the difficulty of providing adequate housing, these diseases are particularly prevalent in Iowa. At present we are still plagued with these diseases primarily because of the prevalence of poorly constructed, uninsulated, overventilated laying houses.

There have been persistent references to paralyzing diseases in Iowa poultry since the beginnings of recorded history of the poultry industry here. However, fowl paralysis (leukosis) in epidemic form was not apparent in the state until the thirties. Large losses of laying

stock have since occurred as a result of the ravages of this disease. In 1935 a special study of it was begun at Iowa State College in the Veterinary Research Institute. In 1938 the Regional Poultry Laboratory was established by the federal government at East Lansing, Michigan, for the same purpose. To date no effective means for controlling the disease is known, except perhaps by breeding for resistance.

IMPROVING FARM FLOCKS

A Poultry Department was established at Iowa State College in 1907 with H. C. Pierce as head. In 1914 poultry extension work was inaugurated by the Agricultural Extension Service of the College. Gradually the work of the College to improve the poultry industry has been felt throughout the state.

During the period 1918-30 an extremely active program of education was undertaken by the College in co-operation with all

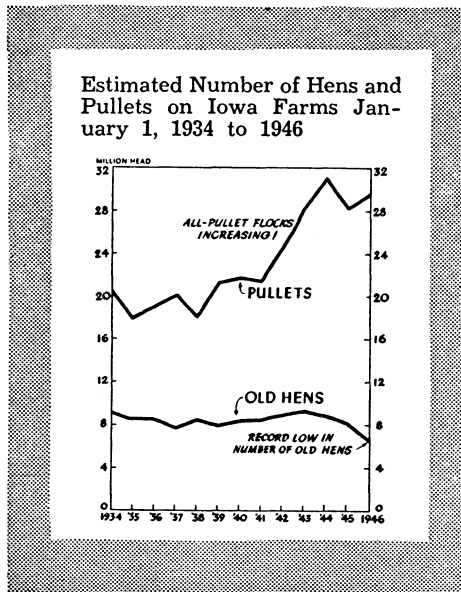


FIG. 8.—Iowa farmers found they had better flocks when they practiced culling, keeping more pullets and fewer old hens.

poultry interests of the state. In 1920 six thousand poultry culling and selecting demonstrations were held, attended by 56,815 people. By 1923, 2,842 boys and girls were enrolled in junior poultry clubs. That these efforts were successful is evidenced by the widespread

changes brought about in the industry of the state during that period. One outstanding achievement was making culling a common practice on a large number of Iowa farms.

Prior to this period most farm poultry houses consisted of discarded and patched up sheds. They were inadequate in size, in sanitary features, and were very poorly equipped. Barns for other farm animals developed earlier because a building could be used for more than one kind of animal, and for hay storage. But chickens needed a building all their own. But because flocks were small and the returns from poultry raising an unimportant part of the farm business, poultry buildings were slow to appear. A campaign for poultry houses worthy of the name was successfully waged. Thousands of new poultry houses were built all over Iowa; thousands of others were remodeled. Facilities for feeding and watering and concrete or wooden floors were installed in the hen houses. Deep litter on the floor was introduced. While the new houses were fairly tightly constructed, draftiness remained a problem. The sunlight craze was widespread during this period. Great expanses of glass windows created drafts of their own almost as bad as the cracks and crevices in the old houses.

As a result of this program, and in spite of its shortcomings, Iowa farmers began to get egg production in winter. This situation has continued to improve until at present the average yearly egg production per hen has risen 20 to 30 eggs. More recently the design of the laying house has been further improved so that draftiness is controlled. Elimination of some windows, use of heavy insulation which protects against moisture, and tight construction—particularly at the ceiling—have helped to make this possible. In some respects this trend represents a return to the old hen house of the 1850–70 period. It was found that it is better to have the house warm, wet, and close instead of cold, dry, and drafty.

CHICKEN FEED

In the early days the hen scavenged her food from all over the farmstead. She fared pretty well at that, probably suffering from little more than a lack of calcium. Many arguments arose over this point, some contending that supplying lime, plaster, or oystershell was unnecessary. Gradually it came to be recognized, however, that calcium-bearing minerals were generally lacking in Iowa topsoils. As a consequence calcium (oystershell) feeding became common by 1900.

As chicks were raised earlier in the spring, with the consequent indoor confinement for considerable periods, special chick feeds were

concocted. Favorite recipes of all kinds appeared in the farm journals of that day (1890–1910). Especially common were baked corn breads, fed to the chicks after crumbling and soaking in skim milk. Poor growth and weak legs were common in the chicks, the correction for which did not appear until the importance of vitamins and minerals became better known in the twenties. Chick feeds were developed and sold by commercial concerns as early as 1910. Gradually, as they proved themselves better and especially as they were more convenient to use than home-mixed feeds, commercial chick mashes became common.

As early as 1890 it was generally recognized that hens needed animal protein in order to produce eggs efficiently. Nonetheless, as late as 1920 this was supplied to the hens rather haphazardly by most farmers in Iowa. Offal from the slaughter of hogs or from game and ground greenbone were common sources. Generally skim milk was available on the farm but more often than not the hen had to steal what she could from the hog trough. During the active campaign to improve the farm poultry enterprise in the twenties the idea of using balanced rations was emphasized. The hatchery flock improvement programs also helped to educate flock owners to the idea. Concentrates containing the protein, mineral, and vitamin supplements to be fed with home-grown grains are currently sold in considerable quantity. Complete laying mashes are not yet popular in Iowa because farmers feel that it is uneconomical to purchase a feed containing a large portion of products (oats and corn) which they raise.

POULTRY AND EGGS FROM IOWA

The raising of poultry by Iowa farmers originated as a means of supply poultry meat and eggs for the table and by the fanciers “just for fun.” In the early days there was no ready market for the products. During the spring the hens very often laid more eggs than could be consumed by the family or than were needed for putting down in waterglass. Eggs were taken to town to be traded for something in shorter supply. The grocery man traded them to his suppliers and eventually the eggs got to the urban centers—often the worse for wear.

By 1880 ice-cooled storage houses were being perfected. During the nineties these became a factor in absorbing the spring surpluses of eggs. Some of these warehouses were built in Iowa although they were more generally found in such urban centers as Chicago.

Fresh eggs were scarce during the fall and early winter months; therefore stored eggs were then much in demand. Operators who

handled stored eggs often were able to reap handsome returns on their investments, although occasionally they experienced disastrous losses because of spoilage. Little was known in those days about the factors responsible for successful egg storage. The storage of shell eggs gradually has become less and less profitable as the winter production of fresh eggs has increased.

Many farmers became dissatisfied with the market for eggs, especially after 1910. Increasing evidence is seen for this in the farm periodicals of the period. There were many attempts to band together for co-operative marketing, but to this day co-operatives have never become an important factor in the marketing of Iowa eggs. Since poultry farming is not a major farm enterprise in Iowa, the over-all monetary gain from such co-operative marketing would be small.

Until 1900 Iowa eggs were marketed exclusively in the shell. However, shortly thereafter H. J. Keith, of Boston, conceived the idea of preparing eggs for bakers, candy makers, etc., in frozen form. The egg contents are removed from the shell. The whites and yolks are separated or yolk and whites are thoroughly mixed. Ten per cent sugar or salt is usually added to the yolk. After mixing and filtering, the products are packed in cans and frozen. Some of the very earliest packs of frozen eggs were put up in Iowa. Since 1918 there has been a steady growth of this industry until a high proportion of the spring egg production in Iowa is frozen.

During World War II, several large spray driers were constructed in Iowa to produce dried whole eggs for purposes of supplying our allies and our armed forces with a nonperishable product. Tens of millions of pounds (one dozen eggs make only five ounces of powder) were produced during 1942-44. The question as to whether egg drying will continue for domestic purposes remains unanswered as yet.

The sale of poultry began somewhat later than did the sale of eggs. At first a few birds were sold to the town butcher for his local Sunday and holiday trade. By the eighties, however, enough chickens were being sold by the farmers to more than take care of this local demand. During this same period large numbers of eastern and southeastern Europeans, great consumers of chicken meat, entered the United States. These led to the shipment, by rail, of large numbers of live chickens from Iowa and the surrounding states to the industrial areas of the East. In the last twenty years the Midwest has begun to kill poultry and ship dressed birds instead of live fowl.

At the turn of the century, dressing of poultry in produce plants was inaugurated in Iowa. The advent of mechanical refrigeration and

the development of a successful refrigerator railroad car were necessary prerequisites to it. Poultry was purchased from farmers, fattened for two to three weeks in special batteries, killed, bled, picked, and chilled prior to shipping. Large numbers of these plants were constructed in Iowa from 1910 to 1920, and an enormous tonnage of dressed poultry has since been shipped to all of the major cities of the country. As farmers gradually learned to feed and care for their poultry better it became less and less profitable for the poultry packer to fatten the birds in the produce plant. Today the birds are kept in the plant only a few days prior to dressing.

About 1910, controversy arose as to whether the dressed birds should be marketed with or without removing the viscera. It was found that with the crude marketing then in use, the birds would arrive at the market in more acceptable form if they were not eviscerated. The majority of dressed poultry then has been bled and picked but not eviscerated.

In spite of this development there has always been a desire on the part of progressive packers to market eviscerated poultry. After several attempts the evisceration of poultry "caught on" in about 1940 and since has shown steady growth. The present trend is to prepare the poultry "ready-to-cook." It is then frozen and marketed in that condition. The housewife has only to thaw the bird prior to placing it in the skillet, pot, or roaster.

TURKEYS COME BACK

Pioneers apparently were fond of turkey, for almost every farm boasted of having a dozen or two on hand for festive occasions. Considerable space in the farm magazines was devoted to descriptions of various varieties of turkeys and to suggestions about raising them. The Mammoth Bronze appeared to be the favorite breed then as today.

No increase in numbers of turkeys raised per farm appeared to take place between 1870-1900, as was the case with chickens. About 1890 turkey raisers began complaining about the death losses in young poults. The blackhead scourge had begun and by 1910 farmers were so discouraged that most of them gave up trying to raise turkeys. In spite of the fact that the cause of blackhead was known by 1895 and the control measures necessary to avoid it had been suggested by 1900, very few turkeys were being raised anywhere at that time.

About 1925 a new start was made in Iowa. This time commercial turkey raising was the goal, not simply a few odd birds for the table. A. C. Gingrich, of Wellman, began with the idea of putting high-

quality poults in the hands of interested and intelligent farmers. He furnished them with feed, a scheme for raising them away from the soil for the first ten to sixteen weeks (thereby controlling blackhead), and a definite feeding and marketing program. After the first successful demonstrations that turkeys could be raised commercially at a good profit there was no difficulty in getting plenty of farmers to raise them. Other groups in various parts of the state have started growing turkeys in large numbers. Today Iowa ranks fifth in the United States in the production of these birds.

ELEMENTS IN THE POULTRY PICTURE

Since the beginning, raising of poultry in Iowa has been done largely in farm-flock sized units. These were classified in four groups: *Backyard flocks* of 10 to 50 hens to produce eggs and meat for the farm table; *Pin-money flocks* of 50 to 100 hens to supply spending money for the family in addition to eggs and meat for the table; *Grocery-bill flocks* of 100 to 200 hens to provide enough income to cover most of the grocery bills; *Semi-commercial flocks* of 200 hens or more to supply a fairly large portion of the total farm income and place the poultry enterprise on a level with that of dairy cattle, hogs, etc.

About 95 per cent of Iowa farms now have some poultry. Most farms have had pin-money or grocery-bill sized flocks. Very few commercial poultry farms of four hundred or more layers are found, in contrast with such states as New Jersey where many farmers raise nothing but chickens. Chickens are usually fourth or fifth in importance on the Iowa farm, in contrast with such states as Washington where chickens, although they are not a farmer's most important source of income, are often second most important. Since large-sized flocks in Iowa are found in combination with dairy herds most frequently, probably more poultry is raised in the northeastern part of the state than elsewhere.

The size of a farmer's flock varies, however, both with a farmer's age and with the change in economic conditions from boom to slump. When a farmer is young and has children or has not yet purchased his farm, he is likely to raise chickens—since they utilize labor that would otherwise go unused. In depressions, chicken production tends to increase since poultry prices fall less than do prices of other farm products.

Continued production of livestock in Iowa on an intensive scale was dependent upon healthy animals. Iowa scientists and farmers worked together to stop disease threats and to prevent further ones.

15. Combating Animal Diseases— and Winning

CHARLES MURRAY, *Veterinary Dean Emeritus*

NO ASPECT OF FARMING HAS BEEN MORE DRAMATIC OR more important to the farmers' economic well-being during the past hundred years than the battle against animal diseases. In no phase of the farmer's life has the change from traditional rule of thumb methods to scientific procedure been more marked than in this field. In few other periods in history has animal disease been as important to the farmer, as it has to the Iowa farmer in this one-hundred-year period which saw the development of intensive livestock production. In some instances disease caused farmers to shift from one kind of livestock to another.

Findings have been far-reaching. Most of the early work on hog cholera leading to the development of a satisfactory method of immunization was carried on in Iowa.

Sometimes the impetus for scientific research has come from sudden severe outbreaks of disease which wiped out livestock. At other times, sickness of humans, passed on to them by animals, has been the influence that caused action. This factor was largely responsible for the campaigns resulting in greatly reducing tuberculosis and Bang's disease.

A poor German farmer in Crawford County had purchased from an unscrupulous seller an old horse suffering from a "bad cold." In a few weeks the other team owned by this man became similarly affected, one of them dying within a short time. The owner held a post mortem examination, hoping to make some discovery that would guide him in successful treatment of the two remaining animals. Five days later he was attacked with glanders and on the fifteenth day he died. Another death occurred in Clarke County, near Osceola. A farmer's wife,

who had assisted her husband in the treatment of several sick horses, contracted an eruptive disease and died within a short time. Her death was attributed to glanders by her physician and a visit to the farm by the state veterinarian proved that these horses were suffering from glanders.

Influenced by the serious situation among the horses of the state and the public health hazard verified by the deaths of these people, "rules and regulations for the prevention and restriction of contagious diseases among domestic animals" were proclaimed by the State Board of Health on December 28, 1884. These rules were very stringent and have remained in effect. They covered recognized diseases which were far fewer than at present. As new diseases were recognized, amendments were made until all diseases known to exist in the United States are covered.

The first official act by the Iowa Legislature for the control or suppression of animal diseases was passed in April, 1884. Up to that time a great deal had been said about control of animal diseases, but little had been done, and nothing in a state-wide program.

The act provided for the appointment, by the governor, of a state veterinarian to serve three years, and be a member of the State Board of Health.

Section 2 of the act prescribes the duties of the office as follows:

The state veterinary surgeon shall have general supervision of all contagious and infectious diseases among domestic animals within or that may be in transit through the state, and he is empowered to establish quarantine against animals thus diseased, . . . make rules and regulations . . . for the prevention, against the spread, and for the suppression of disease. . .

The method of inaugurating action in the case of outbreaks of disease was as follows:

Whenever . . . any (county) board of supervisors, city council, . . . or township trustees, shall in writing notify the governor of . . . any of said diseases, he shall notify the state veterinary surgeon who shall at once repair to the place designated in said notice and take such action as the exigencies may demand.

This program of disease control has continued to include almost universal vaccination of swine against cholera; horses against encephalomyelitis; cattle against blackleg and anthrax; the eradication of tuberculosis in cattle and swine; the control of Bang's disease in cattle by testing and calfhood vaccination, and the extinction of glanders and dourine in horses by testing and slaughter of infected animals.

Governor Buren R. Sherman appointed Dr. M. Stalker in 1884 to the newly-created position of state veterinarian. Dr. Stalker was at that time head of the Veterinary Department of the Iowa State Agricultural College at Ames. He continued to hold both positions for about fifteen years.

The state veterinarian today directs a staff of twelve veterinary inspectors, in charge of field work in ten districts. Employed by the Division of Animal Industry of the State Department of Agriculture, they are assisted by seventeen federal inspectors who work for the United States Bureau of Animal Industry. The principal duties of the combined forces are in connection with the suppression, control, and eradication of tuberculosis and Bang's disease, equine encephalomyelitis, hog cholera, rabies, sheep scabies, and pullorum disease in poultry.

Combating diseases such as tuberculosis, anthrax, foot-and-mouth disease, glanders, Texas fever, and hog cholera is based on well-defined and recognized methods. Chief of them are quarantine; slaughter of infected animals; immunization by vaccination or serum treatment; destruction of intermediate hosts and sanitation. Sanitation includes disinfection, pasture rotation, and proper disposal of body wastes and dead animals. For some diseases one of these methods may be sufficient. For others, combinations of two or more may be necessary.

Quarantine, at least at certain stages of disease, is applicable in all diseases. It alone is not sufficient to bring about eradication of any disease. Applied to individual premises, or even to such large areas as states, it tends to confine the disease to the area already affected, thereby protecting other areas. In the outbreaks of foot-and-mouth disease, Texas fever, and pleuropneumonia in this country, quarantine has played an important part.

In the campaigns to eradicate tuberculosis, foot-and-mouth disease, and to a lesser degree Brucellosis, the slaughter method has found great favor with sanitary officials. This is largely due to the fact that these diseases are apt to become chronic. Infected animals live a long time or even recover, thereby maintaining the infection in a herd and endangering oncoming generations of animals. The choice of this method of disease control depends largely on the incidence of the disease in a country. In the United States the slaughter method is the one preferred for foot-and-mouth disease. It is, without doubt, more practicable economically than others. In Europe this is not the case, because the disease is well established, widely distributed and of high incidence. Continental European countries resort to quarantine and

sanitation. Vaccination is also practiced with doubtful effect, since the only vaccine yet developed is far from perfect.

In the United States the slaughter method is not followed for the control of hog cholera, since the disease is generally distributed and protection can be obtained by vaccination. In Canada, where the disease is not so well established, the slaughter method is preferred. Wherever the slaughter method has been successfully applied, it is accomplished only by the state or the federal government or both paying indemnity to the owners for all animals destroyed.

With some diseases eradication of the intermediate host, which harbors the real cause of disease without being adversely affected, is more easily accomplished than the destruction of the real cause. This was especially true of Texas fever, in which periodic dipping of cattle resulted in elimination of the tick without which the causative parasite cannot exist.

GLANDERS

In his first annual report for the year ending June 3, 1885, the state veterinarian reported glanders as alarmingly present in many parts of the state—with 350 cases found during the year in forty-eight counties. Indicating the need for stringent disease control laws which were to be enacted, he called attention to a racket of that time wherein “unprincipled jockeys and professional traders procured infected animals that were not yet debilitated, patched them up and sent them off to other localities where they were sold at a great bargain to the uninitiated.” He ventured the opinion that in three-fourths of all the cases of glanders he encountered during the year, a trade was an important part of the history. This fact, with the additional one that the horse was the most widely traveled of all domestic animals, explained why the disease had become so widespread.

The specific cause of glanders was in dispute among health authorities, many holding to the theory of spontaneous origin in long protracted cases of debilitating diseases without exposure to a case. Dr. Stalker held to the opinion that contagion was the chief, if not the only, cause of glanders in this country. In the formulation of rules and regulations for the control and eradication of glanders, public opinion was on the side of Dr. Stalker, influenced by the death of several individuals.

No record of the use of mallein as a diagnostic agent for detecting glanders was made until the issuance of the state veterinarian's report in 1893. This test remains today the only means of detecting glanders

and has led to the elimination of the disease. In the 1894 report it was indicated that quite general use of the test had been made that year and a note of encouragement was added to the effect that, "whereas ten years ago fifty-one counties were infected, with the destruction of 350 cases, during the past year barely a dozen animals were destroyed and with ordinary precautions there need not be a general infection." This prediction proved accurate. For the past several years no cases have been observed and it can safely be said that complete eradication of the disease has been accomplished in Iowa. The United States Bureau of Animal Industry's report states that occurrence of glanders is negligible in the United States.

ANTHRAX

Anthrax also was of importance, as indicated in Dr. Stalker's first report: "Most cattlemen have had more or less experience with the disease." This first report came only five years after Pasteur's experiment with a vaccine in France. Dr. Stalker mentions this work but makes no mention of the vaccine having been applied in Iowa. Rather, he enumerates various medicinal agents then common but unsuccessful. Among them were hyposulphite of soda, chlorate of potash, nitromuriatic acid, and quinine. None of these, he states, "would probably stand the test of careful experiment." Apparently the only control measures attempted by the state department were isolation of infected animals, with change of pastures to clean high ground and proper disposal of carcasses of animals dead of the disease by deep burial, or preferably by burning, with the caution never to skin or open the carcasses and to exercise care in handling the same to prevent human infection by such contacts. In subsequent reports of the state veterinarian few outbreaks of anthrax were reported until 1910 when there were many, some of them extremely severe. By this time, however, vaccination was practiced and rigid quarantines were established so that control was soon attained.

TEXAS FEVER

During the eighties, Texas or tick fever was the most serious disease of cattle threatening stock raising in the South, and its cause was not known. It had been introduced in Mexico during colonization of that country by the Spanish. The first reported outbreak in the United States occurred about 1800 and, strangely enough, was found in a herd in Pennsylvania which had been shipped into that state from South Carolina. All outbreaks in the North were observed to

occur in the summer and to disappear after the first heavy frosts in the fall. It was further observed that the southern cattle, which were the supposed source of the disease, in most cases showed no evidence of disease. In some cases direct contact of native cattle with them had not occurred but the native cattle sickened after they had occupied the same pastures. This was later satisfactorily explained when the relationship of the cattle tick in the dissemination of the causative agent became known.

In 1890 it was definitely proved that the tick is the carrier of the minute blood parasite that is the real cause of the disease. Without the tick as the intermediate host of this parasite the disease is of but slight importance. It was rightly concluded that the best way to fight the disease was to eradicate the tick. This proved possible in either or both of two ways: by excluding all host animals from infested pastures, whereby the ticks perish, or by systematic dipping of all animals maintained on the infested pastures, whereby the ticks are destroyed before they become engorged and drop to the ground.

The spread of the disease from the South was greatly favored by the practice of driving cattle overland to better pastures in the Midwest and Southwest. The threat to the cattle industry was so great that several states enacted laws prohibiting the importation of cattle from infected areas. In spite of this, the disease rapidly advanced and the problem of control became a national one. In 1889 a federal quarantine line was established which forbade the movement of southern cattle into northern areas except for immediate slaughter under special quarantine restrictions. This resulted in checking the further spread of the disease but not in improving conditions in the quarantine area. Some southern cattle raisers advanced the theory that ticks were in some way responsible for the disease and the Bureau of Animal Industry sent experts into the South who verified this theory.

Thorough application of the cattle-dipping practice has eradicated the tick in all except two small areas of the original fifteen infested states in the South. These pioneer investigations of the cattle ticks pointed the way for further studies that resulted in the control of such human diseases as yellow fever, Rocky Mountain spotted fever, typhus, and malaria, which are spread by ticks, fleas, and mosquitoes.

The only serious outbreak of Texas fever ever officially reported in Iowa occurred in 1884 at LeMars. It originated from several carloads of cattle shipped to that point from Mississippi. They were unloaded and placed on range for a few days. Then a part were shipped and the rest driven to Dakota. About eighty head of cows

owned in LeMars were taken daily to a pasture used by these Mississippi cattle for four days before being driven to Dakota. Fifty-two days later the town cows became ill with Texas fever and all but one or two died. Fortunately with winter soon coming on all ticks which transmit the disease were killed and there was no recurrence.

RABIES

Rabies was another disease of occasional occurrence at this time, perhaps the most dreaded of the diseases of lower animals transmissible to man. Fantastic stories of the behavior of rabid animals, particularly the dog, were current as well as equally fantastic remedies—such as madstones—for the treatment of the disease in the human. Regarding one of these Dr. Stalker had this to say:

I have received a fair share of criticism for warning the public against the popular superstition on the subject of madstones. No one would be more gratified than myself to know there was in existence a means so efficacious as the virtues imputed to the madstone. But I would fall far short of my duty to the public if I were not to caution them against the employment of means in favor of which there is not a scrap of trustworthy evidence, to the exclusion of those measures that might be of infinite service. Men who have devoted a long lifetime to the study of this subject know nothing of the virtues of madstones. They are unknown therapeutical agents to the world of educated medical men. In a word, this is but one of a long list of imaginary remedies that have found favor from the earliest historic time in the minds of the credulous.

So intense was the fear of the people at this time that schools in some localities were almost deserted because teachers and pupils were afraid to venture out and risk attack by mad dogs. This was a period sometime before Pasteur had developed a vaccine against the disease and the only known method of control was by slaughter or muzzling. Later reports of the state veterinarian indicate that rabies became more serious. In 1910 there was a great deal, but by this time vaccination was common and most outbreaks were short lived. In recent times only sporadic outbreaks have been reported.

PLEUROPNEUMONIA

There was great concern in Iowa at this time lest contagious pleuropneumonia of cattle might be introduced through importation of cattle from areas in the United States where it was prevalent. This disease, previously unknown in America, had only recently been introduced in this country through cattle imported from Europe. The cattle of the neighboring states of Illinois and Missouri were suffering severely and the danger of its spread to Iowa was imminent. To prevent such a calamity a proclamation was issued by Governor Sherman in

June, 1885, calling attention to the danger. A quarantine was proclaimed against the states of Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, West Virginia, Ohio, Kentucky, Tennessee, Indiana, Illinois, Missouri, and the District of Columbia. In 1886, ten thousand cattle in Illinois were affected. Prompt action by the Bureau of Animal Industry resulted in suppression of the disease. With the exception of the exposure of one herd near New Sharon, Iowa herds escaped.

Not the least important effect of this outbreak of pleuropneumonia was that it brought to the attention of thinking people the necessity of national action if such a scourge were to be suppressed. Community or even state action was not sufficient. The disease had been recognized in Europe for a hundred years before it appeared in this country. It was introduced here by importation of breeding cattle from Europe in 1854, but was limited to the extreme eastern part of the United States for a long time. It appeared first in the vicinity of Dayton, Ohio. From there it was carried to western Illinois by breeding cattle purchased in Ohio in 1884. It was soon widely distributed in that and nearby states. The chief of the Bureau of Animal Industry sent his inspectors west to investigate. Quarantine and slaughter, measures long used in Europe for its control, were adopted. Opposition of cattle raisers to such radical measures was encountered but authorities were not deterred. After the policy of paying indemnity for all animals destroyed was adopted, the program was successfully carried through. By 1892 no evidence of the disease could be found in any of the states where it had existed except in New Jersey. This state had refused to co-operate with the Bureau in enforcement of its regulations, but through action of the Congress the Bureau was empowered to enforce its own regulations. In 1893 the Bureau reported: "One year after the last case of the disease expired on the 25th of March, 1893, the entire force engaged in this inspection was dismissed at the end of that month." It has never since recurred, due to stringent importation regulations.

DOURINE

In 1886 a stallion imported from France was put into service at Bloomington, Illinois. This led to an outbreak of dourine, a disease devastating in its effect and rapidly spread through coition. Some of the animals infected were moved from that district, thus establishing new centers of infection in South Dakota, Nebraska, and Iowa. Rigid control measures were enacted and the disease was soon under partial

control. Occasional cases were detected. In 1906 a serious outbreak occurred in southwestern Iowa, which was not brought under complete control until 1916. Through the combined efforts of the Iowa Department of Public Health and the Bureau of Animal Industry, all stallions and jacks in the five infected counties of southwestern Iowa were tested, and all reacting animals were destroyed under condemnation, with compensation paid owners. Thus was another threat to the livestock industry averted by prompt co-operative action of animal health authorities.

SHORTCOMINGS IN THE LAWS

Until about 1900, the law of 1884 seemed adequate to control animal diseases. As time went on, however, new diseases appeared and brought new problems with them. Although the state had become efficient in suppressing disease within the state, diseased animals imported from other states caused serious loss before the disease could be suppressed.

Gradually it became apparent to those responsible for control of infectious diseases in Iowa that little could be accomplished under the laws and regulations then in effect, and under the greater handicap of inadequate appropriations by the legislature to assure enforcement of the meager laws. At every session of the legislature, attention was directed to the situation and the need for increased appropriations was stressed. In 1910 serious outbreaks of anthrax in western Iowa were traced to stock shipped in from other states. Nearly all cases of glanders occurring there were likewise traceable to horses brought into the state. These two incidents, connected with others involving importation of breeding cattle with tuberculosis, prompted the enactment of more stringent laws.

Regulations then in effect specifically forbade any part of the money appropriated by the legislature for the use of the state veterinarian in enforcement of regulations, being used to reimburse the owner of any stock destroyed under provisions of the law. This practically nullified his power to enforce the law which stated that he could order such destruction. As a consequence, livestock owners opposed the killing of their diseased stock and action looking to eradication of tuberculosis lagged. A few forward-looking cattle breeders requested application of the tuberculin test to their herds, agreeing to stand the losses for condemned animals. Naturally there was little or no progress made in a state-wide effort to control disease.

TUBERCULOSIS

Development of tuberculosis in Iowa cattle is recorded in the early annual reports of the state veterinarian. Dr. Stalker's first report in 1885 stated:

There are many cases of this disease, especially among high bred cattle and those that have been subject to high forcing processes. The custom of the time of fitting breeding cattle for sale by close confinement, blanketing, and forced feeding to capacity, followed by their sale to owners who furnish them no more protection against snow and sleet than is offered by the side of a corn crib or a barbed wire fence, results in their catching cold which terminates in consumption.

He also observed that there was a strong tendency for the disease to descend from parent to offspring. Causative organisms of the disease had been first seen by investigators in Europe only a year or two previously and little or nothing was known about its transmission from animal to animal.

No further mention of tuberculosis in the earlier annual reports was made until 1888 when, in the summary of 1,463 animals examined for various conditions, it was stated that but one case of tuberculosis was found. This may indicate that the disease was then rare in Iowa cattle, but many cases may have existed unrecognized. The next year, 1889, the only mention made concerning tuberculosis was that, "In the aggregate it carried off a considerable number of cattle, but never assumed the form of an epizootic."

That there really were many more cases than were being recognized is suggested in the annual report made in 1894 when it was stated that the most serious problem the state veterinarian's office had to deal with was tuberculosis. The tuberculin test by that time had come into use and upon its application to suspected herds, many more cases were being found than previously had been detected by physical examination. Dr. Stalker stated that in a herd of fifty-one milk cows he had, by applying tuberculin, found twenty-seven reactors and a half dozen other suspects. This herd was furnishing the milk supply of an Iowa town. He further directs attention to the public health hazard through the consumption of both meat and milk products derived from infected animals. Inspection of slaughtered animals in packing houses was then very superficial. It was the practice of owners of diseased animals to place them on the beef market as soon as it became apparent that they were reaching the stage of decline from disease.

Seventeen head of registered Angus bulls imported from Minnesota were sold at auction near Waukon. The herd was placed in quarantine the day of the sale and tuberculin test was applied. Eleven of the

seventeen animals reacted. The state herd of dairy cattle at Independence had been increased by the addition of forty-four cattle purchased in New York. In 1909 the herd was tested and fifty-one of eighty-nine head on hand reacted. Twenty-three of them were from the group purchased in New York. At a previous test before the New York cattle had been added, no reactors had been found. Herds at other state institutions were then tested, since importations of out-of-state cattle and exchanges between institutions were being made. More than one-fourth of the 360 cattle at four institutions were found to be reactors. This was a startling reminder to legislators that drastic measures would need be taken if the livestock industry of the state were to be protected.

The campaign to eradicate bovine tuberculosis in the United States was inaugurated in May, 1917. This was to be a co-operative federal-state program for the establishment of accredited herds and was offered for voluntary acceptance by the cattle owners. To encourage its adoption, indemnity was to be paid for all reacting cattle sent to slaughter, based on the appraised value agreed upon by the owner and the representative of the government. One-half this sum was paid by the federal government and half by the state. This met with widespread approval by many cattlemen but with considerable opposition from others. Later, when area testing became obligatory, violent resistance was encountered in a few areas. The most notable of these occurred in Cedar County where groups of farmers, encouraged by agitators against the plan, gathered at farms where government veterinarians appeared to apply the test and forcibly prevented these agents from performing their duties. To enforce the law it became necessary for the governor to call out the National Guard. In time such opposition was gradually overcome and the plan was universally accepted. About twenty years later the last two unaccredited counties of the United States were officially declared to be modified accredited areas, and the entire United States now holds that status, which means that bovine tuberculosis has been reduced to less than one-half per cent. It required more than two hundred twenty-five million tuberculin tests and retests and the slaughter of nearly four million tuberculous animals to accomplish this. In some badly-infected areas as many as 80 per cent of the cattle were infected. The cost of the campaign was enormous, but the dividends are correspondingly large. The records of the Meat Inspection Division of the Bureau of Animal Industry show that in 1917 there were forty-nine thousand carcasses, (about half of one per cent) condemned or sterilized on account of

tuberculosis. In 1940 there were less than two thousand (less than 2 out of every 10,000). Traffic in purebred cattle is now under absolute control by adequate laws, and the hazard of dissemination of the disease is practically nil.

FOOT-AND-MOUTH DISEASE

Foot-and-mouth disease is one of the oldest animal plagues known. In earlier times it devastated herds over the whole of Europe. It spread generally from east to west, abating only after so many animals were lost that there were few susceptible ones left, then recurred when the susceptible population increased. In modern times the adoption of official regulations has caused it to spread more slowly and it has been held in check except in times of war, when livestock movement has been unrestricted. Its control is rendered extremely difficult because so many species of animals are susceptible. Cattle, hogs, sheep, and goats are particularly so, as are cloven-footed wild animals.

In the United States there were six outbreaks between 1902 and 1929. The most serious was the one of 1914-15. Just where the infection originated was never definitely determined, but circumstantial evidence pointed strongly to its introduction through importation of foreign cattle. In previous outbreaks of 1870, 1880, 1884, the disease had been traced to cattle imported from Europe, either directly or through Canada. Those of 1902 and 1908 originated from contaminated cowpox virus vaccine imported from Japan and used for the production of smallpox vaccine by a commercial laboratory.

The 1915 outbreak appeared first at Niles, Michigan, whence it spread to twenty-two states and the District of Columbia. Before it had been accurately diagnosed it had spread to thirty-nine herds in southern Michigan and seven in northern Indiana. On one farm in Michigan, hogs were fed milk from a creamery, contracted the disease and a carload was shipped to Chicago, establishing the disease in the Union Stockyards. From there it spread by livestock shipments to various localities. Its introduction into Iowa herds was traced to livestock shipped from the Chicago stockyards and to the use of hog cholera serum received from a plant operating in Chicago. Nine counties of the state were infected and it was found in forty-nine herds. These herds involved 1,547 cattle, 2,335 swine, and 32 sheep, all of which were destroyed at a cost of \$125,300 reimbursement to owners, plus \$1,330 for disinfection of premises, burial of animals, and destruction of property. This expense was shared equally by the State of Iowa and the United States Department of Agriculture. The first

case in Iowa was discovered November 5, 1914, and final disinfection was concluded March 22, 1915. By June 18, 1915, the eradication of the disease from the United States was completed. The total cost of ridding the country of the disease was enormous, as was the inconvenience to many livestock breeders, but the rigid treatment was certainly justified when it is realized that more palliative methods would not have succeeded and the disease would have become permanently established, as it is in many European and some South American countries.

HOG CHOLERA

Hog cholera has been the cause of enormous economic losses in the United States for more than a hundred years, amounting to as much as sixty-five million dollars in a single year. The first serious outbreak, recognized as such, occurred in Ohio in 1833. From there it spread to surrounding states and gradually to all hog-raising areas. Before its threat to the swine-raising industry was realized, it had become so general and so well established that no nation-wide effort was ever attempted to eradicate it. After the cause was discovered by scientists of the Bureau of Animal Industry, it was not long until a method of immunization was perfected. This proved effective enough to satisfy swine raisers, because, if properly used, it removed all danger of losses from the disease. So long as the present method of vaccination is used, however, there can be no hope of eradication of hog cholera, because it involves the use of the living filtrable virus. Newer methods of immunization which do not require the use of the living virus have been proposed, but they have not yet had sufficient field trials to warrant general adoption.

By 1893, hog cholera had become a serious problem in Iowa. The disease was particularly virulent and acute that year in the southern and southwestern parts of the state, entire herds being wiped out. No method of treatment either with drugs or by immunization had yet been developed. The only suggestion that could be given swine raisers was that there was no cure and the only hope was in prevention. The wave of cholera sweeping the state continued, reaching the peak in 1896, when the mortality reached the astounding height of 140 hogs of every 1,000 raised. Gradually the disease subsided and for fifteen years losses averaged about one-third as great. In 1913 another wave reached a peak of 100 hogs lost per 1,000. Fortunately, by this time a method of vaccination had been developed which reduced losses greatly. For the past thirty years, with the exception of 1926, losses

have been held at about 20 per 1,000. It can therefore be said that the disease is under fair, but far from complete control, without hope of eradication, and that increased control can come only from more universal vaccination.

Much of the fundamental work in the development of control measures and immunization has been done in Iowa. The discovery of the filtrable virus as the causative agent of the disease was made by scientists of the Bureau of Animal Industry working in Iowa. Dr. W. B. Niles, an Iowa State College graduate, Dr. Marion Dorset, and Dr. C. N. McBryde were sent to Page County in 1903 where there was much cholera. From experiments in the field, augmented by laboratory studies at Bethesda, Maryland, it was determined that a filtrable virus rather than a bacterium, previously incriminated, was the real cause. By immunizing swine by injections with this virus, a high degree of immunity was established and the blood serum from such animals would protect susceptible swine, when properly injected. In 1905, a laboratory for the production of hog cholera antiserum was established by the Bureau near Ames. The newly-discovered serum was used extensively on swine on farms in Story County. So successful were these trials that a meeting called at Ames in 1908 was attended by veterinarians and livestock officials from twenty-five states. Methods of preparing and administering the serum were demonstrated. A number of states set up laboratories and began production and distribution of serum to veterinarians and farmers. One of the first laboratories to follow was established by the state in Des Moines in 1910, and continued in operation for three years. In 1913, by action of the state legislature, the State Biological Laboratory was established at Ames and the equipment and personnel from the laboratory at Des Moines were moved. This laboratory continued producing serum for thirteen years, when commercial laboratories had increased sufficiently in numbers and efficiency to meet the demands for service.

In 1912, Dallas and Clay counties were selected by the Bureau for demonstration of methods of controlling hog cholera. The plan was to vaccinate all swine in the area, and to repeat the treatment year after year until cholera was no longer existent. Even had this been possible it is doubtful if the disease could have been eradicated, for when serum alone is used, the protection is short lived. When the so-called "double treatment" involving both serum and virus is used, the infection is maintained. It was impossible to obtain the co-operation of all farmers in the area so the experiment was really a test of the efficiency of vaccination. In this it was successful and demonstrated

that vaccination is a practical procedure, not for eradication but for insurance against loss.

Surveys made during the Dallas County campaign show that in 1913 there were 118,550 hogs raised in the county and that 324 outbreaks of cholera brought losses of 12,000 head. In 1914 there were 138,320 hogs raised with 302 outbreaks and 6,810 lost, or 5 per cent. In 1915 there were 124,500 hogs raised with 60 outbreaks and 1,240 lost, or 1 per cent. This remarkable reduction was due to vaccination, the cleaning and disinfection of stock cars, stock yards and equipment, proper disposition of dead animals, and moderate restrictions on the movement of livestock. Based upon hog prices at that time, the number of swine saved compared with the number that probably would have died had nothing been done, represents a saving in money of \$140,000. This demonstration gave great impetus to the practice of vaccination.

Efforts have been made by geneticists to build up by selection and breeding a strain of swine resistant to hog cholera, but the results to date offer little hope for success.

BANG'S DISEASE

Contagious abortion in cattle has been recognized in Europe as a serious problem for 150 years. It was not until 1895 that Doctor Bang in Denmark discovered its cause. Since then it has been known as Bang's disease, later as Brucellosis. Shortly thereafter it was recognized in the United States and has since become one of the most important diseases of cattle here, particularly of dairy stock. Through studies conducted by Doctor Traum, of California, it was shown in 1914 also to exist in swine. In southern Europe the most prevalent form of the disease in humans is acquired from goats. Later the United States Public Health Service proved it also was transmissible to man from both cattle and swine, and that the organism from swine produces a more serious disease in humans than the cattle organism. It is now recognized as a public health menace and its eradication is urgent.

Attempts to control or eradicate the disease have been made in this country for a good many years, but it was not until 1934 that efforts of federal and state governments were co-ordinated into an eradication campaign. Congress appropriated funds for reducing a cattle surplus. It was logical to direct part of the efforts toward elimination of diseased Brucellosis-cattle, so part of the appropriated funds were earmarked for this purpose. The plan outlined called for testing all dairy and breeding cattle in the United States over six months of age, all reactors to be condemned and slaughtered with compensation paid

owners. Iowa cattle owners accepted the opportunity with considerable enthusiasm and a Federal Bang's Disease Testing Laboratory was established at Ames. In seven years from 1939 on, the laboratory made more than a million and a quarter tests and retests. Some appreciable decrease in percentage of reactors resulted, but not as much as was hoped. Reports from individual herds where systematic testing has been carried on for several years were much more encouraging than those from a large area. This was also true in counties that have adopted area testing. Under such a plan, all cattle except steers and calves under six months of age are tested and the reactors are removed. Retests are made at proper intervals. Sanitary regulations are enforced through co-operative agreements with owners. Whenever all cattle in the county six months of age and over, except steers, show 1 per cent or less reactions, and the total number of herds showing reactors does not exceed 5 per cent, the county is rated as a "modified accredited Bang's disease-free area" for three years. All cattle in the remaining reacting herds are held in quarantine by federal and state officials and are retested at thirty- to ninety-day intervals until all pass two successive negative tests, with a third negative test not less than six months after the second. Two years after area testing was inaugurated, 15 per cent of all the counties in the United States were accredited. These were in twenty-three states. Most of these were counties having a high percentage of dairy cattle.

Dairymen reported 20-25 per cent better calf crops, marked decrease in udder troubles and sterility, increase in milk production, greater marketability of breeding stock with better prices because of increased demand for cattle from disease-free sources.

For many years scientists as well as cattle breeders have looked forward with hope to the development of an effective and safe method of vaccination against Bang's disease. Products proved objectionable or ineffective until the discovery of a *Brucella* organism of low virulence. This was nondisease-producing, and stimulating in its effect to produce immunity. After extensive tests with this product the Bureau recommended its use for calthood vaccination only. Calves between the ages of four and eight months were vaccinated and permitted to mingle with other members of the herd. Reactors were retained at first but later the practice was modified in favor of removal of all reactors as rapidly as replacements were possible from the matured vaccinated calves. Results of trials so far show that such control is effective in calf production, and equally effective in preventing infection. This plan has a strong appeal for cattle breeders. If results continue to be favorable the practice may be universally adopted.

SLEEPING SICKNESS

In the fall of 1884, heavy losses of horses on the Missouri River bottom were reported. After investigation and feeding experiments it was decided deaths were due to consumption of "rattlebox" (*Crotalaria sagittalis*), which grew abundantly in some pastures in this area. From the symptoms and lesions described by Dr. Stalker it might now well be concluded that this was really an outbreak of sleeping sickness or encephalomyelitis, at that time and for a long time thereafter, unrecognized.

It was variously called sleeping sickness, brain fever, Nebraska horse disease, etc.—more properly equine encephalomyelitis. Not until 1930, however, was the cause and nature of the disease thoroughly understood. At that time a severe outbreak in California affected some six thousand head, killing half that many. This resulted in studies and discovery that the disease was caused by a filtrable virus and that it was spread by various biting insects, including the mosquito. In the next few years it spread gradually to other western states, reaching Iowa a few years later. Up to the present it is estimated that nearly a million horses and mules have been affected, with cases reported from nearly every state in the Union. The peak of the disease was reached in 1938 with an estimated loss of 184,000 head. The disease is fatal to at least 50 per cent of the animals attacked, so the desirability of perfecting an immunizing agent is apparent.

In the beginning various drugs were tried with little or no success. Then an antiserum was developed which proved fairly successful as temporary protection in some cases, but wholly inactive in many and of very doubtful curative effect. In 1934, scientists prepared a vaccine from the brain tissue of horses dead of the disease. This proved fairly satisfactory, but was objectionable because it was capable of producing the disease. Improvement upon this was made by adding formalin which killed the virus without destroying its immunizing properties. Further improvement came in 1938 when it was demonstrated that the virus could be cultivated in chick embryo. The virus-containing embryos are ground into a paste to which is added a chemical which inactivates the virus. The vaccine is thus made safe so far as disease production is concerned, and has proved very effective in use in the field.

The immunity established lasts for at least six months, so covers the current season of the disease. In infected areas it is therefore necessary to vaccinate annually. In Iowa vaccination is recommended in May and June, at least, since the season of outbreaks usually begins early in July and lasts until November. Vaccination has brought a

gradual decrease in incidence and mortality. In Iowa there were only 92 cases reported in 1944 compared with 1,097 in 1940. Practically all those lost had not been vaccinated.

AS IT LOOKS NOW

Great progress has been made in animal disease control in Iowa for the past sixty years, since the establishment of the State Veterinary Department. Glanders, dourine, foot-and-mouth disease, contagious pleuropneumonia, and Texas fever are completely eradicated, with no outbreaks occurring for many years. Anthrax and rabies are reduced to a minimum, with only isolated outbreaks reported for several years. Tuberculosis has been reduced to a comparative minimum, as is shown by the great reduction in percentage of cattle reacting to the tuberculin test and in the number of carcasses and parts condemned at packing houses under federal inspection. In 1917 when the tuberculosis eradication campaign was inaugurated, over 2 per cent of all cattle slaughtered at federally-inspected plants showed some evidence of tuberculosis. By 1941 the figure had dropped to 0.07 per cent. Likewise, the incidence of swine tuberculosis has been greatly reduced during the same period, with losses in packing plants dropping from 1.41 per cent to 0.16 per cent. Equine encephalomyelitis is quite successfully controlled by vaccination, with fair prospect of its eradication.

Hog cholera and Bang's disease are far from eradication, but a marked reduction has been obtained. So long as the present method of immunization against hog cholera is followed, the disease never will be eradicated. It can be and is controlled, however, and if all instead of a small percentage of pigs weaned were vaccinated, there would be much less of the disease than now occurs. So long as vaccination is voluntary on the part of swine raisers, there will be many who neglect this important procedure, at least until the disease is imminent in their territory, and this often is too late.

The program of calfhood vaccination against Bang's disease has been in operation too short a time to warrant drawing any final conclusion, but the success attending it thus far offers hope for eventual control, if not complete eradication.

More than eight out of every ten farm families have vegetable gardens. Fruit is raised on a large number of farms, and flowers of some kind brighten up two out of every three farmsteads.

16. Growing Fruits, Vegetables, and Flowers

B. S. PICKETT, A. T. ERWIN, E. S. HABER, H. L. LANTZ,
H. E. NICHOLS, AND E. C. VOLZ, *Horticulture*

WHEN IOWA'S FIRST FARMERS WERE THROWING UP LOG cabins along the streams and digging in for the winter, one might have thought that things horticultural were in the distant future. Traditionally, horticulture follows far behind pioneering, coming only when settlers have had time to establish themselves and to acquire the wealth and leisure to beautify their surroundings.

In Iowa, however, horticulture followed close on the pioneers' heels. Garden crops like beans and pumpkins were planted even before wheat, the traditional first crop of all settlers. Orchard crops like apples and grapes were planted almost immediately. Lack of trees on the open prairie caused shelterbelts and windbreaks to be planted at once. And flowers? The woods were full of wild geranium, columbine, violets, phlox, Solomon's seal, and wild orchids. The prairies were alive with asters, lobelia, goldenrod, sunflowers, butterfly weed, roses, Indian paintbrush, flax, and bergamot. Many of these so-called wild flowers are listed in present-day seed catalogs. By the time Iowa was admitted to statehood, many settlers of means had arrived and already were laying out grounds embellished with gardens and ornamental plants.

In spite of the fact that home gardening and home orcharding began so early in Iowa, the pioneer would hardly recognize the commercial horticulture of Iowa today, with its highly specialized nurseries covering hundreds of acres, its large orchards and vineyards, and its thousands of acres of vegetables. In 1945, vegetables grown for market and canning were worth from fifteen to eighteen million dollars, and fruits, flowers, and ornamental plants another eighteen million dollars.

The pioneer would be at home, however, and his wife's eyes would

shine with pride at the present record of the home gardens. A survey conducted by Iowa State College in 1943 indicated that between 83 and 88 per cent of all farm families, and more than half the urban families, had vegetable gardens worth an average of eighty-four dollars, or a total value for the state of forty-two million dollars. How much gardens, shade trees, and lawns add to real estate values and living pleasure cannot be computed, but certainly their economic importance is large and their esthetic value immeasurable.

About 150 local garden clubs meet monthly, and a state horticultural society, with nine affiliated societies, enrolls seven thousand members.

APPLES

Apple trees were planted in Iowa near Montrose by Louis Honore Tesson in 1799, thirty-four years before the territory was opened for settlement. In 1833, near the site of Davenport, Antoine Le Claire planted four hundred apple trees, some of which bore apples within three years. As late as 1883, fifty years after they were planted, eighty-three of Le Claire's original trees were still growing.

Orchards developed somewhat later in central and western Iowa and the pioneer period may be said to have lasted until about 1870. Early settlers brought with them from the East hundreds of varieties, which grew rapidly on the virgin and fertile land, bearing abundant crops without worm or blemish of any kind. Reports of a fruit growers' meeting held at Burlington in 1855 indicate that 276 varieties of apples and 200 varieties of pears were exhibited, "so wonderfully perfect that they were the admiration of all who saw them." A horticulturist from New York asked, "Who ever saw such apples and such pears as are here displayed? I never have in all my travels, either at home or abroad."

Enthusiasm soon turned to disappointment, however, for that very year cold weather killed or severely injured thousands of fruit trees. Many of the varieties brought from the East were not hardy enough to withstand periodic "test winters." A few varieties proved to be hardy, but they were inadequate to cover the season or requirements as to quality and color which were desired. Severe winters injuring apple trees have occurred more or less frequently. The first such recorded was in 1842. Others were experienced in 1855, 1865, 1872, 1882, 1883, 1893, 1898, 1916, 1917, 1935, and 1940.

Despite bitter winters and lack of hardy varieties, apple growing continued after the Civil War, pushing into western Iowa, particularly

southwestern Iowa, where deep wind-blown soils proved to be well adapted to apples. Labor costs were low in the nineties and the insect and disease problems were as yet of minor importance. I. M. Warren, farmer north of Glenwood, is said to have paid for two farms totaling 480 acres with a few seasons' production of a single orchard.

By 1910 southwestern Iowa had become the major apple-growing section of the state and one of the important regions of the United States. In that year Iowa ranked sixth among the states in apple production, exceeded only by New York, Michigan, Pennsylvania, Missouri, and Kentucky. Six counties—Mills, Pottawattamie, Freemont, Taylor, Page, and Harrison—had 12,700 acres in orchards. A survey in Mills County showed the principal varieties to be Jonathan, Ben Davis, Grimes, Winesap, Wealthy, and Duchess, and the average number of trees per acre to be eighty-seven. In addition to these six counties, twelve others in southern Iowa averaged from seventy to one hundred fifty thousand trees each. For the state as a whole nearly six million trees of bearing age and two million younger trees were reported. Total production for the state was six million seven hundred thousand bushels, with a value of three and a half million dollars.

In 1910 about 72 per cent of the state's farms had home apple orchards, ranging from one to five acres. Generally trees in such orchards were planted much too close together. This fact and rather general neglect led to the decline of home orchards. Several other factors contributed to the decline of commercial apple growing after 1910, especially poorly selected varieties, too many varieties, close planting, failure to control pests, and, beginning about 1908, an invasion of Illinois blister canker. Growers became discouraged and little or no replanting was done.

Apple acreages had been greatly reduced by 1920, and still more so by 1930. Indeed, the whole of the United States had been so overplanted that production exceeded demand. World War I prosperity brought good prices for a time, but falling prices soon after 1920, and especially after 1930, forced many fruitgrowers out of business. Some, however, made profits even during the depression. During the late thirties a strong new growth of apple orcharding occurred under the direction of competent growers. The crop of 1940 was large and of good quality, and brought profitable returns. Then occurred another unseasonable disaster. The morning of November 11, 1940, was comparatively warm, but by nightfall the temperature had dropped 50 degrees, down to temperatures varying from zero in the southeast part of the state to 15 below in the northwest. The cold spell lasted

four days, with below-zero temperatures on November 13, 14, and 15. Orchards throughout southern Iowa, west of Cedar Rapids, were severely damaged and many trees were killed outright. Only two sizable orchards in the west half of Iowa completely survived the 1940 freeze, one at Mitchellville and a twenty-acre experimental orchard at Iowa State College. Both of these had been developed by topworking desirable varieties of apples on hardy, winterproof stocks under the supervision of T. J. Maney, head of the Pomology Subsection from 1917 until his death in 1945. By use of this technique and new hardy varieties, orchards were being replanted as Iowa's first one hundred years drew to a close.

SMALL FRUIT

Small fruits, including strawberries, brambles, and grapes, are grown on farms in nearly every county in Iowa and in limited commercial quantities around the larger towns and cities. For many years Montrose has been regarded as the leading commercial center for strawberries, shipping out many carloads. In 1930 there were more than four thousand acres of strawberries growing on thirty-two thousand farms. The leading varieties over the years have been Dunlap and Premier. Recently Blakemore and Beaver have come into prominence.

Grapes have been raised with considerable success, both by farmers and by commercial growers. More than a thousand acres once grew on the hills of western Pottawattamie County. More than seven hundred acres remain with new plantings being added rapidly. Southeastern Iowa also boasts of some excellent large vineyards. Concord is the most popular variety for both home and commercial growing.

The prairies along the streams always have abounded with native plums which the pioneers used to advantage. Many large-fruited types of the native wild plums were selected for propagation and sale by nurserymen. They were planted all over Iowa and were used by fruit breeders in producing a long list of new plums, commonly referred to as the Jap hybrids. These crosses of native and Japanese plums produced varieties far superior to the native varieties and since 1920 have almost entirely replaced the natives.

Cherries, highly prized as a crop for home planting, are precarious commercially as they are rather short-lived and subject to winter injury. Only the red varieties, commonly called the "sour" cherries, are grown. The chief varieties are Early Richmond, Montmorency, and English Morello.

Although the fruit is not dependably hardy anywhere in Iowa, people always have planted peach trees in their back yards, and in mild winters the buds are undamaged and good crops are obtained. Since peach trees bear fruit three or four years after planting, crops are produced often enough to encourage the planting of some trees each year. In 1910 there were one million three hundred thousand trees in Iowa. The 1940 census showed over 350,000 trees, nearly all in the southern third of the state.

Iowa grows many pears in its back yards but has few commercial pear orchards, due to the prevalence of a bacterial disease called fire blight. In 1910, slightly more than three hundred thousand trees were reported in the census; but by 1940 there were less than ninety thousand trees on farms. A few small commercial plantings have done well in southern Iowa. The chief variety is Kieffer. Several new varieties of promise were introduced in the early twenties; but pears seem destined, as in pioneer days, to be relatively few in Iowa until hardier trees are introduced and a remedy is discovered for fire blight.

POTATOES

All through Iowa's history, potatoes have been its most important vegetable crop. Their production reached a peak toward the close of the last century with 170,000 acres planted. In later years, an increase of diseases caused a marked decline in acreage. In recent years the industry has become stabilized at approximately sixty thousand acres annually.

The first raising of potatoes on a commercial scale centered around Prairie City in Jasper County, where the Dowden potato digger was invented. Later the industry moved northward to Grundy County. During World War I, St. Ansgar in Mitchell County became an important center. About 1920, potato growing began to move from mineral soils to the newly-drained peat lands of northern Iowa, and since then commercial production of potatoes has been confined largely to the bog areas.

The shift to peat soils came because of greater yields of potatoes, and also onions, cabbage, and carrots. Because of the looseness of peat and muck, horse-drawn machinery could be used only in a limited way on small areas; tractors with power sufficient for operation on these loose soils, and especially rubber-tired tractors in the early thirties, greatly increased operations on peat lands. Two-row, high-speed potato planters and two-row potato diggers came into wider use in the thirties, as did larger, faster, sizing and grading machinery,

and brushers to permit a more attractive marketing appearance. Such machinery caused an increase in the size of operations, so that most potatoes moving into commercial channels now are grown by specialists. Another reason for the concentration in a few hands is the difficulty of controlling insects and disease without large spray machines which can cover twelve to twenty rows at a time.

From 1860 to 1870 principal varieties were Peachblow, Marshall, and Nashannock. The Early Ohio appears to have been introduced in the early seventies along with the Early Rose and the Beauty of Hebron. The Rural New Yorker, first tested at the Iowa Experiment Station in 1888, and the Early Ohio were the leading commercial varieties from the nineties until about 1920, when they were replaced generally by the Irish Cobbler.

ONIONS

The Pleasant Valley district in Scott County, north of Davenport, is the earliest commercial onion-producing area recorded in the state. Henry Schutter of this vicinity sowed the first crop of onions in 1856. Since the first crop was sown broadcast, cultivation was impossible and the land became foul with weeds, making growing of the crop unprofitable. Soon after, the hand drill for seeding was invented, making cultivation possible. More German settlers moved in and onion acreage increased and other crops decreased. In the early days river transportation was in its heyday and the bulk of the crop was shipped by boat to St. Louis and New Orleans. The Pleasant Valley growers were the first to develop and use machine planters. Hand planting sets required ten to twelve men per acre per day. Set planters operated by one man now can plant several acres per day.

CANNING CROPS

Growing of vegetables on a commercial scale for canning started in 1878, when Iowa's first cannery was opened in Marshalltown by A. T. Birchard, a Marshalltown druggist, and a Mr. Young. In 1879, at Vinton, another plant was started by Samuel H. Watson, a prominent business man of eastern Iowa. Watson made a trip to Maryland, at that time the center of the infant canning industry, and on his return established his own company, canning both sweet corn and tomatoes.

In these pioneer canneries all operations were performed by hand. According to early reports:

Women prepared the tomatoes, filled the cans, and stacked the cans in trays. The trays were carried by small boys to men, who soldered the tops on the cans

with hand soldering tools. The cans were made by hand. The tin was shipped to the cannery in sheets and a crew of men worked the year round making cans by hand. Losses from defective cans and poor processings were tremendous.

Watson rightly has been called the father of the Iowa canning industry, since men working for him established plants of their own and for others in Iowa and neighboring states. Henry B. Kelly, who was largely responsible for the successful operation of the Watson cannery from 1883 to 1892, established a second plant in Vinton known as the Kelly Canning Company. He left Vinton in 1901 for Waverly, where he erected and operated a large sweet corn cannery. J. W. Cuykendall, another pioneer, established a cannery at Atlantic in 1885 and continued in its active management until his death.

A gradual increase in the number of canning plants and acreage devoted to the growing of vegetable crops, especially sweet corn, took place until about 1920. In 1914 the first machines for removing husks from the corn mechanically were installed in the canning factories, speeding up operations and causing an increase in sweet corn acreage. During the decade from 1920 to 1930, Iowa led the nation in production of canned sweet corn. After the crash of 1929 both the acreage and the number of operating canneries declined. From 1930 to 1940, although sweet corn declined in acreage and amount packed, the tomato, pea, snap bean, and asparagus acreage increased, so that the total pack of canned vegetables was nearly as great as previously. During the war years, 1940-45, vegetable crops raised for canning increased tremendously.

In 1933 the first hybrid sweet corn was grown for the canneries. Open-pollinated varieties had been used exclusively. With the advent of hybrid sweet corn, the proportion of white to yellow sweet corn changed, so that at present more yellow sweet corn is grown and canned. Practically no open-pollinated varieties are grown for canning now. In 1941 the first mechanical picker for sweet corn was used. Not until 1945, however, was an efficient picker used which did not partially husk or bruise the ears. A dual machine which would harvest field corn as well as green sweet corn was invented by Edward J. Schaaf and Edwin F. Greedy, of Anderson, and Oliver Stevenson, of the Otoe Food Products Company. Two earlier pickers had been used to a limited extent, but did not prove satisfactory on short sweet corn.

VEGETABLES FOR SEED

The production of vegetables for seed, particularly tomatoes, peppers, and sweet corn, is an important horticultural industry of the

Muscatine Island. The J. E. Hoopes family, of Muscatine, pioneered in this field and grew their first crop of vegetable seed there over fifty years ago.

The Muscatine Island section is the only vegetable-growing area in the state where irrigation is a regular practice. Beginning with furrow irrigation, using water pumped from the inexhaustible supply only ten to sixteen feet below the surface of the sandy soil, growers have gradually adopted a portable overhead rotary sprinkler system which gives excellent results with melons and sweet potatoes. Ingenious but crude hotbeds for sprouting sweet potatoes, heated with fermenting cornstalks or manure, are gradually being replaced with electrically heated cables. Harvesting, a tedious hand job, has recently been facilitated by using a machine invented by Warren Seright, of Muscatine County, which cuts the vines before the roots are dug.

NURSERIES

Nurserymen have played a conspicuous part in Iowa horticulture from pioneer times. The first nurseries were usually parts of general farm or fruit-growing enterprises and their owners were the horticultural leaders of their day. They were largely responsible for promoting and directing the Iowa State Horticultural Society. They wrote articles on fruit growing for the newspapers and were the chief speakers on horticultural subjects at agricultural meetings. Their fruit trees stocked the early orchards and gardens of Iowa and their young willow, poplar, soft maple, walnut, and ash trees planted the shelterbelts, windbreaks, and woodlots. Their osage orange seedlings provided the uncounted miles of hedge which once fenced the farms of Iowa, and the millions of posts needed when barbed wire replaced the hedges.

Iowa's first nursery was established by Robert Avery near Burlington in 1836. In 1837, Henderson Luelling planted 35 varieties of apples, pears, cherries, peaches, plums, and small fruits in a nursery at Salem. Joined by his brother John in 1841, Luelling developed a prosperous business and in ten years became the leading citizen of his community.

It is a matter of the greatest horticultural significance, historically, that in 1847, ten years after planting his nursery, Henderson Luelling decided to move to Oregon. He loaded a wagon with seven hundred fruit trees and bushes, watered them en route and got about half of them safely to the Willamette Valley seven months later and seventeen hundred miles away from his Iowa home. With this stock he started the great Pacific Northwest fruit industry. A giant sweet cherry tree,

budded by Luelling in Salem, Iowa, was still standing about 4 miles from the city of Olympia, Washington, in 1941. It then had a circumference of nine feet.

Other pioneer nurserymen were D. W. Adams, of Waukon, Suel Foster, of Fountain Hill, H. A. Terry, of Crescent, and C. F. Gardner, of Osage. Gardner and C. G. Patten, who in 1860 started the nursery at Charles City now known as the Sherman Nursery, bridged a gap between the first pioneer nurserymen and the more specialized propagators of a later day. Between 1860 and 1900, many well-known nurseries were established. Captain C. L. Watrous established the Capital City Nurseries at Des Moines during this period; Lake's famous Shenandoah Nurseries were started by D. S. Lake in 1870. Elmer Reeves, of Waverly, began in 1883, and the great Mount Arbor Nurseries were established by E. S. Welch in Shenandoah in 1890. At Hampton S. W. Ferris began a nursery in 1869 which has grown to large proportions under the direction of three generations of the Ferris family. In 1856 Nathan Gould Platt founded a nursery at Oelwein in which the fourth generation of the Platt family is now engaged. At Hamburg the Sjulín brothers—Carl, Leslie, and David—and their mother have established in the last twenty-five years one of the great mail-order nursery businesses of the country, the Inter-State Nurseries.

The nursery industry of Iowa progressed steadily in national importance from its beginning. Today there are about two hundred retail, wholesale, and mail-order nurseries in Iowa. Their sales run around eight million dollars annually. The industry has its own organization, the Iowa Nurserymen's Association, an affiliate of the Iowa State Horticultural Society.

During the one hundred years of Iowa's history, the nursery industry has changed greatly in character. Pioneer nurserymen grew their own plants and sold them directly to their customers by personal solicitation and ever-present tree salesmen. Now, the bulk of Iowa nursery stock is sold throughout the country wholesale or by mail-order. Modern methods of merchandising by radio, catalog, and through established retail dealers and national mail-order and chain store connections, have largely replaced personal solicitation.

The type of plants produced by nurserymen has changed greatly with the growth of the state and the country and the increasing proportion of urban population. Pioneer nurseries grew mostly fruit trees, grapevines, and berry bushes, or trees for windbreaks, shelterbelts, and hedges. Now, ornamental shrubs in infinite variety, street and lawn trees, and perennial flowers make up the bulk of the nursery products.

The equipment of modern Iowa nurseries is far different from that of the first quarter-century of the state's history. Commonplace in Iowa nurseries today are elaborate greenhouses, acres of shaded beds, extensive overhead irrigation systems, tractors built to straddle rows of trees, mechanical tree diggers, cultivators, and high pressure sprayers, extensive storage houses for nursery stock, railroad switches into the shipping sheds, belt lines for assembling orders, machine bookkeeping, the employment of specialists in propagation, pest control, and soil management.

About ten thousand acres of land are constantly in nursery stock, but approximately twice as much is needed for rotation purposes and new plantings. Many Iowa nurseries maintain dairy, hog, or beef cattle farms as necessary sidelines to maintain fertility and rotation procedures in their business. The permanent labor force in Iowa nurseries is approximately three thousand people, many more in the shipping season.

FLOWERS

The flowers which the Iowa pioneers used to decorate their homes and churches, and for various ceremonials, grew in their gardens or wild on the prairies. But no matter how plentiful they were from April to October, they could not meet the demand for flowers in the winter months. Enterprising gardeners in the fifties started plants in glass-covered hotbeds, glass-enclosed porches, and kitchen windows. Presently greenhouses were being constructed and a glass house commercial flower business began.

Pioneers in the greenhouse business were a Mr. Harkett, of Dubuque, Andrew Bather, of Clinton, Joseph Bancroft, of Cedar Falls, Charles Page and J. S. Wilson, of Des Moines, Joseph Bock, of Burlington, J. C. Rennison, of Sioux City, John Franklin Wilcox, of Council Bluffs, W. E. Kemble, of Oskaloosa, and Ira Kemble, of Marshalltown. Most of the firms founded by these early florists are still operated by second and third generations of the families. All of these men and their successors furnished leadership and example on which has been built the present industry with annual sales of ten million dollars.

W. E. Kemble started one of the largest greenhouses in the state in Oskaloosa in 1866. Later he established additional greenhouses in Ottumwa and Cedar Rapids. His sons, W. R. and Roy, took over when their father retired in 1886. Ira Kemble, a brother of W. E. Kemble, also established a chain of greenhouses, at Marshalltown,

Boone, Dubuque, and Mason City. Thus the Kemble name for seventy-five years has been synonymous with flowers in Iowa. Beginning about 1867, L. A. Casper, of Council Bluffs, was operating a market garden and florist's establishment and growing plants in hot-beds and glass-covered frames. In 1880 John Franklin Wilcox, sixteen years old, began working with him, learned the business, became a partner in 1885, and later bought the concern and built what is still the largest range of greenhouses west of the Mississippi River. These houses, and others built later by the Lainsons and other firms, are uniquely located on the edge of the city, step above step on the sides of steep bluffs, sheltered from cold north winds and warmed by the southwest sun. Mr. Wilcox died in 1912, leaving five sons, all in the flower and nursery business.

Most of the greenhouse business in Iowa consists of growing cut flowers; but pot plants, vegetables and flowers for transplanting, and ranges operated for growing nursery stock also are economically important. The large Davis range at Davenport grows tomatoes, cucumbers, and occasionally other vegetables.

Amateur flower growing is of tremendous interest in Iowa. One of the writers once made a census of farm flower gardens by counting those which could be seen from the road, taking many ten-mile stretches of highway as samples. Flower borders, beds, rows of flowers in gardens, window boxes, and so forth were seen in two-thirds of the yards. Back yards in the towns are often bowers of flowers. Interest is so keen that 150 or so local garden clubs hold regular meetings and exhibits.

The state legislature designated the wild rose as the official state flower in 1897. Many volunteer beds of them are found along Iowa highways.

HORTICULTURAL SOCIETIES

Exhibits of apples, pears, potatoes, and other vegetables were shown at Iowa's first State Fair, held at Fairfield in October of 1854, and flowers were exhibited for the first time at the 1857 Fair. The first state-wide meeting of fruit growers probably was held in the First Presbyterian Church at Oskaloosa in 1858, when persons attending the State Fair there were called together. Similar evening fruit meetings were held at later fairs at least until 1861.

Even before this state-wide activity, several county or district horticultural societies had been organized. In 1866, after the Civil War, twenty-eight fruit growers met at Iowa City and formed the State

Horticultural Society, which met at the State Fair in Des Moines in 1868 and adopted a constitution. The Horticultural Society was the first specialized agricultural society organized in Iowa.

The state legislature appropriated eight hundred dollars to pay for educational work in fruit and tree planting for two years. In 1872 the legislature finally voted an annual appropriation of one thousand dollars. Two hundred dollars of this was to be used as premiums for the growing of forest trees.

Among the activities of the state society was promotion of local horticultural societies. Some of these, including one in northeast Iowa and one in Clinton County, had been formed before the state organization. Other early local societies were formed in Scott County, before 1874; Iowa County, 1874; Dubuque County, 1882; Delaware County, 1886; Union County, 1887.

As finally organized there were four district societies: Southeastern, in 1869, Southwestern, in 1874, Northeastern, in 1891, and Northwestern, in 1892. They received grants from the state society that rose gradually from \$50 to \$225 a year and then fell. For over a third of a century these societies met annually. However, with greater commercialization they gradually lost their effectiveness and were superseded by specialized organizations. The last district society was disbanded in 1924. To take the place of the general district societies, nine affiliates of the State Horticultural Society were formed between 1903 and 1931.

First of these was the Society of Iowa Florists, organized in 1903, and affiliated with the state society in 1918. The Iowa Fruit Growers' Association, organized to buy and sell orchard supplies and equipment for its members, was formed in 1912. A year later the Iowa State Vegetable Growers' Association was formed, primarily for educational purposes. Iowa nurserymen organized in 1920, the year these three latter organizations joined the state society. Other societies, with the dates of organization and of affiliation, are: Beekeepers' Association, 1915-23; Gladiolus Society, 1924-25; Rose Society, 1928; Federation of Garden Clubs, 1928-30; Greenkeepers' Association, 1931-38. All of these societies meet annually, some more often. The Federation of Garden Clubs is made up of more than one hundred local garden clubs, which usually meet monthly. They helped sponsor the Victory Garden program in World War II.

In 1917 the first of nine Midwest Horticultural Expositions was held in Des Moines. Management of all but the first two expositions, as well as much of the reorganization within the society since 1920,

was carried on by R. S. Herrick, who served as secretary of the State Horticultural Society for twenty-five years until he resigned in 1946.

RESEARCH

Research in horticulture began in Iowa with eighteen "experiment stations" sponsored by the state society. The stations studied hardiness and adaptability of plants brought from the East and began plant breeding and other studies taken over by the Iowa Agricultural Experiment Station when it was organized in 1882 at the Agricultural College.

Private research, especially in Iowa's early history, did much for Iowa horticulture. N. K. Fluke grew some noteworthy seedling dewberries on his farm near Davenport about 1860, and J. S. B. Thompson, of Grundy Center, produced a large collection of seedling apples. F. O. and Millard Harrington, of Williamsburg, compared the merits of a great number of varieties of the principal fruits, introduced the first outstanding variety of the native aster, Harrington's Pink, and experimented with nuts. H. A. Terry, of Crescent, seeking a replacement for plums subject to disease, introduced one hundred selections of native varieties, five or six of which are still listed by nurseries in the Great Plains. Charles F. Gardner, of Osage, introduced new plums, crosses between American and Japanese varieties rather than selections from native thickets. Gardner's outstanding contributions were the everbearing strawberries Red Gold and 909.

The two greats of the private research workers in Iowa were C. G. Patten, of Charles City, and Harlow Rockhill, of Conrad. Patten operated a large nursery and set aside seventeen acres for one of the state horticultural society's eighteen testing stations. In it he planted varieties of apples, pears, and plums from all over the world. He recognized winter-hardiness as the principal problem in apple and plum breeding and sought to develop it by hybridizing hardy and disease-resistant varieties with more desirable varieties. From his work came the hardy Patten Greening and Brilliant apples, Patten pear, and Patten plum. In 1917 his experimental area was purchased by the Iowa Agricultural Experiment Station, which continued work until remaining materials were removed to Ames in 1934 and the land sold. Rockhill introduced the everbearing strawberries Progressive and Rockhill, and a gladiolus much used by florists for forcing, the Cherry Red. His most useful work, however, was a demonstration of the wide crosses that could be made in the genus *Prunus* and the genus *Amygdalus*, the two most important in the family of trees that include peaches, cherries, and plums.

Since 1900, interest in ornamental gardening has grown and two flower hybridizers have come into prominence. They are Mrs. C. G. Whiting, of Mapleton, who has introduced several fine iris varieties, and Dr. Harry Knight, of Ames, who has done the same for gladiolus and dahlias.

Research at Iowa State College began under Professor J. L. Budd, first head of the Department of Horticulture, a nurseryman and fruit grower, and secretary of the State Horticultural Society for seventeen years. The society appropriated one hundred dollars in 1874 for importation of Russian scions. Four years later Budd imported two hundred varieties of apples from Moscow, together with cherries, pears, and plums. When the state legislature made its first appropriation for agricultural experiments, in 1881, half of the money helped finance a trip Budd made to Europe. He searched Russia for hardy fruits. From 1879 to 1885 no less than nineteen importations of apples were made from Russia, Poland, Germany, and Austria. The imports were propagated in college nurseries and no group of varieties was ever tested more thoroughly. Although importations proved disappointing, a few useful varieties were included and Budd's efforts led to a more systematic breeding program later.

H. C. Price, head of the college department from 1900 to 1905, began the first fruit storage experiments and directed construction of the first laboratory and greenhouses. When Professor S. A. Beach became head of the department in 1905, the new science of genetics was taking form. Eastern scientists had succeeded in originating numerous valuable grape varieties by hybridizing. Budd's success in originating plums by the same technique inspired fruit breeders. Beach recognized the need for good quality winter apples, blight-proof pears, and plums and peaches resistant to winter and brown rot. He at once began a program of fruit breeding supported by congressional appropriations. From this work originated such apples as Secor, Edgewood, Hawkeye Greening, Sharon, Joan, and Monona, the Polly Peach, and in co-operation with others, the Sungold peach. Beach directed the forming of a section of landscape gardening, the organizing of genetics into a separate department, the granting of a degree in forestry, and construction of the present Horticulture Building. Research on apple orchard soils was conducted near Council Bluffs; surveys were made of the orchard and onion industries of the state; and search was conducted for "yellows"-resistant cabbages and potatoes resistant to "hopper burn."

When Professor B. S. Pickett became head of the department in

1923, 157 acres of vegetable gardens, vineyards, small fruit plantings, orchards, and propagation areas were laid out. A horticultural farm was set up and greenhouses were turned from semi-commercial operation to largely teaching and research. From 1923, breeding of raspberries and strawberries was carried on extensively and orchard stocks work expanded under the leadership of T. J. Maney. Open-pollinated seedlings of about one hundred varieties of apples were compared for vigor, hardiness, uniformity and desirability for grafting stocks. Progress was made in dwarfing apple trees. An experiment in soil management of apple orchards was begun and a one hundred-acre farm in the hill area of Pottawattamie County was developed for study of Missouri Valley fruit-growing problems. As mentioned before, dramatic evidence of the value of research was exhibited in the 1940 November freeze, when a mature college orchard of eight hundred trees of nine varieties top-grafted on hardy stock survived, although an adjoining orchard of the same age on standard stock was killed.

Vegetable crops work has included improvement of sweet corn, development of a better canning pumpkin, use of sand and peat lands for vegetable crops, discovery of new potato and onion varieties, and many experiments on canning vegetables carried on under the direction of A. T. Erwin and E. S. Haber. Tests on vegetables are conducted at Fruitland and Crystal Lake, as well as at the college. In floriculture, research has covered variety comparisons, trial of soil mixtures, peat, sphagnum moss and solutions for greenhouse plants, comparison of soil types, study of root growth in pots, and comparison of United State and Dutch-grown tulip and narcissus bulbs in forcing. The College's rose test gardens rank at the top of eighteen or twenty such garden in the country.

Wooded tracts to the pioneer meant materials for shelter and fuel, and game for food. Today they mean woodlots, windbreaks, shelterbelts, and erosion-control areas.

17. Trees of Our Times—and Pioneer Times

GILMOUR B. MACDONALD, *Forestry*

WHEN SETTLERS FIRST ENTERED THE TERRITORY WHICH IS now Iowa, timber covered about six and one-half million acres, or 17 per cent of the land. This region was the transition zone between the more heavily timbered lands of the states to the east and the prairie lands to the west. Clearing land for cultivated crops has reduced the original timbered area to about two and one-half million acres, of which about half a million acres are planted woodlots and shelterbelts.

Forests set the pattern of pioneer settlement in Iowa. Many of the early settlers selected timbered areas in place of open prairie lands. Most of them came from timbered sections where "clearing" had been necessary and many thought that the timberland, when cleared, would be better crop-producing land than the prairie. Essentials for existence, shelter and fuel, depended upon a source of supply from the nearby timberlands. The woodlands also made their contribution in supplying game for food.

At the time of the early settlers, much of the early transportation, especially along the Mississippi River, was made by water. There were no railroads and wagon roads were poor, sketchy, and far between. A map of the original forest areas of Iowa shows that the more heavily timbered areas of the state followed in general the water courses from southeast to northwest. The settlements of the first pioneers, starting at the Mississippi River, followed these same water courses.

Many settlers on prairie land acquired small timber tracts of five to twenty acres, which were sometimes located at a distance from the farmstead.

Following the first settlers came the sawmills which provided lumber for the rapidly growing settlements. Bottom lands were cleared first because they were most valuable for cultivated crops. The farmer was

occupied with planting and harvesting food crops during the cropping season, but on the approach of cold weather he went to the woods with ax and saw.

Much of the lumber manufactured in eastern Iowa in the early days was cut from logs floated down the Mississippi River from Minnesota and Wisconsin. Yet large amounts of native Iowa trees also were manufactured into lumber. In 1877 the river towns sawed nearly four hundred million feet of lumber. Even western Iowa, in this same year, cut about eight million feet of lumber in the vicinity of Sioux City, most of which was cottonwood. The price of the sawed cottonwood lumber was fourteen dollars per thousand feet.

NEED FOR TREE PLANTING

Nearly a century ago the need was realized for tree planting in the prairie or sparsely timbered sections of the country. Arbor Day, initiated in 1872 by J. Sterling Morton, of Nebraska, started a movement that influenced more tree planting in Iowa than in Nebraska.

The Timber Culture Act, passed by Congress in 1873, gave 160 acres of land to any farmer who agreed to plant 40 acres of them in trees. It was later adjusted so as to give title when the settler could prove that 10 acres were planted and were properly cared for. This act was responsible for the planting of several million trees in the state. These early plantings furnished fuel, building materials, and shelter for many farms. The act became ineffective when no additional lands were available from the government, and less than thirty-two thousand acres of Iowa's total lands were claimed under it.

The need for planted timber, especially in the treeless portions of the state, was urged as protection against severe winds.

One writer in 1872 commented: "The rank verdure of the native prairies has been succeeded by cultivated fields; ponds and marshes are now dry, and . . . the only remedy against this great and increasing evil is tree planting and windbreaks."

Many agencies in Iowa, other than the federal government, were instrumental in stimulating tree planting. The Iowa State Agricultural Society reported that one farmer in Appanoose County had planted thirty thousand trees and another in Lyon County two hundred fifty thousand. In 1873 this society offered twenty-one premiums for different kinds of trees set out in permanent plantations. In 1868 the society proposed a tax exemption law which would reduce by one hundred dollars the taxable value of farm lands for each acre planted in trees for a period of ten years. This act was finally amended so that

"no person should have more than one-half of his estate free from taxes and no owner of a nursery which is growing stock for sale should be exempt." As with some of the federal acts, some landowners abused this privilege. In some cases after the ten-year period the trees were cut before they became of usable size and another area was planted in order to secure one hundred dollars' exemption.

The Horticultural Society also published an annual tree manual for twenty years, beginning in 1874 as an outgrowth of the Arbor Day program. The manual included instructions on methods of planting and offered premiums for tree planting.

One of the federal acts which has been of great interest and help to the farmers of the prairie section is a portion of the Clarke-McNary Act of 1924. Under it the federal government co-operates with the states in tree planting, growing, and distributing trees for reforestation, soil erosion control, shelterbelts, and in providing cover for game birds and animals. The federal government, acting through the Forest Service, pays one-half the cost of the trees, and the state the other half. Since the enactment of the law eight to ten million small trees have been furnished to the farms in Iowa. The program has been particularly beneficial in making possible the reforestation of lands which are not best used for cultivated or forage crops.

Throughout the entire woodland area, which includes Iowa, timberlands have generally been depleted over the past hundred years to such an extent as to justify aid from governmental sources in getting these lands back into productive condition. The Farm Forestry Act of 1935 was the answer. In brief, the plan provided for giving the farmers and woodland owners "on the ground" assistance in selecting the proper trees for removal when harvesting, determining the contents and market value of the timber, and assisting the owner in getting the products marketed and manufactured.

When this act was passed much of the forest land was not producing timber of value. Some hillsides had been reduced to raw gullies, others had been cut and culled over for many years and were worthless brush areas. These lands called for guidance in methods of reforestation, selection of proper tree species to use, methods of improving immature stands, and protection against such destructive agencies as fire, livestock grazing, tree diseases, and insect infestations.

Establishment of the Civilian Conservation Corps was another act that gave Iowa forestry important assistance. At one time the forty-six camps in the state had approximately nine thousand young men engaged in tree planting, soil conservation, forest improvement, park and

wildlife conservation work. Although the CCC program was an emergency work program, many farms gained immeasurably in better land, water, and wildlife conservation during its brief existence. The CCC program led to establishment of the Soil Conservation Service. A further development in legislation brought the Soil Conservation District law for Iowa. Its provisions are now adopted in some eighty-five of the ninety-nine counties. They provide effective voluntary means for carrying out long-time plans in better cropping methods, soil conservation, and woodland management.

AGENCIES PROMOTING FARM FORESTRY

The reports of the Iowa State Horticultural Society since its beginning are full of investigations or observations which have been of aid in woodlot forestry. This is especially true with respect to the planting of trees for ornamental and windbreak purposes. The report of this Society for 1867 contains articles on "Planting Trees"; "Trees and Timber Culture"; "Raising Groves and Timber Belts in Northern Iowa"; "Evergreens for Hedges, Protection and Beauty"; "Transplanting Large Evergreens"; "Care of Soft or Silver Maple Seed." J. R. Stickney in this report states: "Every prairie dweller should see this Norway Spruce hedge which is twenty feet high, eight feet broad, and which makes a good windbreak." Another contributor of that same year voiced the sentiment of many of the members when he stated: "The fact, too, that the most calls for teaching in a horticultural direction are now in the line of evergreens and timber growing, will save us any apology for changing the usual order, and giving our first essay pages . . . to those deeply interesting subjects."

Judge C. E. Whiting, of Monona County, observed in a Society report that our timberless prairies need not be timberless: "I also repeat that, in spite of all the learned discussions and scientific theorizing in regard to the cause of our timberless prairies, our cultivated forest trees, year after year, grow right along with immense rapidity, in blissful ignorance of all the reasons why they should not grow."

This same landowner had in mind the need for forest products in the future in his statement: "If I were to plant a section to timber for an investment for my children, I would have it all black walnut—a tree that will grow to saw-log size sooner than pine, and even now in our markets it is quoted at three times the price of pine." Through a period of nearly eighty years the State Horticultural Society has encouraged tree planting by farmers.

A later organization, the Iowa Park and Forestry Association, which

originated in 1901, was instrumental in educational and legislative programs. One of the first efforts of this association was the sponsoring of an act providing for the partial exemption of farm timber tracts from taxation. The act was finally passed in 1906 and still is in force. It provides that planted and native timber tracts may, upon application, be taxed upon an assessed valuation of one dollar per acre (now four dollars per acre). To qualify, the timberland must have at least two hundred trees per acre and be kept free from livestock grazing. The act recognizes the inequality in taxing a growing crop of timber year after year upon its full valuation, when the crop is removed at maturity only after a long period of years. By 1920, 14,700 acres were listed for tax reduction. This had increased to 36,000 acres in 1933 and to a total of 56,000 acres in 1943. The principal purpose of this act was to encourage farmers to avoid undesirable timberland clearing.

This organization, which later became the Iowa Forestry and Conservation Association, was active for twenty-five years. In addition to its contributions toward farm forestry and conservation, it was one of the most potent influences in the establishing of the state park system.

Voluntary associations and societies were among the first educational agencies promoting farm forestry in its various phases. Conservation of forests and soils was not brought into the public school educational program until recently.

Iowa was one of the first states to give college courses in forestry. These were designed specifically for Iowa landowners. The Ames Agricultural College bulletin of 1873 outlined several courses of instruction in forestry and arboriculture in the newly-established Department of Horticulture and Forestry. This early program was largely due to Suel Foster, first president of the board of trustees, and to Professors Henry McAfee and J. L. Budd. Professor Budd served on a federal forestry commission sent to Europe to investigate "trees and forestry conditions." His findings resulted in the introduction of several new tree species to Iowa and other states.

Not much advance in college forestry work came about until 1903 when a trained forester was placed in charge of forestry instruction in the Department of Horticulture and Forestry at Iowa State College. Courses in farm forestry were set up for agricultural students, and technical training for professional foresters. Although the graduates from the professional course have usually entered federal forestry employment or taken positions with the various forest industries, some of them have entered state work with conservation commissions and extension services. More recently, graduates have joined the Soil Conser-

vation Service and the farm forestry division of the United States Forest Service. More and more of the technical forester's time is being devoted to farm forestry.

Organized extension work in forestry has been conducted since about 1906. It has included assistance to the farmer on problems of woodlot management, reforestation, planning and planting farm shelterbelts, control of erosion, use and marketing the products from the woodlot, and assisting in boys' and girls' club work. The forestry extension program has been one of the most important means of promoting better forest practices on the farm.

No organized research in forestry was conducted in the pioneer period, yet many valuable demonstrations and investigations in forestry problems were conducted at an early date. Early in this century the Iowa Agricultural Experiment Station, with federal and state support, initiated limited investigations on forestry and allied problems. Practically all forestry research in Iowa has related to the farm forests. Beginning about forty years ago the Experiment Station has carried forward projects to determine survival, adaptability to soil and moisture conditions and yield in products; planting for soil erosion control; preparation of management plans for hardwood timber; forest nursery methods; forest soils investigations and windbreak planting experiments.

The bee benefits the farmer in two ways. Most important, though this has been realized only fairly recently, is in pollinating his crops. Second—and this has been recognized throughout history—is in providing honey.

18. Bees—The Beneficial Insect

F. B. PADDOCK, *Apiarist*

THE HONEYBEE WAS PROBABLY INTRODUCED INTO THE United States at two places—by the English in New England, and by the Spaniards on the coast of Florida. The spread of bees through the mild climate of the South was much more rapid than from New England. The bees moved across the nation a little in advance of the white settlers, so that the Indians called them the “white man’s fly” and knew that when they came, the white man was not far behind. By 1797 honeybees had reached the Missouri River, for it is recorded that honey was cut out of hollow trees then by both Indians and whites.

Iowa honey was highly prized by settlers farther east. The great profusion of wild flowers furnished “pasture” for swarms of honeybees that lived in tall trees along the streams. Expeditions were made into the state to hunt bee trees. If a bee tree was found to be marked, it was as a matter of honor left unmolested as belonging to a prior expedition.

Accompanied by an Indian guide, John Huff came up the Skunk River in 1835 and camped a short distance above the present location of Rome, in Henry County. The region was still occupied by the Sac and Fox Indians. Eighty gallons of honey were collected and put into barrels made at the camp. In the fall the expedition returned by canoe to Illinois where the honey was sold at fifty cents a gallon. Later a camp was set up two miles northeast of Fairfield.

Bees figured prominently in an early boundary dispute between Iowa and Missouri. The disputed section was known to have many bee trees in it. One summer evening a Missouri farmer hitched his oxen and invaded the “no man’s land.” During the night he chopped down three bee trees and pulled them back across the line into Missouri. Eventually troops were ordered out on both sides, while Mis-

sourians taunted the Iowans by yelling that the honey had been very tasty! The Supreme Court ruled in 1849 that the bee-tree strip belonged to Iowa.

Actual beekeeping began about 1850 when settlers came in from regions where tame bees were well known. After the Civil War, beekeeping spread rapidly. Despite the lack of any transportation faster than horse and wagon, beekeepers operated rather large numbers of colonies. Tama, Bremer, and Benton counties reported beekeepers operating from 104 to 155 colonies apiece, while a man at Oskaloosa was said to be operating 260 colonies in 1874, and in 1878 one man was operating 500 colonies within the city limits of Burlington. Some of the territory which today is considered of little value for honey production was at that time quite satisfactory. One report from Madison County indicated a two thousand-pound yield from 25 colonies. Today a yield of fifty pounds from this area would be considered excellent.

By actual count, twenty-six varieties of wild flowers on the western prairie were a source of honey in 1867. None of them, however, was visited by the wild bee but only by the Italian bee. The basswood tree was placed at the head of the honey plants. Although the tree bloomed but a short period, it had a wonderful honey flow and apparently was so common that bees could store a considerable surplus. The second plant of importance was white Dutch clover.

Movable frames were just being introduced, to replace the home-made dome-shaped beehives of twisted straw. Hives were small, with only one story of eight combs. Only one hive body was used as brood chamber so that the number of colonies increased rapidly. As a result, colonies soon reached their maximum size of bee population. Swarming resulted, and bees established new units for the beekeepers or found a new home in a hollow tree.

Although the small hive meant larger numbers during the season and a sizable honey crop, it did not provide for wintering. Colonies occupied space which should have been devoted to honey storage for the winter. Fall flow was uncertain.

In winter, hives were moved into cellars or caves, where the temperature of 42 to 45 degrees required by the bee could be maintained. Severe winters meant long confinement. This in turn meant that the inadequate food supplies were soon exhausted, and bees starved to death. Even during summer many bees starved to death because of practices followed.

Little attention was given to the matter of improving the bees

themselves. Since wild bees greatly outnumbered tame bees, stock deteriorated. The first Italian bee, which today is the chief commercial bee, crossed the Mississippi River into Iowa in the fall of 1860. Edward Kretschmer, of Coburg, claims to have owned the first Italian bee in the state. This claim also is made by another correspondent, Dr. Jesse Orew, of LaPorte City. Since the Italian bee had reached the United States (Long Island) only that same year, its spread westward was fast. Five years later the Italian Bee Company was organized in Des Moines, with Mrs. Ellen S. Tupper and Mrs. Annie Savory as partners. Although the company did not last long, it supplied a good many queens during its existence. The process of Italianizing the colonies of Iowa has continued, but still is not complete.

HISTORICAL FIGURES

Mrs. Tupper was one of the outstanding Iowa beekeepers. Advised by her doctor to give up her home near Boston and seek outdoor work if possible, she came to Iowa with her husband in 1853. She obtained a colony of bees and studied them. An essay she wrote was published by the Department of Agriculture in its report for 1865. She was operating one hundred colonies of bees and reporting for the *Iowa Homestead*, of Des Moines, and for farm papers in Chicago, St. Louis, and New York. She was several times vice-president of the National Beekeepers' organization and at one time associate editor of the *American Bee Journal*.

Kretschmer, an immigrant from Germany, published a small pamphlet on beekeeping in German and followed it by a 244-page volume in English, *The Beekeepers' Guide*. He operated an apiary of substantial size, and he refers to extracting three thousand pounds of goldenrod honey in a single day from his apiary. Later he began the manufacture of beekeeping supplies. Kretschmer had charge of the state's honey exhibit at the Chicago World's Fair of 1893, where he also received a medal and diploma for his exhibits of extracted and comb honey. At one time he specialized in breeding of queens, selling them to California.

Elisha Gallup, of Osage, a pioneer who performed functions now carried on by experiment stations and book publishers, wrote hundreds of letters to beekeepers seeking information.

Associations of beekeepers came into existence between 1850 and 1880. Transportation difficulties restricted the area for each to three or four counties. The first report of such an organization, in 1861, records that beekeepers met on the third day of the State Fair at

Dubuque, in the name of the "Iowa Apirians' Society." Northwest beekeepers seem to have met usually at Lyons, while central Iowa men met at Cedar Rapids, and the southern district convened in Oskaloosa.

From 1880 to 1915 few changes took place except a steady expansion of beekeeping. Sweet clover as a source of honey was reported first in 1884 in Chicksasaw County. Leading beekeepers of this period were O. O. Poppleton and Eugene Secore, of Forest City, who were interested in the planting of alsike clover and probably the first to undertake careful marketing with special attention to the home market. Local organizations became less active, while the State Beekeepers' Association grew stronger.

PRODUCTION PRACTICES

"Backlot" production became common in cities after 1900. Fruit trees in the backlot furnished some honey, but since white clover was now the chief source of honey, the backlot producer could not be too far from rural areas. He produced chiefly comb honey, which could be handled readily for the grocery trade, and did not require extractors, settling tanks, or storage equipment.

In early days, farmers often felt that the more hives of bees they had, the more honey they would get. Beekeepers found this was not true. A certain amount of "overhead" honey is needed for every hive, but the amount doesn't increase as fast as the number of bees in a hive does. The number of bees in a hive was increased, and therefore the amount of "surplus" honey which could be taken from the bees was increased.

Whenever the bee population in the brood chamber reaches a certain critical size the bees automatically "swarm." A new queen appears and half the hive heads off with her to find a new home. Increasing the size of the brood chamber delayed this critical point. Brood chambers were made two stories instead of one, and more and more cells in each story were added. Bees in the wild state number about fifteen thousand to a hive. Today the ordinary colony numbers as high as seventy thousand. Another way of increasing production has been to do some things for the bees which they would otherwise have to do for themselves. A bee can make its own comb by converting honey into wax, but it takes sixteen pounds of honey to make a pound of wax. If a bee were building the cells itself, it might mix some large cells, for eggs, in with the honey cells and cause trouble when it came time to sell the honey. By furnishing the bee with ready-made cells of exactly the size he wants, the beekeeper gets the results he wants.

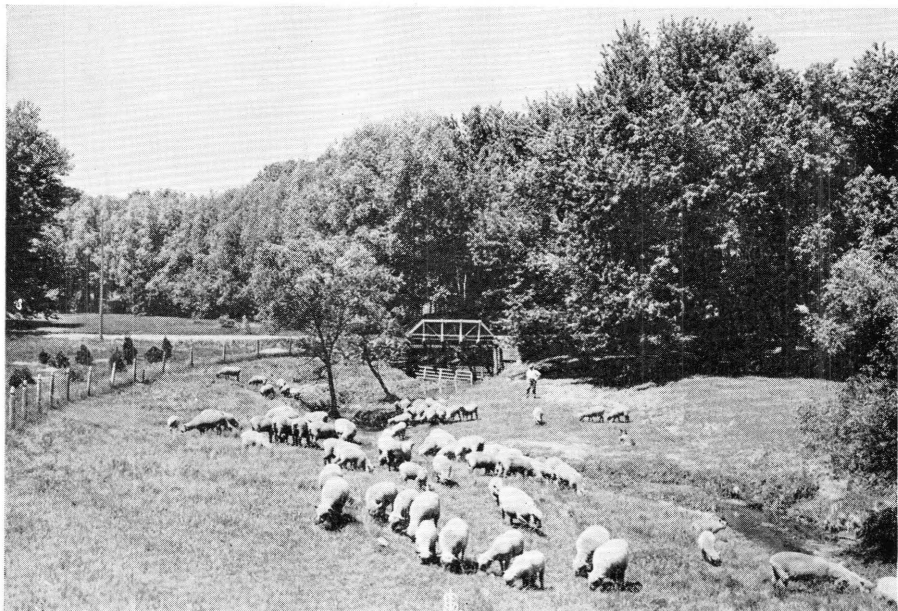
Among the most distinctive changes of the modern period of beekeeping, which began about 1915, is the change in the hive. Up to this time the one-story eight- or ten-frame hive had been used. The coming of World War I and the shortage of sugar brought a great increase in demand for honey. There was an almost immediate shift from production of section honey to extracted honey. At the same time there was a shift from the eight-frame to a ten-frame hive, and even suggestions of a two-story, ten-frame hive for a brood chamber. Apiarists were beginning now to use automobiles, which permitted them to put out more colonies than before throughout the countryside. Hives grew larger until it is advocated now that colonies use a three-story, ten-frame or a two-story, eleven-frame hive.

There has been a definite shift in the practice of wintering. The larger brood chamber has permitted a larger population, and special emphasis has been given to bees reared late in the season as a preparation for wintering. There also has been additional attention given to supplies of honey which accompany the colony into winter quarters. The matter of actual protection has changed definitely from cellar wintering to outdoor wintering.

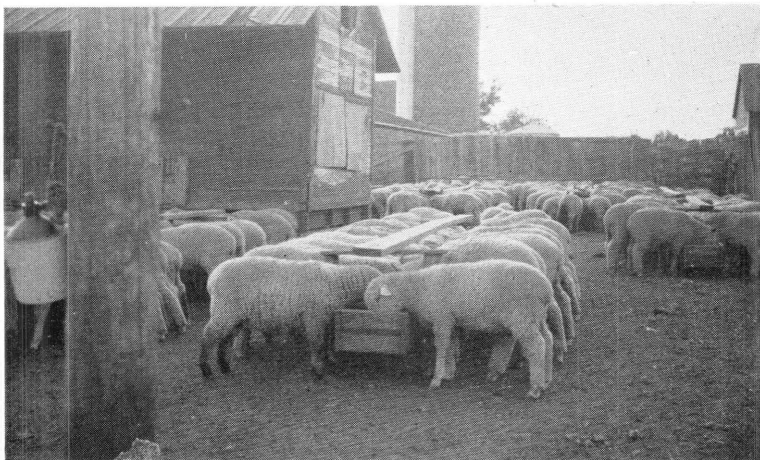
Another change has been the introduction of the package-bee business. Use of larger hives has tended to discourage a natural swarming, so it was a matter of purchase of bees to make up any deficiency due to winter losses or losses from other causes. It was a simple matter to maintain the desired number of units to be operated through the purchase of package bees. The South has found raising bees for the northern producer more profitable than producing honey.

Accessory equipment associated with the development of extracted honey production also has changed. This shift in demand called for larger extractors, development of uncapping machinery, and more investment in settling and storage tanks. More recently has come the demand for accessory equipment in the honey house for the preparation of honey for market. All of this has resulted in a definite shift in honey production from the kitchen or the operator's basement to a special structure called the honey house.

Probably the greatest change has occurred in the honey plants of Iowa. Basswood has continued to disappear each succeeding year. At present, there is little basswood honey obtained in Iowa. It can hardly be listed even as a plant of minor importance today in the total production of the state. White clover has gradually decreased in importance. This is not due to a disappearance in the acreage of clover available. It seems that there must be some correlation between climatic conditions or soil conditions which retard the production of



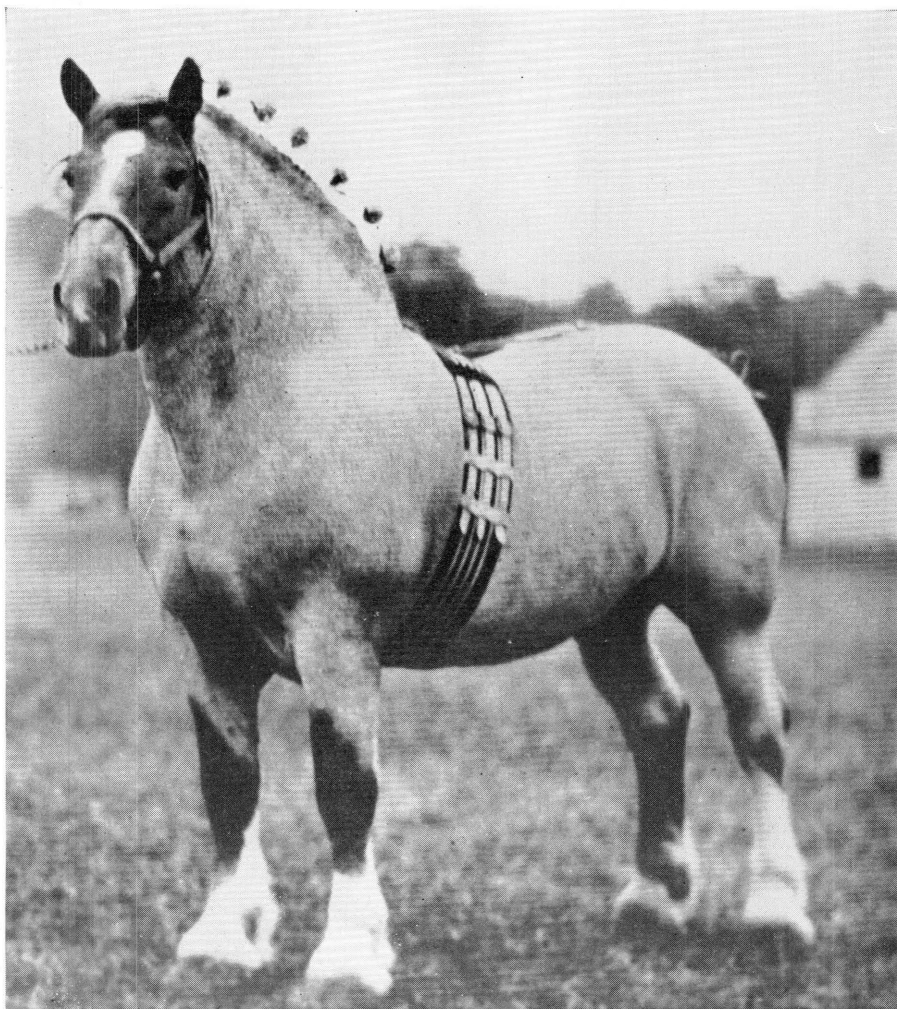
In 1891 and 1892 the trend toward a mutton-type sheep was growing stronger in the state. Henry Wallace in 1896 emphasized, "No state in the Union is better adapted for the production of mutton sheep than is the most of Iowa." The county reports of agricultural societies from 1895 to 1900 tell of the increasing interest of farmers in sheep. These reports stated that farmers were finding sheep of mutton breeding profitable, even more so than hogs and cattle.—CHAPTER 12, SHEEP PRODUCTION IN THE LIVESTOCK ENTERPRISE.



The feeding of western lambs has increased rapidly in Iowa over the last two decades. When the feed in the fields is no longer adequate, the lambs are finished on suitable rations in the dry lot. Adequate shelter is provided against storms.—CHAPTER 12, SHEEP PRODUCTION IN THE LIVESTOCK ENTERPRISE.



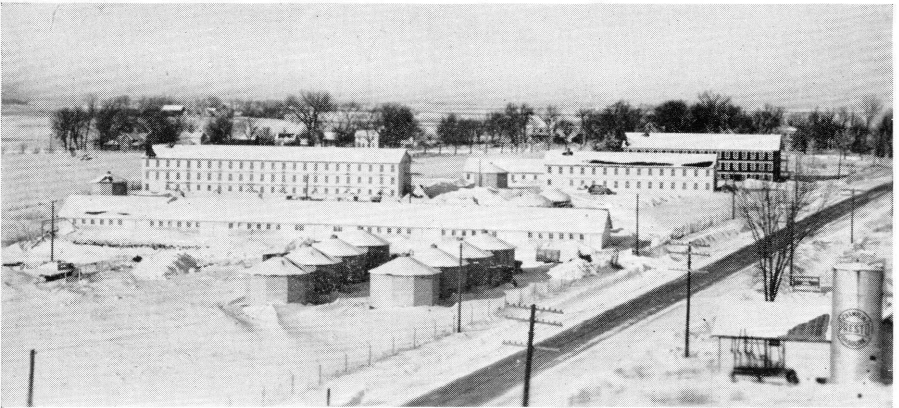
The powerful draft horses for which Iowa has long been famous deserve much of the credit for Iowa's prominence in agricultural production. It was these heavy horses and mules that for more than seventy-five years furnished the power needed for every farming operation from plowing to harvesting and even for transporting the produce to market.—
CHAPTER 13, HORSES PULL IOWA INTO PROMINENCE.



Outstanding Belgian stallion in the history of the breed in the United States was Farceur 7,332, imported from Belgium in 1912 by William Crownover, of Hudson, Iowa. He was purchased by C. G. Good, of Ogden, at the dispersion of the Crownover stud in 1917 at \$47,500, the highest price ever paid for a draft horse in this country.—CHAPTER 13, HORSES PULL IOWA INTO PROMINENCE.



About 95 per cent of Iowa farms now have some poultry. Most farms have had "pin-money" flocks of 50 to 100 hens, or "grocery-bill" flocks of 100 to 200 hens. — CHAPTER 14, EGGS AND MEAT FROM IOWA POULTRY.



Commercial hatching of eggs took away from the farm poultry raiser not only the incubation of the eggs, but also the breeding of the birds. Whereas the farmer might put up with mistakes in breeding of his own making, he was much less inclined to do so with the hatcheryman from whom he bought chicks. This is a modern breeding farm maintained by one of Iowa's hatcherymen. All of the large buildings in the picture are used for housing the breeding stock.—CHAPTER 14, EGGS AND MEAT FROM IOWA POULTRY.



In the fight against hog cholera, much of the fundamental work in the development of control measures and immunization has been done in Iowa. Experiments demonstrated that vaccination is a practical procedure, not for eradication but for insurance against loss.—CHAPTER 15, COMBATING ANIMAL DISEASES—AND WINNING.



More than a thousand acres of grapes once grew on the hills of western Pottawattamie County. This is a typical vineyard scene in southwestern Iowa in 1921.—CHAPTER 16, GROWING FRUITS, VEGETABLES, AND FLOWERS.



The Pleasant Valley district in Scott County, north of Davenport, is the earliest commercial onion-producing area recorded in the state. Henry Schutter of the vicinity sowed the first crop of onions in 1856.—CHAPTER 16, GROWING FRUITS, VEGETABLES, AND FLOWERS.



Organized extension work in forestry has been conducted in Iowa since about 1906. It has included assistance to the farmer on problems of woodlot management, reforestation, planning and planting farm shelterbelts, control of erosion, use and marketing the products from the woodlot, and assisting in boys' and girls' club work. The trees shown above are White Pine planted on steep land to stop excessive sheet erosion. At this stage they were thirteen years old.—CHAPTER 17, TREES OF OUR TIMES—AND PIONEER TIMES.



Among the distinctive changes in the modern period of beekeeping, which began about 1915, is the change from the one-story eight- or ten-frame hive to use of larger hives.—
CHAPTER 18, BEES—THE BENEFICIAL INSECT.

nectar by the plant. It is barely possible that this is also associated with the change of white clover from a seed crop to a hay crop or pasture crop. White clover is frequently available in what would appear to be ample profusion for a fine crop of honey, but the beekeepers' experience with this plant has been definitely disappointing.

Sweet clover, which has taken the place of white clover, came into the state from the Northwest through Woodbury County. Beekeepers said it was possible to keep two hundred colonies of bees in a yard at every two-mile intersection. Production of honey stepped up in this county and in this section of the state so that it was shipped out by carloads. The white sweet clover spread from this area until it has covered at least the western two-thirds or three-fourths of the state, where it is the major honey-producing plant. Sweet clover seemed to lend itself especially well to the production of extracted honey.

Due credit must be given to accessory sources of nectar and pollen in the spring, although these sources are of value only as an aid in colony development for surplus gathering during the summer. Few fall-blooming plants have been available in recent years. This is due mainly to the changed agricultural conditions, especially the more efficient operation of land with the consequent reduction of waste and wild areas.

The earlier tendency to market extensively in an adjacent area has given way to wider marketing with the coming of truck transportation. High specialization of honey production in the hands of fewer individuals, with the consequent enlarged tonnage, also has extended marketing by truck beyond state borders. This period has seen the development of independent honey packers around the large consuming centers, mostly in the East. They have taken the product from the producer in bulk and prepared it for retail trade.

Another development in this period has been the co-operative marketing of honey. The outstanding example of this for Iowa is located at Sioux City. A small group of producers found themselves confronted with restricted outlets for their product. Consequently, they developed a co-operative marketing organization, which has now developed into one of the biggest marketing agencies in the United States. Members are scattered over many states and the co-op sells throughout the middle two-thirds of the United States.

DISEASE PROBLEMS

Today there is much interchange of bees from one location to another and from southern states to northern states. Such movements of bees and honey have complicated the disease situation for the bee-

keeping industry. One disease in particular, American foulbrood, is a serious handicap to honey production and demands a constant fight to keep it under control.

The Iowa law for control of foulbrood differs from that of any other state in that it is fundamentally an educational law, based on the assumption that if the beekeeper knows how to control the disease he will, for his own good, prefer to do so. This law is largely the work of Frank C. Pellett, a native of Atlantic, who has become a national leader of the beekeeping industry, and since 1915 a staff member of the *American Bee Journal*.

IMPROVEMENT PROGRAM

The Iowa Beekeepers' Association has continued its existence after reorganizing in 1912. In that year the association decided to co-operate with Iowa State College in an educational program which would include the teaching of beekeeping, at the college and throughout the state through the Extension Service, and an adequate research program.

The research work, under the supervision of O. W. Park, has centered around fundamental projects such as the gathering and storing of nectar, nectar secretion of plants as affected by weather factors, and development of a strain of bees resistant to American foulbrood.

Two state apiarists have served as supervisors of apiary inspection, F. Eric Millan for two years, and the present writer since 1919. In 1919 a system of demonstration apiaries was established in several counties where method demonstrations brought to beekeepers the value of the best known methods in honey production. More recently the demonstration apiaries have been established in those counties where inspection work has been organized. Now thirty-six counties in the state help finance local control programs.

During the latter years of this period, the honeybee has again taken its place as a part of agricultural production through the realization of its services for the pollination of fruit and the production of seed, especially legume seed. The need for bees for pollination has been less than in states that grow more commercial fruit. But a general distribution of bees is necessary to make home orchards and gardens more profitable.

Effort is under way now to increase production of legume seed as a basis for a balanced agricultural program as developed by the Soil Conservation Service. This will require an increase in the number of bees for pollination. It will simultaneously increase honey pro-

duction. Current production goals call for an increase of 18 per cent in number of bee colonies in Iowa, as compared with an increase of but 8 per cent for the nation as a whole.

Complete pollination takes a lot of bees. With complete pollination of alsike clover, for instance, one could harvest seed up to twenty bushels an acre. But an acre of alsike clover contains some four hundred million individual florets, each of which must be visited by an insect to get 100 per cent pollination. Complete coverage is out of the question. It is practical, however, by increasing the number of bees to get eight bushels of clover seed to an acre—a lot more than the 1.6-bushel average in Ohio where such studies were made. Red clover seed can be increased from one to four bushels an acre. Insects other than bees aren't of much help in pollination. It has been found that of flowers pollinated in a field, 15 per cent were pollinated by bumblebees, 3 per cent by other insects, leaving 82 per cent for honeybees.

Up to World War II, beekeepers increased honey production by operating more and more colonies farther and farther afield. War-scarce labor and transportation reversed this tendency. Instead, beekeepers tended to operate fewer units, but more efficiently. This in turn required better stock, a greater investment in equipment. The average producer has equipment adequate for only 120 to 180 pounds of surplus honey per unit—far less than the 500 pounds per unit which is possible. Labor-saving devices are needed, for there have been no improvements in equipment for colony manipulation or honey extraction in the last forty years. Numbers of bees and amount of honey both may increase as legume crops increase. However, tying honey production to such crops will mean that drastic reduction in hive operations will result if farmers ever shift to legumes which are of advantage to soil and to livestock, but of no value for honey production.

Small dairies of the early settlers furnished pioneers with one of their most important foods, and with ready cash with which to pay current expenses. Iowa dairies now are factories marketing food products throughout the world.

19. Dairy Product Output From Iowa Farms

M. MORTENSEN, *Dairy Industry*

FARM BUTTERMILKING HAS BEEN KNOWN FOR CENTURIES, for the servants of Abraham churned milk in a skin bag. No record is available as to when the dash churn was invented, but it was known by the time of the Iowa pioneers. At that, early Iowa settlers were not all equipped with a dash churn. Frequently they churned by agitating cream in any kind of utensil available. Mrs. N. Sanford writes about a Peter Newcomer who settled in Polk County in 1844:

Mr. Newcomer built his cabin, but he was often at a loss for many of the conveniences of civilized life. His good lady had no churn; necessity is the mother of invention; so taking a hollow log and scraping it smooth, he then put in a board bottom, fashioned out a dasher from a hickory pole, and the churn was made.

Most farm women knew how to make cheese, each following her own formula. Such cheese was generally consumed on the farms where it was made. But this was not enough to meet the demand, and cheese had to be imported. This demand interested some of the farmers in the production of cheese for market. George Acres and Watson Childs, of Delaware County, started to make cheese on their farms in 1858 or 1859. Acres increased his herd to about thirty cows by 1862. Childs was obliged to peddle his cheese for two or three years after starting and realized from eight to ten cents per pound, mainly in trade.

Another farmer who became a successful cheesemaker was Ara C. Bowen, of Bowen's Prairie, Jones County, who had come from Herkimer County, New York, where the manufacture of cheese was almost the only source of income to the farmer. Bowen started to make cheese on his farm in 1858 and sold during the year 1863 more than ten thousand pounds of cheese and some butter. In 1863 he erected a separate building, 20 by 40 feet for cheesemaking.

The first commercial cheese factory in Iowa probably was one

erected in 1866 at Delaware, by William M. Hefner and K. W. Kingsley. A building 24 by 40 feet, two-and-a-half stories high was erected, and an experienced cheesemaker, a woman from Madison County, New York, was employed. There might have been a cheese factory located in Lee County earlier, since certain citizens of Lee County exhibited at the first Iowa State Fair, held at Fairfield in 1854, a cheese weighing 360 pounds. However, this cheese probably was made on a farm with the co-operation of several farm dairies.

The cheese factories soon increased in number. The *United States Census* reports fourteen cheese factories in Iowa in 1870 producing 256,906 pounds of cheese. The number increased until 164 were reported in 1889. This number was never again equaled and sixty-eight discontinued operation the following year.

Milk for the cheese factory had to be delivered daily and required considerably better care than cream skimmed on the farm and collected once or twice weekly. In addition, the farmer felt that he could make more money by selling his butterfat to a creamery and feeding the skim milk to calves than by selling whole milk to the cheese factory.

Under such conditions the Iowa cheese factories were doomed to failure. In 1910 only five factories, making slightly less than three hundred thousand pounds of cheese, were reported. Later there was a slight increase until twelve plants were reported in 1916. This number rose to twenty-four in 1917, due to the establishment of ten new factories by D. J. Murphy, of Waukon. Murphy felt that Allamakee County was especially well adapted for cheese-making and that a dairy state such as Iowa should at least manufacture the cheese consumed within the state. He hoped to arouse others to follow in his footsteps, but as the basis for starting the plants was sentiment rather than business judgment, their life did not exceed more than three or four years. By 1922 the low number of five small plants was again reported. Following this there was a slight revival up to 1937 when twenty-seven factories manufactured 3,715,992 pounds of cheese.

In 1941 the United States Government asked for more cheese for the army and lend-lease. To comply with this request, twenty-three new cheese factories were started in Iowa. In 1942, forty-two plants produced 11,315,000 pounds of cheese. This production decreased to 7,500,299 pounds during 1943 and the number of cheese factories dropped to twenty-nine.

Realizing the unfavorable conditions for the manufacture of cheese in Iowa, the Dairy Industry staff members at Iowa State College had

for several years considered the possibilities for manufacturing special foreign types that could be sold at a price high enough to assure a sufficient milk supply. The amount of work that had been done on such types in this country was limited. Denmark, on the other hand, had carried on research at the government Experimental Creamery by which they had improved such types as Swiss, Blue Cheese, and Edam. A representative from the Dairy Industry Department of Iowa State College, who visited Europe in 1931, suggested to the director of the Danish Experimental Creamery that he select an outstanding student and train him in the manufacture of some of the more common foreign varieties. Fourteen months later Verner H. Nielsen arrived at Iowa State College as an assistant in dairy industry.

Nielsen had had several years' practical experience in Danish cheese factories and two years' experience at the Experimental Creamery. Research was started at Iowa State College on the manufacture of Swiss, Blue, and Edam varieties. Dr. B. W. Hammer and his assistants in Dairy Bacteriology were studying the mold that produced the best results in the manufacture of Blue cheese, and later developed the process of manufacturing Blue cheese from homogenized milk, a process that became generally employed by most American plants. The mold culture produced at the college likewise became standard among most American factories and many of such factories are supplied with the cultures direct from the Dairy Industry Department.

In Switzerland the Swiss cheese is made into large wheels weighing from 60 to 220 pounds. This type had been modified at the Danish Experimental Creamery to a cheese weighing about 30 pounds with rather small round holes in contrast to the larger holes of the imported Swiss. The Danish process was originally followed at the Iowa Dairy Industry Department but later the size of the cheese was reduced to 5 or 6 pounds, a size more satisfactory for marketing.

Cottage cheese is manufactured extensively from skim milk in Iowa. Blue, Swiss, and Edam cheese also can be manufactured profitably in the state. Up to the present time, several firms have adopted the Iowa process but have located most of their factories in other states where milk can be obtained at a lower price.

EARLY CREAMERIES IN IOWA

The first creamery in Iowa was started in April, 1872, by John Stewart at Spring Branch, three miles southeast of Manchester. Stewart was a butter dealer in Massachusetts. He came to Iowa to obtain butter to be shipped to his partner A. C. Clark, who took

charge of the business in the East. In 1869 Stewart bought two carloads of Iowa butter which were sold at a fair profit. The following year he purchased as much as was obtainable, reworked it, and shipped it to Clark at a loss.

Stewart was convinced that for the establishment of a satisfactory outlet in the East it would be necessary to have a product of high and uniform quality. He consulted Matthew Van Deusen, who was engaged in the produce business at Manchester. Van Deusen, in February, 1872, made a trip east to visit the dairy of a Mr. Boyse who used the output from his herd of 75 cows to make butter which sold in Chicago for 45 cents per pound. Van Deusen studied Boyse's method of manufacture and marketing and became enthusiastic about the system. After his return to Manchester, Van Deusen and Stewart canvassed the territory around Spring Branch and reported:

A meeting was called in March, 1872, at the school house in the neighborhood, and was well attended by the dairymen. A proposition was submitted to pay them 65c per 100 lbs. for the season. After the matter had been fully discussed, they accepted, and the milk from about 300 cows in a two-mile radius was pledged. In thirty days from the time of this meeting the creamery opened for business. The system adopted the first season was the shallow pan dry setting system. Square box churns were used propelled by horse power. The butter worker was the roller hand worker. The whole outlay on building and machinery and blind horse, did not exceed one thousand dollars.

Stewart obtained quality. His butter won first prize at the St. Louis Exposition in 1874 and first and second prizes in 1875. This encouraged him to make an exhibit at the Centennial Exposition in Philadelphia in 1876 where he won first prize and the gold medal.

Stewart was now operating three or more creameries. He selected a sample of butter for the exposition from each of three creameries, never divulged who had made the prize tub, but he had three medals cast in bronze, duplicates of the gold medal, and presented one to each of the three buttermakers.

Stewart's business partner, A. C. Clark, came to Manchester in 1872 and the following year started a creamery there, the second creamery in the state. Stewart soon started creameries at Sand Spring, Lamont, and Strawberry Point. Henry C. Neiter built a creamery at Walker about 1877 or 1878 and J. G. Cherry, founder of the J. G. Cherry Company, was employed as buttermaker. In 1875 H. D. Sherman built at Monticello the first creamery in Jones County. He erected a line of fifteen creameries known as the "Diamond Creameries." Sherman exhibited butter at the International Fair in New York in 1878 and 1879 and won the sweepstake prize both years.

CO-OPERATIVE CREAMERIES

State Dairy Commissioner R. G. Clark claimed the first co-operative creamery was built in 1877 at Spring Branch, near the John Stewart Creamery. This was later confirmed by Henry Brayton, who had been the buttermaker. He and Mrs. Brayton started housekeeping in rooms above the creamery. Part of the walls of this creamery are still standing. This creamery also has been referred to as the Brayton Creamery, thus indicating that it might have been owned by Brayton.

In 1896 E. C. Bennett, of Oelwein, a well-informed dairyman, made the following statement before the State Agricultural Society:

It may be interesting to know what became of this primitive creamery that won the gold medal in 1876. It did business at the old stand until 1880 when it was replaced by Mr. Brayton (on whose land it stood), and operated by him until 1887, when the patrons organized as a co-operative creamery company and leased the creamery for ninety-nine years.

Sam Shilling, who spent his early years at Manchester and worked for John S. Stewart for one year, claimed the Maynard Creamery to be the first co-operative creamery in the state.

On June 10, 1875, articles of incorporation were filed for "Long Grove Dairymen's Association" at Maynard. Capital stock was \$1,000 issued at \$10 per share, each share to have one vote. The corporation was for the purpose of conducting a cheese business. This creamery was later rented to John Stewart who operated it as a creamery for one year, but since he met with business reverses in 1877 the creamery was closed until April 15, 1878. It was then opened by the farmers as a co-operative creamery with Sam Shilling as buttermaker.

From this early beginning creameries were built at a rapid rate. The following from the ninth annual report (1895) of the state dairy commissioner gives a fair estimate of how rapid this increase was. The commissioners sent a letter to each of the creameries operated in the state "Out of the 774 creameries 580 answers were received, from which the following information:

Creameries built from 1870 to 1875	8
Creameries built from 1875 to 1880	36
Creameries built from 1880 to 1885	41
Creameries built from 1885 to 1890	172
Creameries built from 1890 to 1895	323

This large increase in creamery construction in the nineties was largely due to the activity of the creamery promoter, who was more

interested in collecting money from the farmers than in rendering service to the industry. Several of the creameries that had been started were soon closed. Some of the promoted creameries did not even open for business. It was discovered after the creameries were built that there was not sufficient milk being produced for operating.

In 1899 there were 779 creameries and 188 skimming stations. This was followed by a gradual decrease until it reached the low of 398 creameries in 1919, after which there again was a gradual increase until they numbered 488 in 1940.

GATHERED CREAM SYSTEM

When the creameries were first started, milk was delivered twice daily and set in shallow pans for the cream to rise by gravity. This involved much labor and difficult hauling because of poor roads. In 1877 A. M. Bingham, of Jesup, built a creamery at Spring Creek, near Jesup. Bingham encouraged farmers to skim the milk on the farm and deliver several days' cream at one time. This method, which became known as the gathered cream system, meant poorer quality, since the cream would generally be held on the farm several days. It improved the hauling situation, however, which meant greater inducement for the erection of creameries.

CENTRIFUGAL CREAM SEPARATOR

In 1878 Dr. DeLaval, of Stockholm, Sweden, invented his first power-driven centrifugal cream separator, with a capacity of three hundred pounds of milk per hour. By 1881, when the first DeLaval machines were shipped to America, the capacity had been increased to seven hundred pounds an hour.

Another centrifugal cream separator invented in Denmark appeared at the same time. The first of the Danish separators brought to America was shipped to Canada in April, 1882. The second was brought to Iowa in July, 1882, by Jeppe Slifsgaard who operated a creamery about seven miles from Waterloo. This was the first separator operated in an Iowa creamery.

The introduction of the separator marked a great step forward. It now became possible to collect milk from a comparatively large territory, have it separated at the creamery and the skim milk returned to the farms the same day.

Another improvement essential to the successful operation of a commercial creamery was a satisfactory milk and cream test. Several

tests had been tried but none of them were satisfactory until Professor G. E. Patrick of the Iowa Agricultural College in 1889 invented a test named after him. This test was a year in advance of the Babcock test which later, because of its simplicity, became generally adopted.

CENTRALIZED CREAMERIES

In 1900 the Hanford Hazelwood Cream Company was started in Sioux City, the first large, centralized creamery in the state. At that time Sioux City was surrounded by small whole-milk co-operative creameries making butter of rather irregular quality. The Hanford Hazelwood Cream Company bought the cream from many of those creameries and received it in sweet condition at the central plant. It was manufactured into a uniform, high-quality butter which brought higher prices. The company was able to pay a better price for cream than the small plants.

In 1885 the DeLaval hand separator was introduced in America and by 1890 there were several thousand of them in use. By 1900 use of this machine increased rapidly in Iowa and resulted in various small centralized creameries. Those creameries depended almost entirely on hand-separated cream, much of which was shipped to the creameries by rail.

This cream was generally of inferior quality, but with their superior marketing facilities the centralizers outbid the weaker local creameries and compelled many to discontinue.

The centralizers, in order to obtain business, emphasized volume rather than quality. As a result the quality of Iowa butter deteriorated. The Hanford Hazelwood Company, founded on quality, became a strictly hand-separator creamery in 1904, the largest creamery in the world.

Local creameries did not receive cream by rail nor did they operate cream receiving stations. Because roads at certain times of the year were about impassable, the territory from which local creameries drew cream was limited. After the State Highway Commission was established in 1913, improvement of roads was started. The more progressive local creameries increased in volume, forcing many of the smaller plants out of business. Centralizers, because of poor quality and excessive cost of operating cream receiving stations, were unable to compete with well-organized and efficiently operated local plants. Centralized creameries were making only 20 per cent of the Iowa butter in 1940, compared to 39 per cent made in 1923.

REVIVED INTEREST IN BUTTERMAKING

Buttermaking in Iowa showed little increase for many years. In 1890 Iowa produced seventy-one million pounds of creamery butter. In 1898, 811 creameries produced nearly eighty-eight million pounds and in 1920, 399 creameries produced eighty-nine million pounds. Then came a rapid increase in butter production and a gradual increase in number of creameries until 488 creameries in 1940 produced nearly 245 million pounds of creamery butter.

ICE CREAM INDUSTRY

Ice cream has been used for centuries in Europe as a dessert served in the home of the aristocracy. It was served in the United States as early as 1774. An advertisement of ice cream appeared in a New York paper as early as June 8, 1786.

The first ice cream factory in Iowa was started by Frank D. Hutchinson at Sioux City in 1890. On July 4, he shipped nearly three hundred gallons of ice cream, all frozen by hand power. In 1901 the Hanford Hazelwood Cream Company installed ice cream equipment and employed an ice cream maker who was formerly a pastry cook at a prominent Chicago hotel. The Hazelwood ice cream was extensively advertised, and the Hanford Hazelwood Company was for several years the largest ice cream manufacturer in the state.

In 1907 F. D. Hutchinson started a factory at Cedar Rapids and in 1909 he purchased the McFarland Ice Cream Company in Des Moines, which had been started as a wholesale business in 1902. These three factories were operated as one company until 1926 when the Des Moines plant was sold to C. J. Hutchinson and the Sioux City factory to W. and Ed. Hutchinson. F. D. Hutchinson retained the Cedar Rapids factory which over the state at one time had twenty-five branches, organized from 1920 to 1925. The Hutchinson Ice Cream Company of Des Moines was sold to the Beatrice Creamery Company in 1929, and in 1930 the Hutchinson Ice Cream Company, Cedar Rapids, was sold to the Borden Company.

The Hutchinson brothers, especially Frank, were for many years the leaders in the ice cream industry in the state. Another active leader is P. W. Crowley, who has served the Iowa Ice Cream Manufacturers' Association as secretary since 1919. In 1943, 579 ice cream factories were operated in Iowa.

MARKET MILK

Pioneers brought their cows along when settling on Iowa soil. Town dwellers at first would keep a cow or two to furnish milk for

the family. As towns became larger, family cows gradually disappeared except from homes located in the outskirts. Farmers living nearby started to produce milk for the townspeople. Milk was hauled around in a milk can with a quart measure hanging on the outside of the can, exposed to flies and dust. There was no sanitary standard, for few persons suspected that contaminated milk could in any way endanger the health of people.

The legislature established a State Board of Health of nine persons in 1880: the attorney general, a civil engineer, and seven physicians. This board adopted in 1889 the following standard for milk:

	Percentage
Water (maximum)	86.87
Butterfat (minimum)	3.50
Milk sugar (maximum)	4.35
Salts (maximum)	0.60
Ash (maximum)	0.70
Casein (maximum)	3.98
Total	100

This standard served to prevent skimming and adulteration of the milk, a rather common practice, but it was of no value as a sanitary standard. Later a sanitary standard was introduced by the state dairy commissioner and not by the State Board of Health.

The office of the state dairy commissioner was established in 1886. Through its efforts the legislature adopted the first sanitary standard in 1892. This standard read in part as follows:

If any person or corporation shall sell or exchange, or expose for sale or exchange, deliver or bring to another for domestic use, or to be converted into any product of human food whatsoever, any unclean, impure, unhealthy, adulterated, unwholesome or skimmed milk, or milk from which has been held back what is commonly known as strippings or milk taken from an animal having disease, sickness, ulcers, abscess or running sore, or was taken from an animal fifteen days before, or less than five days after parturition, shall upon conviction thereof be fined not less than twenty-five dollars nor more than one hundred dollars, or be liable in double the amount of damages to the person or persons upon whom such fraud shall be committed. Provided that the provisions of this act shall not apply to skimmed milk when it is sold as such.

The same standard reduced the fat standard in milk to 3 per cent. It also authorized the dairy commissioner to appoint milk inspectors in every city having over ten thousand inhabitants. Every dealer was required to obtain a permit from the state dairy commissioner.

The standard required an adequate force of inspectors. Since the

amount of time city inspectors were able to devote to inspection service was limited, and there was a shortage of state dairy inspectors, the milk inspection was much neglected until 1911 when Dr. O. P. Thompson was appointed state dairy inspector in charge of market milk inspection.

Through the efforts of the principal milk distributors in the state, the state dairy commissioner, the State Board of Health, the State College, and other educational agencies, the market milk industry has made great strides since 1900. Pasteurization, sanitary handling, eradication of tuberculosis from dairy cattle, and the present effort to eliminate the source of undulant fever all tend to produce a market milk of outstanding quality.

CONDENSED AND POWDERED MILK

The condensed milk industry in Iowa has, like the cheese industry, suffered because farmers prefer to keep the skim milk on the farms for stock feeding. The Waverly Condensery was started by R. G. Fraser and Company in 1899. This plant shifted from one owner to another until purchased by the present owners, Carnation Company. The Van Camp Packing Company started a condensery at Perry in 1908. Daily receipts of milk had in the summer of 1910 reached one hundred thousand pounds. The plant was operated by the original owners for only a few years and was listed by the Iowa State Secretary of Agriculture in his annual report of 1943 as a creamery.

The state dairy commissioner's report of 1920 gives the value of the condensed milk produced by the two plants at \$733,521.34. During later years some of the larger city milk plants have condensed part of their surplus milk while the larger creameries installed drying equipment for drying buttermilk. World War II brought about abnormal conditions. The United States Government appealed to the dairy interests to produce great quantities of condensed and powdered milk. Dairy plant operators made an effort to meet that demand and in 1943 seven plants in the state were producing condensed milk and ten plants were producing milk powder. In addition, thirty-nine creameries were drying buttermilk.

MARKETING DAIRY PRODUCTS

Early settlers generally brought cows along to furnish the family with butter and cheese as well as milk. As cattle increased, more butter was produced than was required for home consumption. That created the problem of marketing. Butter intended for marketing would be

shaped into rolls, wrapped with muslin and brought to the grocery store to exchange for groceries. The grocer sold part of it to the townspeople, and the rest to butter packers who would rework it, thus making a somewhat uniform product from the numerous rolls that originally were of various color and flavor. This butter, generally sold under the name "ladle," was naturally of poor quality. Dealers searching for some method to improve the quality devised a process by which the butter was renovated and marketed under the names of "renovated" or "process butter."

This process consisted in melting the butter, allowing the curd and salt to settle and be drawn off. Air was then forced through the molten fat to remove undesirable odors. Milk was mixed with the fat, and the mixture was sprayed into ice water to solidify in granular form. Sour milk (starter) was generally added to the granules in sufficient amount to churn the mixture and the further treatment could correspond to that of natural butter.

This butter was frequently sold for creamery butter until Congress passed the act of May 9, 1902, requiring that it be properly labeled. Iowa, with thirteen process plants, led the states in processing. The Iowa Pure Butter Company, of Keokuk, was possibly the first to renovate butter in Iowa with the J. L. Humphrey Company, of Hume-ston, a close second.

Early settlers were in particular need of marketing facilities. The state was almost without roads. Another handicap to outside marketing was the lack of railroads. Shipments had to be made by boats. Such shipments of produce were made as early as 1844. It was evident that butter shipped to eastern markets by boat and without refrigeration would not arrive in the best condition. Western butter was therefore considered to be of much inferior quality and there was no demand for it except when the eastern states were unable to supply the amount needed. This prejudice continued even after shipments were made by rail. The injustice in this discrimination was emphasized by Halstead Fitch, a well-known New York commission merchant, in a communication to the Iowa Dairy Association in 1889:

The phenomenal strides made, not only in the quantity but in the quality of western butter, vastly greater than in the East, has been achieved against and in spite of strong opposition. The writer remembers well the strong prejudice that existed against western butter a few years ago in the eastern markets. If the butter came from the extreme western township of New York or Pennsylvania, all right; but if it came from Ohio, twenty miles farther west, it was not to be compared with it. At that time nearly all the finest butter came to market in return pails, and the writer conceived the idea of sending these return pails to Ohio to be filled

by some of the finest dairies and creameries of the Western Reserve. A shipment of creamery butter came in from that state, part in tubs and part in New York labeled return pails, but all of precisely the same butter. The tubs were shown to a fastidious grocer uptown. He noticed they were Ohio made and indignantly remarked: "You ought to know that I cannot use western butter for my trade, I want nothing but the finest state." He was urged to lay aside his prejudices and judge the butter on its merits. He tasted it, but reiterated his assertion that he could not use it under any circumstances. One of the pails was then shown him, precisely the same creamery and the same invoice. He smacked his lips over it, remarking: "That is the kind of butter I want; I could tell state butter with my eyes shut." The butter was sold—so was the customer, for he paid 3 cents more a pound for it than he could have bought the tubs for.

IOWA BUTTER KNOWN FOR QUALITY

Iowa first became recognized as a producer of fine butter in 1876, when John Stewart won the sweepstakes prize for his butter exhibited at the Centennial Exposition in Philadelphia. This was worth millions of dollars to Iowa milk producers, since Iowa butter became known as the finest butter sold in the eastern markets. Eastern buyers came to Iowa willing to buy butter at a premium. As the creameries become more numerous throughout the state a marked improvement in quality followed and Iowa butter continued to enjoy an outstanding reputation in the eastern markets. It was generally marketed through the commission houses, usually at 5 per cent commission. Little effort was made to market direct until after the establishment of the centralized creameries.

IOWA STATE BRAND BUTTER

In 1900 a special brand designating quality was adopted for Danish butter. In 1904 the Netherland Government authorized the butter control stations of that country to use a similar brand. Comparable steps were taken in New Zealand, Australia, and other countries. In 1915 a butter trademark was established in Iowa. Control was left with an executive committee composed of the president of the Iowa State Dairy Association, the president of the Iowa State Buttermakers' Association, the dean of the Division of Agriculture of the Iowa State College, the professor of dairying of the same institution, and the state dairy and food commissioner. Permission for the use of this brand was granted to creameries producing butter scoring 93 points or better and manufactured in a creamery scoring 85 or higher in accordance with the state score card. The first creamery qualified to use this brand was the Strawberry Point Farmers' Creamery which in May, 1916, obtained License No. 1.

Ever since the establishment of the Iowa State Brand for butter,

consideration had been given to the organization for marketing Iowa State Brand butter. This did not become a reality until April 11, 1927, when such an organization was started with headquarters at Davenport, with \$1,300 paid-up capital stock.

The original plan for this association was to establish a market for Iowa State Brand butter in the Tri-Cities and after this had been accomplished to start a more general advertising campaign. H. A. Harmison, a graduate of Iowa State College and a member of the Dairy Industry Extension staff, was selected as manager. He soon discovered that the plan would take a long time before a sufficient outlet would be developed for the total amount of State Brand butter produced, so the plan was changed. On Thanksgiving Day, 1927, the entire equipment was brought to a Mason City headquarters in the E. B. Higley Cold Storage plant. A central print room for the creameries in north-central Iowa was set up, and a campaign was started to sell butter throughout the United States. Sales for the first year at Mason City amounted to about one and one-half million dollars with a profit of over twenty thousand dollars. This was all accomplished on a paid-up capital of \$1,300.

Harmison left the organization in 1931 and Roy O. Storvick followed him as manager. Storvick had graduated from Iowa State College with an advanced degree in Dairy Industry and had served for some years as a Dairy Industry extension specialist. During his management, sales increased from eight million pounds of butter in 1931 to twenty-three million pounds in 1943. The association was then serving eighty-nine creameries and had a net operating profit of \$129,818. In 1932 a supplies and equipment department was started, and a cheese sales department was added in 1934. A. L. Ronneberg, a graduate from the University of Minnesota, took charge after the resignation of Storvick in 1943.

A smaller marketing association was organized by southern Iowa creameries in 1934 with headquarters at Keosauqua. C. M. Reeve, manager of the Keosauqua Creamery, also served as manager of the marketing association. This association was merged with the Iowa State Brand Creameries in 1943.

Small dairies of the early settlers were of great importance to the welfare of pioneers, for they furnished them with the most important food of their diet and with ready cash with which to pay current expenses. This often was enough to retire farm mortgages. Farm dairies gradually developed into factories producing food products to be marketed throughout the world. The year 1944 brought to the

Iowa farmers an income of more than \$141,000,000. The 6.7 billion pounds of milk produced were converted into products as follows:

	Percentage
Creamery butter	72.5
Farm butter	1.4
Market milk and sweet cream	15.3
Ice cream	1.5
Cheese	1.5
Used on farms	7.8
Total	100

Iowa, due to its distance from the large cities and its high production of beef and pork, has for the past forty years placed greatest emphasis on the manufacture of butter, and has for several years occupied second place as a butter producer. Iowa manufactured during the year 1944 nearly 212 million pounds of creamery butter or over 14 per cent of the product made in the United States.

The family-sized farm, though a successful and typical unit of production in Iowa, in many situations proved too small for economy in selling products or in buying raw materials to be used in production.

20. The Marketing Phase of Iowa Farm Living

SAM H. THOMPSON, *Economics*

AS THE VIRGIN SOD WAS BROKEN, IOWA GRAIN PRODUCTION increased rapidly. In 1849 the state grew only about one and one-half million bushels each of wheat and oats, and less than nine million bushels of corn. Ten years later Iowa farmers produced five times as much wheat and corn and four times as much oats. Iowa had climbed in a single decade from nineteenth place to seventh place in corn production and from fifteenth to eighth place in production of wheat. Farmers had products to market.

Older settlers often sold feed or livestock to newer arrivals in their own neighborhood. Since there were no railroads, surplus grains had to be hauled overland in wagons or moved by waterways. Large amounts of grains were fed to cattle, hogs, and sheep, and these animals were often driven to market on foot.

GRAIN MARKETING

The coming of the railroads made it possible for the Iowa farmer to market his grain without having to convert it into livestock or meat. As rails reached one town after another, elevators were erected to collect, store, and load the grain. Railroad companies, terminal commission companies, and local capitalists built the elevators. Where they did not, the farmers did. In some cases there was dissatisfaction with established private agencies.

The first farmers' elevator organized at Blairstown in 1867-68 ran only two years. With the coming to Iowa of the Grange in 1869 the movement got under way in earnest. The first incorporated elevator began at Brooklyn in 1869. By 1877, forty-two had been organized. Half of these failed by their third year, and none were in operation

after 1883. For a time, line and other private elevators again handled all the local grain trade.

The second period of the farmers' elevator movement started in 1886 when two elevators began operations. The farmers had picked up the idea of strictly commercial organizations for improving farm marketing. At every turn they met with determined opposition from existing private companies, and for fifteen years success hung in the balance. By 1903 fifty-two elevators had been organized and thirty of them were still in operation. One of the chief factors in their success was the protection clause, commonly called the penalty clause by the enemies of co-operation, requiring members to pay a handling charge to the co-operative elevator if they sold grain to a competitor. In this way a member guaranteed the maintenance of his agency whose aim was to handle grain at minimum cost. The protection or maintenance clause was first adopted in 1890 as a bylaw by the Farmers' Co-operative Society organized at Rockwell in 1889. This is generally recognized as the oldest survivor which has remained in continuous operation as a farmers' elevator. Most other farmers' elevators speedily adopted the maintenance clause bylaw.

Alarmed at the foothold achieved by farmers' elevators, local independents and line elevators of Iowa attempted to destroy them by cutting them off from markets. The secretary of the state organization of private elevators informed grain commission firms at Chicago in 1904 that they would lose the business of the "regular" country grain shippers if they continued to handle farmer elevator grain from elevators using the maintenance clause. As a result, commission firms refused to accept co-operative shipments and their grain stood on track at Chicago or piled up in Iowa elevators until two firms defied the association of private dealers, thus ending the boycott.

As a result of the boycott seventeen farmers' elevators met at Rockwell in November, 1904, and formed the Farmers' Grain Dealers' Association of Iowa. Aggressive work by leaders of the group led to rapid and steady growth of farmers' elevators. Elevators were assisted in legal details of organization and commercial phases of their work, weighing and grading practices at terminals were improved, and a fairly good state co-operative law was passed in 1915.

From thirty farmers' elevators in 1904, numbers in operation increased to 244 in 1909, 345 in 1914, and 516 in 1922, the peak year. In fifty-five years beginning with 1867, 636 farmers' elevators had been organized and in 1922 more than four-fifths were still operating. Overexpansion, collapse of grain prices at the end of World War I,

inadequate volume, and inefficient management were among the factors that reduced numbers of elevators to 346 in 1938. Meanwhile, by 1931 farmers' elevators had lost many of their original members and much of their co-operative character. Following 1931, membership and financial and co-operative structures were being rebuilt. By 1938, two-thirds of the elevators were organized under one of the three co-operative laws and by 1939 fifty-seven elevators were incorporated under the 1935 co-operative law.

In 1937 farmers sold 58 per cent of their grain through farmers' elevators. One farmer in four was a member and two out of three patronized them.

Collapse of grain prices stimulated various attempts to provide co-operative facilities at terminal markets or on a nation-wide scale. The first of these, United States Grain Growers, Inc., organized in 1921, grew out of plans developed by a committee of seventeen, appointed by an Iowan, J. R. Howard, president of the American Farm Bureau Federation. It operated a sales agency at Minneapolis for a short time. In 1924 a group of farmers' elevators in Iowa and Illinois organized the Rural Grain Company which began operations in 1926 but was forced into receivership four years later.

During 1932, Iowa members of the defunct Rural Grain Company organized the Iowa Co-operative Grain Company. In 1934 this organization joined the Farmers' National Grain Corporation, sponsored by the Federal Farm Board, and continued to channel in grain for it until 1937 when Farmers' National Grain Corporation went into receivership. The Iowa organization ceased operations in 1938. In 1943 the state Farmers' Grain Dealers' Association inaugurated brokerage service at Fort Dodge, and since 1945 has operated a terminal elevator at Des Moines. Two other federations serving Iowa farmers' elevators are Farmers' Elevator Mutual Insurance Association, organized in 1909, and the Farmers' Elevator Service Company, dating from 1926. The latter operates on a brokerage basis and purchases feeds, fencing, coal, and other merchandise for member associations. In 1946 it acquired a feed plant at Des Moines.

LIVESTOCK MARKETING

Outside of Iowa, Cincinnati so dominated the livestock and packing trade from 1830 to 1860 that it was called "Porkopolis." Its pre-eminence resulted from its nearness to livestock-producing areas and its location on the Ohio River which served as a highway for transport of livestock and packing house products and also carried off wastes.

Consolidation of trading at a single public market, the Union Stock Yards, on Christmas 1865, marks the beginning of the importance of Chicago as a livestock marketing and packing center. Other public stockyards were begun at Kansas City in 1871 and Omaha in 1884.

Mississippi River firms had almost exclusive handling of the Iowa packing industry until the early seventies. However, State Agricultural Society reports note that in 1858, twenty cattle were driven from Kosuth County to Chicago and four thousand cattle were slaughtered for export or driven from Jackson County. But hogs could not readily be driven such distances. In the winter some were slaughtered on the farm and others went to merchants along the Mississippi who forwarded products to St. Louis and New Orleans by boat. In the early forties small packing plant were in operation at Keokuk, Burlington, Muscatine, Fort Madison, and Davenport. More adequate plants were developed in the fifties and until 1874, river packers processed more than half the hogs slaughtered by packers in Iowa.

PACKING HOUSES

Pork packing at Davenport was begun in 1842 on a small scale by provision merchants. The real beginning, however, should be credited to four local butchers who in the early sixties began pork packing operations in connection with their meat markets. Eventually pork packing became their major interest. By the mid-nineties only Henry Kohrs and one other were operating and in 1907 the Kohrs Packing Company became the sole operator at Davenport. The Tri-City Packing Company promoted at Davenport in 1893 did not become a going concern.

Packing operations were carried on at Ottumwa from 1860 to 1863 with fair success by B. Ladd and Company. Later the plant declined and was leased in 1877 to John Morrell and Company, a seasoned English firm with half a century of experience. In 1878 Thomas D. Foster, Morrell representative, concluded that Ottumwa was a satisfactory site for a permanent location and under his leadership a new plant was constructed.

Pork packing was started in 1871 at Cedar Rapids in an old icehouse by T. M. Sinclair, whose experience in the field dated back to 1832 in Belfast, Ireland. In 1872 a modern plant was built. By 1878 Cedar Rapids claimed the fourth largest packing plant in the world.

At Des Moines pork packing, mainly for the local market, was carried on in a small way before and during the Civil War. For twenty-four years following 1870 two plants handled by various

proprietors were fairly active. In 1894 Liverpool capitalists, then owners of both, suspended operations.

The importance of Waterloo as a packing center began with the arrival of E. F. Rath, Jr., and John W. Rath in 1891. Members of the Rath family had been packers since the early fifties at Dubuque but they moved when their plant was destroyed by fire.

Packing began at Mason City in 1895 and the enterprise was purchased in 1899 by Jacob E. Decker and son, Jay, whose family had been in the business in Europe since 1777.

Brittain and Company began packing pork for Liverpool at Marshalltown in 1882 and by the turn of the century Marshalltown was in fourth place among Iowa packing centers.

The first of the national packers to locate at Sioux City was Cudahy in 1892. Even before the opening of public stockyards there five years earlier, James E. Booge, a merchant who started pork packing in 1870, had attained some success.

For limited periods at more than fifty other Iowa towns and cities there have been small operations in packing, particularly while the country was new and inadequate transportation and simple processing operations prevailed. For the ten years ending in 1900, annual slaughter of hogs in Iowa averaged 1.5 million head. Almost one-fifth of this was at the relatively new Sioux City market.

CONCENTRATION YARDS

In 1896 concentration yards for hogs were opened at Boone and Des Moines. Most of the hogs purchased at these stations came in by rail in single-deck cars on a through rate from point of origin. Sorted, graded, fed, and watered, they were then loaded into double-deck cars for greater economy in transportation and sold to best advantage. In 1904 the J. P. Squires Corporation, with eastern slaughter facilities, established concentration yards at Burlington and Valley Junction (now West Des Moines). The following year it opened yards at Muscatine and in 1913 at Clinton. The first interior packer to open a concentration yard in Iowa was T. M. Sinclair at Perry in 1914. Cudahy Brothers established concentration yards in 1916 at Creston and in 1917 at Tama. Squires opened a concentration yard at McGregor in 1917. Thus in the first two decades of the 1900's seven additional concentration yards were established in Iowa. In 1920 packing houses in Iowa (excluding Sioux City) slaughtered more than 1.8 million hogs, a gain of 40 per cent over 1900.

During World War I, contracts for meat to be shipped overseas

were allocated principally to the five national packers. As a result, interior packers supplied a larger part of domestic needs. They were helped by the increase of hog production in Iowa and the northwest Corn Belt, and by development of truck transportation which increased the accessibility of live hogs. Freight rates which made it cheaper to forward pork products than live hogs also assisted. By 1930 there were eight interior Iowa packing plants operating, only one of them—Swift at Des Moines—by a national packer. Wilson acquired the Sinclair plant at Cedar Rapids in 1930 and Armour the Decker plant at Mason City in 1935. Swift acquired plants at Marshalltown and Perry in the thirties. Concentration yards or hog-buying stations were operating in Iowa at 43 points in 1940 and there were 1,247 local dealers as well as 22 interior packing plants. In 1940 more than half the hogs, sheep, and calves and about 30 per cent of the cattle marketed from Iowa farms went to packing plants within the state.

One or more community livestock auction sales barns had been operating in Iowa since 1904. They increased rapidly from 25 in 1929, to 195 by 1936. Stimulated by abnormal distribution of feed resulting from drouth, they seemed favorably located for handling locally-produced stocker, feeder, and breeding animals. A few specialized in distribution of range cattle. Slaughter animals were handled by most auctions to a limited extent only.

Co-operatives for shipping of livestock began in 1904 at Postville. Although as late as 1916 there were only fifty-seven active associations, four years later 682 co-operatives were serving one hundred thousand farmers and handling about one-fourth of the livestock from Iowa farms. The local co-operatives federated in 1920 to form a state service agency, the Iowa Co-operative Livestock Shippers, later reincorporated as the Iowa Co-operative Livestock Marketing Associations. In 1924 there were 697 local associations but by 1937 the active associations declined to 173, handling about 10 per cent of livestock shipments. Some associations ceased because they were not needed. Inadequate objectives, lack of dependable membership, and failure to adjust to changing economic needs of farmers were factors also. Expansion of interior packing, improved roads, and flexible transportation influenced many local livestock co-operatives to become merchandising or marketing associations. In some associations adjustment was too little and too late. Some acquiring a substantial volume of business continued to serve. A federation of local associations, the North Iowa Co-operative Livestock Marketing Association, incorporated at Mason City in 1930, sold hogs co-operatively for two years.

SALES AGENCIES

Iowa livestock growers did not participate in the earliest attempt to establish sales agencies at Midwest markets, begun in the early seventies by the Missouri State Grange. Nor did they take part in 1889 in organizing the American Livestock Commission Company sponsored by the Kansas State Grange and State Farmers' Alliances of Kansas, Nebraska, and Missouri. However, Iowans did assist in organizing the Co-operative Livestock Commission Company in 1906 as a protest to increased commission rates at Chicago, Kansas City, and St. Joseph. One of the sponsoring organizations was the Corn Belt Meat Producers' Association, originally organized in Iowa in 1903. The Farmers' Union Livestock Commission of Omaha began operations in April, 1917, and paid a patronage dividend of 30 per cent the first year. At the end of one and a half years the Farmers' Union had outstripped all but one of the fifty firms in numbers handled. Within two and a half years livestock-selling agencies had been established by Farmers' Union organizations at five western markets, including Sioux City.

In October, 1920, the American Farm Bureau held a conference on livestock marketing which resulted in the appointment of a committee of fifteen and the emergence in 1921 of a plan for organizing terminal commission organizations and related agencies. Competing sales agencies were set up at East St. Louis by the Missouri Farmers' Association and the Committee of Fifteen. The former opened the Farmers' Livestock Commission Company in November, 1921, and the latter opened the Producers' Livestock Commission Association in January, 1922. Both rather quickly reached positions of leadership. The Producer group opened several more commission agencies during the next two years, including Chicago in 1922 and Sioux City in 1924. In 1930, a State Farm Bureau-controlled marketing corporation was organized in Iowa to sell hogs, as a unit developed under Federal Farm Board plans. Discontinuing this type of service in 1934, it served as a procurement agency for feeder cattle and sheep until it ceased operations in 1938. At Sioux City a third farmers' selling agency was established in 1933 by the Progressive Farmers' Union.

Today we find a reduced number of local co-operatives handling livestock. The number of active auctions is somewhat less than in 1936. The future of local livestock co-operatives rests on relative gains from co-operative disposal as compared to other methods. There are three farmer-owned selling agencies at Sioux City and two each at Omaha, Chicago, St. Joseph, and Kansas City.

Operating in Iowa in 1940 were 506 locker plants, with 98 additional branches. Iowa pioneered in the service type of locker. Meat is chilled at the plant, cut into consumer-size packages, wrapped, frozen in a sharp freezer, and stored in a locker.

So-called co-operative livestock packing enterprises in Iowa were mainly stock selling schemes and had little to do with co-operation or packing. In 1915 stock was sold in Brittain's Marshalltown plant to three hundred persons who soon found that the promoter was receiving \$78,000 of the \$170,000 being paid for the plant, and in addition was getting 12.5 per cent commission on stock sales. Between 1917 and 1925 Iowans invested about fifteen million dollars in four packing house projects, two of which never passed the paper stage and one of which operated only three months. Twelve hundred persons—including one thousand farmers—bought over three million dollars of stock in the Associated Packing Company of Des Moines. In ordering dissolution of this concern the judge said:

The evidence . . . has convinced me . . . as showing . . . a stupendous fraud planned in cold blood . . . a scheme concocted not for the purpose of building a packing plant . . . but . . . of selling stock and getting . . . money out of stock sales.

Stock sales in the Midland Packing Company, incorporated at Sioux City in 1918, reportedly totaled over eight million dollars, salesmen being paid 30 per cent. The Corn Belt Packing Company at Dubuque, in which 1,857 invested nearly two million dollars, brought in 1922 only \$150,000 at sheriff's sale, of which \$45,155 went for delinquent taxes. Investors in the Muscatine Packing Company, later renamed Farmers' Mutual Packing Company, were said to have lost three hundred thousand dollars.

Transportation from the days of the river flatboat was always a key factor in Iowa marketing problems. Iowa had indeed set a precedent for the nation when the United States Supreme Court upheld the Iowa Grange Law fixing maximum rates railroads could charge for freight and passengers. In the early twenties, livestock transportation began to shift from rail to truck. Only 6 per cent of Iowa hogs went to market by truck in 1920; ten years later 31 per cent were so transported. And at Sioux City in 1931, more than 85 per cent of the livestock received from Iowa arrived by truck. Improved roads put four times as many trucks on the road as there had been ten years earlier. Increase in truck transport has resulted in abandonment of some railroad lines. By 1940 nearly all of Iowa's livestock was moved from the farm by truck, mainly by common carriers. Farmers themselves trucked to market only 5 per cent of their cattle and sheep, 12

per cent of their hogs, and 31 per cent of their veal calves. For grain, dairy products, and poultry the bulk of hauling from the farm also is done by truck, chiefly by common carriers although much milk and cream is hauled by contract haulers.

During World War II necessity for conserving trucks and tires tended to limit somewhat the distances animals were hauled. Ceiling prices on hogs tended to produce the same result.

POULTRY AND EGG MARKETING

Except for turkey raisers, Iowa has few producers of poultry on a commercial scale. Stores and produce plants have long been important outlets for poultry products. Co-operative marketing of poultry never has been important in Iowa. Co-operatives specializing in other types of farm products handled some poultry as early as 1910. In 1938, fifty-nine co-operatives were handling poultry and eggs. A regional organization, Iowa Poultry Producers' Marketing Association, controlled by the state Farm Bureau, processed poultry and handled eggs at Ottumwa from fourteen county-buying branches for a short time in the thirties.

WOOL MARKETING

During most of its history as a state Iowa wool has been handled by private dealers. In its twenty-fifth anniversary year, 1943, the Iowa Sheep and Wool Growers' Association sold co-operatively for its members over 2,200,000 pounds of wool, about one-fourth of total production in the state.

OTHER FARM PRODUCTS

Other products marketed in quantity from some Iowa communities include fruits, vegetables, and honey. In addition to private dealers there were in 1937 four fruit and vegetable co-operatives, two canning factories and one regional honey co-operative.

The marketing of dairy products already has been described in Chapter 19.

FARM SUPPLIES

In their role as a producer of foodstuffs, farmers use large quantities of raw materials and equipment. During the early days in Iowa, private merchants were exclusive suppliers and still continue to furnish the bulk of farm supplies.

Through 940 local and regional co-operatives, Iowa farmers in 1937 sold to themselves twenty-three million dollars' worth of farm

supplies. In order of their importance these supplies were petroleum, lumber, fencing, hardware, feeds, seeds, and coal. Farmers' elevators led in importance, selling at retail more than half the co-operatively handled farm supplies. Petroleum co-operatives rank second. General merchandise co-operatives, co-operative creameries, and livestock marketing co-operatives in the order named come next in dollar volume of supply sales.

Early efforts of the Grange and Farmers' Alliance were expended to obtain lower prices and lower freight on farm supplies. From the beginning, farmers' elevators were active in purchase of farm supplies for members. Farmers' lumber companies started in the nineties. General merchandise co-operatives were established during and after World War I, mostly in 1919 and 1920. In 1936-37, co-operatives handling supplies included 300 elevators, 80 petroleum co-operatives, 180 creameries, 21 livestock co-operatives, 18 lumber co-operatives, 32 general merchandise co-operatives, and 20 others. In 1938 the Farmers' Elevator Service Company on a brokerage basis supplied to its 350 member elevators about one-tenth of the supplies sold by them at retail.

Petroleum co-operatives in Iowa began in 1923. Organization went forward rapidly in the last half of the twenties and early thirties. In spite of a slight decline since 1935, the peak year, there were eighty-six in operation in 1937 with thirty thousand members. During 1938 over three-fifths of the gasoline co-operatively sold in Iowa was delivered by three wholesale organizations: Farm Bureau Service Company, Co-operative Service Company of Waterloo, and Consumers' Co-operative Association of North Kansas City.

MUTUAL FIRE INSURANCE

Local farmers' mutual insurance associations for protecting farm property developed early in Iowa. The first to organize was the Swedish Mutual Insurance Association in Jefferson County in 1865. A second was organized in Clayton County in 1866, and a third in Johnson County that same year. Three more local mutuals were organized in 1867. A general insurance act passed by the General Assembly in 1868 permitted any number of persons not exceeding two hundred to organize "self insurance companies for loss by fire." Two years later the limit was raised to seven hundred and in 1874 to two thousand. In 1900 there were 130 county mutuals. Twenty-nine have been established since the turn of the century. They have been characterized by marked stability, effectiveness, and economy. There were 154 county

mutual associations serving Iowa in 1944 and nine federated insurance mutuals. Fire and lightning risks in force at the close of 1944 exceeded one and one-half billion dollars.

MUTUAL TELEPHONES

In the late nineties farmers became highly interested in telephones and in the next few years built many community lines. Ten or fifteen neighbors, usually as an unincorporated group, would jointly construct a line and furnish their own telephones. Usually several lines converged at a nearby city or village and further co-operative action in paying a switchboard fee made other community groups accessible. Construction of lines often did not exceed twenty to thirty dollars a mile for first cost. There are still more than 3,700 unincorporated community lines in Iowa. Thus many Iowa farmers through the technique of co-operative effort provided themselves with telephone service long before it could have been obtained by an alternative method. In recent years there has been a trend to reorganize the separate community lines and the local switchboard into a single business unit, under the 1935 co-operative law. Small farm lines often failed to make suitable provision for maintenance and depreciation reserves and many suffered later. Larger organizations tend to systematize maintenance of lines, poles, and equipment.

RURAL ELECTRIC SERVICE

Although a few communities did pioneer work a good many years ago, the development of rural electrification in Iowa for the most part came about in the last decade of Iowa's first hundred years. In 1944 there were fifty-one local electric co-operatives with twenty-four thousand miles of line serving about sixty thousand members. More than 90 per cent of the electrified farms have radios, irons, and washing machines; half of them have electric refrigerators. Local co-operatives federated to form the Iowa Rural Electric Co-operative Association to assist locals in legal, legislative and other problems.

OTHER SERVICES

Iowa farmers also are interested in other service co-operatives such as dairy herd-improvement associations, farm business associations, banks for co-operatives, and national farm loan associations.

GOVERNMENT AND MARKETING

Several congressional acts have a specific bearing on marketing of farm products. One of the first was the Twenty-Eight Hour Law

originally passed in 1873 but modified in 1906. This provided for unloading of livestock in transit for rest, water, and feeding after twenty-eight hours' confinement. By a congressional act of 1890 federal inspection was provided for live cattle, hogs, and sheep for export. Extended to meats and to animals moving in interstate commerce the following year, it was made more thorough by further legislation in 1906.

By congressional enactment, rural free delivery of mail had become general in the early 1900's and parcel post was introduced in 1912.

In March, 1913, Congress authorized an Office of Markets in the United States Department of Agriculture "to acquire and diffuse among the people of the United States useful information on subjects connected with the marketing and distribution of farm products." In its first year of operation the Office of Markets established standard cotton grades. In 1914 the Co-operative Extension Act passed by Congress provided for close co-operation between land-grant colleges and the United States Department of Agriculture. Establishment of research in marketing and of federal provision for extension services had been recommended by the Country Life Commission in its 1909 report.

Market news about fruits and vegetables was begun by the Office of Markets in 1915. In 1916 a similar service was inaugurated for livestock. The same year the United States Grain Standards Act was passed and official standards announced for corn. Market news service was then extended to include grain, hay, seeds, and dairy and poultry products. Market news, first transmitted from station WOI at Iowa State College in 1921, was received by wireless for three years and by commercial news dispatches for two years before the coming of the leased wire in 1926. In 1928 the leased wire was extended to Sioux City. By 1938 about three farms out of four reported a radio receiving set.

The Packers and Stockyards Act of 1921 provides for government supervision of meat packers, of stockyards, commission men, and yard traders. In 1922 the Capper-Volstead Act recognized the right of producers to organize co-operatively, and, for co-operatives conducting lawful business, removed the threat of prosecution under federal anti-trust laws. A division of co-operative marketing in the Bureau of Agricultural Economics was authorized by Congress in 1926. By executive order of the President this division was attached to the Federal Farm Board in 1929 and later became part of the Co-operative Division of the Farm Credit Administration.

As early as 1859 the Iowa State Agricultural Society indicated the

need of Iowa farmers for timely agricultural statistics. This need was in part supplied by market news programs and earlier efforts of the Bureau of Statistics of the United States Department of Agriculture. It was supplemented in 1923 by "outlook" work of the United States Department of Agriculture in which research and extension joined to determine and inform individual farmers of profitable readjustments in the extent and nature of their farm enterprises.

The Federal Farm Marketing Act, passed in 1929 for the purpose of stabilizing prices of farm products and achieving equality for agriculture, found it impossible to achieve those objectives.

ECONOMIC CO-OPERATION IN FARM MARKETING

In the first hundred years of Iowa agriculture many farmers had discovered that the family-sized farm, though often an effective unit of production, is in many situations too small for economy in selling products or in buying raw materials to be used in production. Co-operation, while by no means universally applied and never a cure-all, has become an essential tool enabling the farmer and his family to keep pace with commercial organization.

Co-operative practice in Iowa long preceded specific legislation authorizing co-operatives. Nearly half a century elapsed from the organization of the first farmers' elevator in Blainstown to the enactment of the first co-operative law in Iowa in 1915 which provided for financing by issuance of stock. Fundamentally, co-operation provides for a democratically-controlled association in which members serve themselves at cost through their co-operative. When incorporated, the early co-operatives used the general corporation law. In 1896, however, the legislature amended the general corporation law to exempt "mutual co-operative creamery associations" from payment of incorporation fees. In 1921 a nonstock co-operative law was also enacted in whose membership only producers of farm products could participate. The membership certificate became void upon the death of the member or upon his ceasing to be a producer of the specified product. The 1935 co-operative law, which superseded the two earlier ones for new co-operatives, provided for issuance of a single share of voting stock or of a membership certificate. Membership is limited to producers of products marketed by the co-operative or users of the supplies it handles. Financing, which is separated from membership, may be by loans from members, sale of preferred stock, or other methods. Both membership and finances revolve. Farmers who use the organization gradually become its owners as dividends on patronage are credited to each, and patronage dividends are paid in the order of their priority.

The early settler furnished the energy for production under hand methods. Now the farmer directs machine labor, and boosts production accordingly.

21. The Role of Machinery in Iowa Farming

J. B. DAVIDSON, *Agricultural Engineering*

THE COVERED WAGONS THAT FOLLOWED THE GRASSY trails from the East into the Territory of Iowa carried precious cargoes. Besides food, clothing, and shelter that were to last until the soil could be made to produce, they also brought the basic tools of husbandry by means of which production could be started. The simple plows, hoes, scythes, cradles, flails, and axes, together with seeds for the various crops to be grown on the rich soil, represented the basic elements of the agriculture which was to make Iowa the leading agricultural state of the Union.

IMPLEMENTS

Farm implements used in Iowa in 1846 were for the most part simple ones. The plow tied to the outside of the settler's wagon was his most highly-developed implement. With such simple tools it has

TABLE 10
LABOR REQUIREMENTS FOR PRODUCTION OF ONE ACRE OF CORN—HAND METHODS, 1855
(Yield About 40 bushels*)

Operation	Equipment Used	Man Hours Labor
Plowing.....	Walking plow	5.
Harrowing.....	Harrow	1.2
Marking rows.....	Shovel plow	2.5
Planting.....	Bucket	1.2
Covering seed.....	Hoe	2.5
Harrowing.....	Harrow	1.2
Cultivating.....	Shovel plow	10.
Husking and hauling.....	Pegs and wagon	10.
Total.....		33.6

* *Power and Machinery in Agriculture*, U.S.D.A., Misc. Pub. 157, 1933.

been estimated that as late as 1855, it took a farmer thirty-three hours to grow one acre of corn. Today, using modern machines, the Iowa farmer can grow and harvest the same acre of corn in less than four hours (Tables 10 and 11).

The revolution in farming methods caused by the adoption of power-driven machinery has taken place within the one hundred years

TABLE 11
LABOR REQUIREMENTS FOR PRODUCTION OF ONE ACRE OF
CORN—MACHINE METHODS, 1940
(Yield 60 bushels*†)

Operation	Equipment Used	Man Hours Labor
Breaking stalks.....	30-foot harrow	0.08
Plow.....	two 16-inch plows	.88
Disking and harrowing.....	8-foot disk and 10-foot spike tooth harrow	.34
Planting.....	4-row planter	.25
Cultivation.....	2-row, 3 cultivations	1.22
Picking.....	2-row picker	.83
	servicing equipment	.36
Total.....		3.96

* *Machinery for Growing Corn*, U.S.D.A., Cir. 592, 1940.

† *Mechanizing the Corn Harvest*, U.S.D.A., Farm Bul. 1816, 1938.

of Iowa's history. Not until 1850, four years after Iowa became a state, did the general movement begin to substitute machines for hand labor of the farm. The period from 1850 until World War I saw the replacement of simple hand tools by horse-drawn machines. As machines became larger and more complex, more and more horses were needed to pull them, and breeders began to produce heavier types of horses. Eventually, however, a limit was reached. Dependence on horse power limited both the size of the machines and the speed with which farm operations could be performed. With the invention of the gasoline tractor, these limits were broken down. Machinery, and the farmer, entered into a new phase of history.

Iowa's flat and fertile acres have so well adapted its farms to the use of machinery that today Iowa is the most extensive user of farm machinery in the nation. Its farmers have invested in farm machinery nearly one and a half times as much as farmers of any other state.

PLOWS

The prairie sod was so thick and tough that ordinary plows could not break it, and for a time it seemed that the riches of the soil were locked up. It took a plow with a long, sloping moldboard to do the

job. A thin, sharp share for cutting roots was welded to a low, long landside and attached to a beam by a combination wood and steel standard. The furrow was turned by a series of rods attached to the share, but curved in such a manner that the furrow slice could be slowly turned without breaking. A writer of the period described the machine thus:

It is . . . like other plows but much larger, being 10 feet long and cutting a furrow some 22 to 24 inches in width. The fore-end of the beam rests upon an axle, with wheels, one of which runs in the furrow and gauges the width, acting like the wheel of the locomotive upon the rail. A level is attached to the fore-end of the beam, running back to the handles, which regulates the depth of furrow and throws the plow out when desired. When the plow is once set in, it needs no further attention in good prairie, as it runs alone, and the driver has only to attend to his team, which consists of some five yoke of oxen. . . It is considered best to break the ground as shallow as possible . . . the thinner the sod, the sooner it will rot. Often the farmer sends his boys to drop corn along every third or fourth furrow and corn is thus produced, with no further care, yielding 30 bushels to the acre. . . The next season the sod is well-rotted and the ground in prime order for wheat. In the meantime the immigrant incloses his fields . . . and erects his dwelling.

Since few farmers had breaking plows or the animals to draw them, the job was performed by contractors who charged about \$2.25 an acre.

After the prairie was broken, farmers used to the iron plow of the East had trouble in Iowa's black soils. Farmers in Illinois had learned that a cast iron plow such as was used in the eastern states would not scour in the black soils of the Midwest. The manufacture of steel plows which would scour had been started in a small way as early as 1837 by John Deere and others. Such plows were made the principal product of a factory established by Deere in 1847 at Moline, Illinois, across the Mississippi River from Davenport. The location was intended to be a strategic one for supplying plows to the newly-settled Iowa farmers.

Cyrus Hall McCormick made a reaper in 1831 in Virginia, but by 1846 little progress had been made in the manufacture of reapers for general farm use. In 1836 there was an "almost unprecedented" devastation of the wheat crop by the Hessian fly in the middle states and Virginia and in 1837 a financial crisis seized the land. As a result development of the reaper had to wait. McCormick sold only six machines in 1842 and in 1848 it is reported that the "whole western output for the season did not exceed 50 machines." That same year, however, McCormick established a factory in Chicago, and the years following witnessed the formation of the McCormick Harvesting Machine Company, which became a part of one of the largest manufacturing concerns of the country.

Conditions in Iowa in 1846 were favorable to the rapid develop-

ment of farm machines which would substitute the energy of work animals for the muscular effort of the farm laborer or, in other words, "save labor." There were wide areas of fertile soil available for cultivation with little effort for preparation except breaking. Furthermore, labor was scarce. When the war between the states came, the demand for grain and its high price furnished a most effective incentive to grow grain in any suitable area from which the grain could be transported to market.

The first comprehensive record of the early machines used in Iowa during the early days of statehood is found in a report of the "standing committee on the Implements of Husbandry of the Iowa State Agricultural Society," published in the annual report of the society for 1867. The report indicates that there was much interest in farm machines on the part of farmers. The exhibit of farm machines was an important feature of the State Fair of that year, of which the committee had the following to say:

At the recent State Fair, there were 379 entries in the several classes allotted to farm tools and machinery. This afforded an exhibition of great interest. Several acres were covered with labor-saving machines, which were the admiration of all beholders. At first it was the design of your committee to present, in a connected form, the various implements in general use by Iowa farmers, the amount paid for them, their advantages, etc., but it was found impracticable.

CORN PLANTERS

A heavy hoe was first used to plant corn by driving the blade of the hoe into the soil by a forceful swing, so that a quantity of soil could be lifted, leaving a pocket in the soil into which the desired number of kernels of grain could be dropped while the soil was held on the soil blade. A quick downward movement of the hoe placed the soil over the corn in the pocket. The final operation was that of pressing the soil over the hill of corn with the foot.

Hand corn planters were shown at the state fairs in the sixties. These planters consisted of a tube from two to three feet long with a wedge-shaped point which could be jabbed into the soil and then opened, leaving a hill of corn in the soil. Such planters saved little labor and the transition in corn planter development proceeded for the most part from the hoe to the horse-drawn machine.

One of the early successful horse-drawn corn planters was the Brown, named after its inventor, George W. Brown, of Galesburg, Illinois. This machine had two furrow openers into which hills of corn were dropped by a hand-operated mechanism. Two operators were needed, one to drive the team and manage the raising and lower-

ing of the furrow openers, and one to operate the dropping mechanism. The hills were spaced and placed in checked or cross rows by marking off the field by shallow furrows across the row, indicating where the hills should be placed. This machine was popular as soon as it was placed upon the market. Four hundred sixteen machines were sold in Iowa in 1867 for \$70 each. By 1880, the wire-operated check rower was available and quickly came into general use.

Now, with four-row corn planters, more than four acres can be planted in an hour. On level fields the hills of corn can be checkrowed by a device using a wire with "buttons" to locate the hills. In some instances tillage equipment such as a cultivator may be used in combination with the planter, thus combining the operation of the completion of the seedbed with planting.

CULTIVATORS

The first horse-drawn cultivators were single or double shovel, one-horse implements. In 1867 two-horse straddle row cultivators were being manufactured with runners to give the implement stability. Later the runners were replaced with wheels, and soon provision was made for the operator to ride.

Today, on level fields four-row cultivators may be used. There is also a tendency to increase the number of cultivating units—shovels, sweeps, or disks—thus raising the effectiveness of the machine. With the higher field speeds of the tractor it is necessary to use cultivating devices that will not clog with trash or vines and which will not throw the soil into the corn plants.

HANDLING THE CORN CROP

The harvesting of ear corn with a machine was one of the last operations to be mechanized. The corn picker was an expensive machine and the early machines left too large a percentage of the crop in the field. Due not only to the improvement of the machines but also to the breeding of corn hybrids which were better adapted to mechanical harvesting, the corn picker has replaced hand picking except on very small areas. The conventional machine now harvests two rows and is either drawn by the tractor or is mounted on it.

The storage of the corn crop as ensilage became a recognized practice before 1900. In the making of ensilage the entire corn plant is reduced by cutting into short lengths and stored as a succulent feed in an air-tight silo. In early practice corn fodder was harvested in the field with a hand corn knife, and after hauling to the silo was chopped

with a stationary cutter. A first step forward in saving labor came with the corn binder which bound the fodder into bundles, thus reducing the labor and facilitating the handling of the fodder. The most advanced method now practiced is to chop the fodder as it is harvested in the field with a silage harvester. This machine is usually operated by power from the tractor engine transmitted through the power take-off shaft and delivers the silage to a vehicle—trailer or truck—drawn beside the harvester. The chopped silage is placed in a silo with a blower or pneumatic elevator; thus much of the arduous labor is eliminated. At the present time silage harvesting can be accomplished with less than one-half man hours of labor per ton while formerly about three to five hours were required.

HAYMAKING

In the early days of Iowa, haymaking was an operation performed entirely by hand. The grass was mowed with a scythe, raked by hand, and handled from the windrow with the pitchfork. One of the first machines to gain universal adoption was the mower. The report of the State Agricultural Society for 1867 indicated that the mower was one of the machines then being sold in large numbers. The price ranged from \$110 to \$195. The next machine added for haymaking was the dump rake, a comparatively simple and reasonably priced machine.

Following the dump rake came the hay loader and with the development of barn equipment for unloading, haymaking equipment became standardized about 1900. The small acreage of hay grown on the average farm made a large investment in this equipment unprofitable. During the past quarter of a century, only about three million acres of hay were harvested annually in Iowa, or an average of about fifteen acres for each of two hundred thousand farms. During the settlement period much prairie hay was harvested and stacked in the field, with sweep rakes to gather the hay from the windrow and stackers to lift the hay onto the stack.

With the labor shortage that became acute during the World Wars I and II new methods of conserving labor were introduced. Chopping hay in the field has come into general use. The reduction of long hay to the chopped form makes it possible to blow it into storage with a pneumatic elevator.

Another method coming into use and competing for favor with chopped hay is that of baling the hay in the field with a windrow pickup baler. This makes handling easier and requires less storage space.

A better knowledge of the nutritional value of feeds has led to greater appreciation of quality in hay. This has created a desire to be free from the weather hazards of curing hay by natural means in the field where frequent rains often result in low grade hay. Artificial drying is now being used. In one method green grass is converted into dry forage with a furnace type of dryer. In another form partially-cured hay from the field is cured by forced mechanical ventilation after it has been placed in the mow.

A popular machine with the early Iowa farmer was the self-rake, reaper, and mower combined. When used as a reaper the grain fell behind the cutter bar on a table from which the grain was raked at intervals and deposited in even gavels on the stubble. The self-rake and platform were removed when mowing grass.

HARVESTING GRAIN

The thresher at first was a stationary machine. Later it was mounted on a truck for transportation to the grain to be threshed. About 270 of these threshers were sold in Iowa in 1867. The machine was said to have the capacity to thresh three bushels of wheat per minute. The combined harvester-thresher saves about one-half the labor required by the binder and stationary thresher, thus reducing the labor per acre from six hours to about three hours under normal conditions. Other factors, such as the saving of the straw, may lead farmers to prefer the stationary thresher, however.

MILKING

Growing and harvesting crops is not, of course, the only farm operation in which the farmer uses machinery. The milking machine has come into wide use on dairy farms with herds of more than eight to ten cows. The machines, crude at first and difficult to clean, are now perfected so that with proper management the quality of milk they turn out exceeds that of hand milking. Although the saving of labor has not been more than about 7 per cent during the past thirty-five years, a much better product is obtained. Even more important changes have come in the handling of milk. Refrigeration which makes it possible to cool the milk, and pasteurization which reduces the bacterial content, extend the period that milk may be kept without souring.

POWER

The function of farm machines is primarily that of applying energy to farm operations. When hand methods prevailed, the worker

supplied the energy from his muscles. As a source of power, man is hopelessly outclassed. The amount of energy which a sturdy worker can supply is limited to about one-tenth of a horse power, and the cost of the energy supplied is excessive. The accomplishment of a farm worker is in direct proportion to the amount of energy directed. Thus a four horse plow will enable a farm worker to plow an acre in half the time of a two horse plow. The early settler in Iowa used work animals, mostly horses. Oxen were used to some extent in the early days of the state for breaking the native prairie, a type of work for which they were particularly fitted, when used in large teams. Oxen, however, were never used to the same extent in Iowa as in the eastern states. When the immigrant came to the state he wanted to travel faster than he could with oxen whose gait is about one-half that of horses. Since oxen are controlled by lash and command rather than by reins they were not so well adapted to the cultivation of a row crop such as corn. And since a man's output is determined by the amount of energy he can direct, the number of animals in the teams were increased with more extended use of machines. Thus Iowa became the leading horse-raising state. A survey of power used on the farms made in 1933 credited Iowa with more power than any other state. These sources of power are shown in Table 12.

TABLE 12
APPROXIMATE AVAILABLE PRIMARY HORSE POWER IN IOWA, 1930

Horses and mules.....	1,169,240
Gas tractors.....	1,523,934
Stationary gas engines.....	287,442
Trucks.....	816,725
Electric motors.....	55,602
Electric light plants.....	62,679
Combined harvester-threshers.....	8,750
Total primary horse power.....	3,924,372

The tractor has continued to grow in favor. The principal reason for this may be the advantage of the tractor in supplying the farm worker a larger power unit. Early tractors did not make as rapid an advance in Iowa as in small-grain states. These early power plants were not adapted to the growing of corn. They were more or less satisfactory for plowing but not suitable for other operations, such as planting and cultivating. In time a more versatile tractor was developed suitable for all the operations. During recent years the number of tractors has increased rapidly until Iowa today has a larger number

than any other state. This trend shows in the listing of the number of tractors in Iowa year by year, as follows:

1920	20,270
1930	66,258
1940	124,487
1944	160,557
1946	175,000 (estimated)

There have been many important advances in the agricultural practices of the state during the past century but none has been of more significance or has had a greater effect upon Iowa's agriculture than the extensive use of farm machines and power. The influence has been expended in many ways but one of the most noticeable has been in the increased productivity of labor.

For example, the labor of producing an acre of corn has been reduced to about one-eighth of the time required in 1855. The reduction of labor in the producing of other staple crops has been of a similar nature. Although the reduction of labor is of fundamental importance, there have been many other changes more or less dependent upon labor efficiency. The character of farm labor has changed. The laborer now directs the machine and its power, while under hand methods he furnished the energy. Farming is now "more a matter of brain and less of brawn." The length of the working days has grown less. Wages have increased and the living conditions surrounding the laborer have improved. The labor of women in the field is no longer needed.

Observers who have made a careful study of the influence of farm machinery on farm labor during the past century declare it to be significantly beneficial. The farmer is no longer "the man with the hoe" but a worker whose equipment not only relieves him of drudgery but stimulates his mental faculties, enables him to be a better citizen, and permits him to enjoy the larger measure of well-being which should come through increased productive efficiency.

Improved farming methods have required better buildings, for increased output. Developments have been pointed toward the need for structures which are low in cost when measured against production.

22. Trends in Farm Structures

HENRY GIESE, *Agricultural Engineering*

BUILDINGS, THE SILENT PARTNER IN FARM OPERATION, have played an important and ever increasing role in the development of Iowa agriculture. From bare shelters almost primitive in nature, they have increased in importance and extent until at the present time Iowa farmers maintain an investment greater than do the farmers in any other state, and one which represents nearly one-twelfth of the national total. As agriculture has grown from a bare subsistence level to that of a modern food and feed factory there have also been marked structural changes in modern houses, animal shelters, and crop storages, all effective shelters and production tools in the great agricultural industry.

Early settlements in Iowa were made near the principal streams, because such land could be farmed without tile drainage, and because the wooded area there furnished building material and fuel. Poor transportation and few cash markets required that practically all necessities be produced on the farm. There were few buildings except the farm house because livestock was usually allowed to roam at will.

Some of the more progressive farmers framed their houses and barns from hand-hewn timbers, largely of native oak, as they had done in the East. The year 1856 marked the approximate beginning of a great lumber industry which mined out the white pine forests along the upper tributaries of the Mississippi River. Logs floated down the Mississippi to lumber mills in the river towns and were sawed into huge timber, planks, and boards, making possible the expansion of building on the farm. The period 1856-1900 was marked by the construction of many full frame barns of mortise and tenon construction, which used a large amount of material. White pine, the principal lumber, did not possess great strength and was used in large timbers. A great deal of labor was required to fabricate and large

crews to erect. It was a proud carpenter whose barn frame, completely pre-cut, would fit together at a neighborhood raising without extra cutting. The large amount of material required was little handicap as long as there was plenty of timber in Wisconsin and Minnesota.

Depletion of these forests about 1900, however, with remote timber more expensive, brought structural economies. Plank frames using largely materials no thicker than two inches became rather common. Other factors also contributed to this general trend. Douglas fir from the West and yellow pine from the South both possessed structural properties superior to white pine. The lighter plank frames could be erected by smaller crews. Development of the self-supporting gambrel roof eliminated troublesome braces which cluttered the haymow when full-frame construction was used.

About 1920, A. W. Clyde, then extension engineer for Iowa State College, developed another truss. It provided structural stability with additional saving in materials and labor. Gas pipe was used for shear pins at the ends of the trusses to make a joint comparable in strength to the remainder of the structure.

During the latter part of the Nineteenth Century, another type of construction appeared which promised to be the most popular of all. This is the curved or so-called "Gothic roof." The self-supporting arch was used in masonry construction for centuries and before the days of reinforced concrete, large openings could be spanned only by the use of this principle. It offered advantages also in the use of wood. The first ones to appear were formed by cutting one edge of relatively wide and short boards to an arc of a circle. These were then laminated, using a total thickness of three or four, staggering splices to give a continuous rafter of the desired length. The popularity in Iowa has been less than in the Northwest due to the wastage of lumber and the large amount of labor necessary in the fabrication. The strength has been satisfactory when such rafters were spaced on two-foot centers. The urge to cheapen the cost, however, resulted in spacing the sawed rafters eight feet apart. This was unsatisfactory primarily because the sawed rafter was not strong enough when spaced so far apart, and also because the savings were not as great as anticipated. The trend turned gradually but surely toward the bent rafter. The exact date of the first application of this method in Iowa is not known. However, the Hershey Creamery, a unique barn and operations structure near Muscatine, was built in 1878 of hip Gothic construction on a very substantial level. Being 72 feet by 120 feet, it required more substantial construction than would be required in our

more common barn widths. It is said that each rafter required a keg of nails.

Popularity of this type of construction has been slow due to the fact that many roofs have sagged out of shape, as the result of improper construction methods which can be readily overcome. Modern glues, cheap and effective, have provided a satisfactory solution to the problem of fastening, and promise to revolutionize construction methods. Glued laminated construction becomes increasingly popular because members can readily be formed to the correct structural shape. It makes possible bending the wood, avoiding cross grain and staggering splices so that members of any desired size can be obtained without weak joints.

Some of the changes come so gradually that one must look to the past to appreciate how extensive they have been. Improvements have been made not only in the farm structure, but also in the equipment within. Iowa people have been leaders in this development. In 1866 William Loudon received the first patent issued on a hay stacker. The next year in 1867, he received the first patent ever issued on a hay carrier. This invention made possible the two-story barn, since previously all hay had to be pitched by hand. He set up a factory six miles southeast of Fairfield in 1868. In 1895, Loudon invented the first flexible barn door hanger, the forerunner of practically every barn door hanger used today. He brought out a manure or litter carrier and exhibited the first practical all-steel cow stall in 1907 at the National Dairy Show. In 1912, he introduced the first individual sanitary water bowl for cows.

The modern house is not only different from the log cabin of the settlers of a century ago in appearance, but also in the methods employed in erection. The early pioneer lived almost entirely upon a subsistence basis with few goods to purchase and little surplus to store. From log cabins with roofs of poles thatched with straw, grass or sod, to hand hewn timbers, to milled shapes, to almost complete prefabrication—this represents the progress witnessed since Iowa became a state. Prefabrication is not new and really is only a matter of degree. Years ago, sash and door factories started making windows, doors, and moldings. Each year brought progress until windows are now completely fitted in frames ready to place in the wall to give superior performance. Precutting and sectional construction will doubtless advance to the benefit of the ultimate user because the product can be made better and will be better designed.

But improvement in construction methods represents only a small

portion of the progress in providing better places for people to live. Fireplaces were notorious wasters of heat, most of which traveled up the large chimney. Even the old stove which displaced the fireplace has been discarded. Modern stoves are streamlined, more efficient, more sightly and less dirty. Yet many Iowa farmers today insist upon modern heating systems which are almost completely automatic, not simply in regulating temperature within rather narrow limits but also in humidifying the atmosphere and filtering out dust particles, for better health.

Modern sanitary systems made possible by automatic water systems are becoming increasingly common on Iowa farms. More than half the Iowa farms are now supplied with electric power. Thanks to electricity, the farmer can have adequate refrigeration, radios, electric irons, and many other conveniences.

Timber resources have always been relatively small in Iowa. The broad prairies covered for centuries by a heavy sod of native grass have made Iowa a leading agricultural state, but also have meant that Iowans must, to a large extent, look elsewhere for building materials. Portland cement, practically unknown a century ago, has become an indispensable material in the construction of foundations, walks, feeding floors, and pavements, and frequently of buildings themselves. The development of methods of reinforcing concrete with steel has brought to the farmer a versatile, durable product. Iowa has a plentiful supply of clay, limestone, and gypsum so that we now have several plants making high-class building material. Local manufacture is an important factor in the cost and consequent use of heavy building materials.

CLAY PRODUCTS

The general suitability of many Iowa clays for burned clay masonry has led to valuable developments originated by Iowans. The clay products industry in Iowa had its origin almost one hundred years ago in the many small "backyard" plants which were sometimes opened to supply brick for the construction of a single building or only a few buildings in the immediate vicinity. Not much is known about these plants, but there are many old buildings constructed of these bricks that are still serving the purpose for which they were built. A number of the buildings at Iowa State College were constructed from brick made on the campus.

As the pioneers settled in Iowa, the demand for brick grew. Lack of adequate transportation again stimulated small community brick

plants. As farming practices improved, the need for farm drain tile added another product to these small plants. There were eventually over two hundred such small brick and tile plants scattered over Iowa, most of which survived until World War I. Today only twenty such plants exist. Modern transportation and newer methods of manufacture enable the remaining plants to supply the demand.

The brick manufactured by these early plants were handmolded, dried in the sun, and burned in "scove" kilns, the earliest type of brick kiln. A scove kiln was merely a pile of dried brick set with parallel cross tunnels spaced about four feet apart at the bottom. Fires were built in these tunnels and the heat passed up through the mass of brick, thus "burning" them. The sides of the pile of brick were plastered with a mixture of clay, sand, and water to help retain the heat. The top of the pile would be left unplastered to provide a draft. This crust or "scove" applied to the outside gave the kiln its name.

In 1871, soon after the coming of the Milwaukee Railroad to a north Iowa trading post now called Mason City, N. M. Nelson and Henry Brickson established a brickyard near there. This was the first "commercial" plant built in Iowa. The clay was a surface formation known as boulder clay.

In 1894, Robert Goodwin and Frank Dale established a small drain tile and brick plant at Grand Junction, and also the first press brick plant in the state at Goodwin, on the site of a coal mine owned by Goodwin. W. J. Goodwin and Dan Goodwin, sons of Robert, built the Goodwin Tile and Brick Company in Des Moines in 1902. This plant is still in operation, now owned by Dan Goodwin, and is near the site of the old press brick plant operated by his father. Robert Goodwin and a Mr. McBroom also founded the Redfield plant in 1896. This plant is still in the hands of the Goodwin family.

The Kalo Brick and Tile Company of Fort Dodge was founded in 1889 by Luke and S. C. Johnson, brothers.

The Straight family, which first produced clay products in Scotland, established their first Iowa plant in Fonda in 1894. Their other plants at Spencer and Auburn were built in 1904 and 1907, respectively, and the Adel Clay Products Company at Adel also in 1907. This plant was moved to Redfield in 1927 and is now operated by M. T. and H. R. Straight, sons of Lee Straight, one of the founders.

Other pioneer plants which are still in operation are the Johnston Clay Works, Inc., established in 1898 at Fort Dodge; the Sheffield Brick and Tile Company organized at Sheffield in 1907; the Rockford Brick and Tile Company, first formed in 1910 at Rockford; and the

Vincent Clay Products Company, organized in 1911 by the Vincent family of Fort Dodge and still in their hands.

With the exception of the Vincent Clay Products Company, all modern Iowa clay products plants now use the round "beehive" periodic downdraft kilns in burning their ware. The Vincent company uses a continuous chamber kiln.

These Iowans developed new units to meet the ever-changing demands of modern construction, improved methods of manufacture and distribution, and a better conception of the industry's responsibilities to the economy of the state and nation.

Since Iowa's greatest industry is agriculture, much of the development in clay products here has pointed toward better farm buildings. The "Iowa Type" clay tile silo, for example, was originated at Iowa State College in 1907-08 by Professor J. B. Davidson and Matt King. The first such silo, built with curved hollow clay blocks and reinforced with steel, was built on a farm near Rockford in 1908. This silo is still used on the Howell farm.

The clay products industry of Iowa also developed the clay crib tile which has been used extensively for the past twenty-five years for permanent corn cribs and granaries on many an Iowa farm. The textured facing tile which is used in the construction of many of Iowa's farm buildings, as well as in commercial, industrial, and residential structures, is another contribution of Iowa producers. Previously hollow tile was used almost exclusively as a "back-up" material, or where appearance was not important. The application of a texture to the face of the tile, plus better control of manufacturing, raised hollow tile to the ranks of the finer building materials and its use has spread throughout the United States.

The "universal" closure or corner-jamb unit is another product originated by the clay products industry in Iowa which has been adopted generally by the industry. This versatile unit can be used to close the corners and at the window and door jambs in clay tile construction as well as in the construction of pilasters and load-bearing piers.

The use of finely-ground or pulverized clay in place of lime in cement-lime mortars was first introduced by the clay products industry in Iowa.

One of the most recent contributions of the clay products industry in Iowa was the development of a system of precast tile joist floor construction. Co-operation in research between Iowa State College and the building industry resulted in eliminating expensive formwork,

and made possible the use of a low-cost, permanent, and fire-resistant floor construction in all types of buildings.

The industry in this state also has contributed nationally in the perfection of the "de-airing." By means of a vacuum chamber attached to the auger machine, the clay is made more workable, denser, and much stronger, resulting in a finer and more uniform brick or tile. H. R. Straight, of the Adel Clay Products Company, was largely responsible for the perfection of this de-airing process.

The Iowa members of this important industry are considered among the most progressive and "researchminded" groups in the entire industry by those who manufacture clay building products in other areas. While the research and development of new products and better production methods by the Iowa clay products industry have been carried on largely with the thought of improving the construction of farm buildings, their contributions have had application to all types of construction.

FENCING

Early reports of the State Agricultural Society reveal how serious the fencing problem was. Some of the writers predicted that as the population increased, Iowa would follow the European pattern of small, fenceless farms. Iowa lacked the stone for the New England type of fencing and the timber for rail fences used in Ohio and Indiana.

Early farmers kept only a minimum of livestock and had constant difficulty in controlling what they had. Livestock losses constantly plagued the owner, and damage to his neighbors' crops, if the loss to his own were not enough trouble, led to frequent feuds and lawsuits. Lawmakers, worried over means of settling the controversies, provided for suitable damage and for the recovery of stray animals.

During the late sixties and early seventies the planting of willow slips and osage orange seeds for hedge fences was at a fever heat in the Midwest. Osage orange seed was shipped from Texas to Illinois where it was sold for five dollars per pound. Eloquent essays were written pro and con. Growing conditions were not as favorable in Iowa as in its native habitat. Dying hedge plants left gaps in the fence. Even a properly trimmed hedge taxed the moisture and plant food of the soil, and trimming was expensive. The hedge fence was gradually replaced by wire.

The sod fence also appeared in the prairie states where wood and stone were scarce and hedge fences were still a rarity. C. A. Martin describes it as follows:

A sod fence, besides its other value, is a double barrier against the prairie fires which are so sweeping and destructive . . . for a wide strip is cleared of sods, the fence standing in the middle of it. The sod is first cut, then with a breaking plow one furrow is turned directly in the line of the fence, completely inverting the sod. The team is turned to the right, and a second or back furrow is inverted on top of the first. Additional furrows are cut, diminishing in width to five or six inches on the outer side. . . After the two inner sods are turned, the rest are carried by hand, wheelbarrow, or a truck and laid on the sod wall, care being used to "break joints" and to taper gradually to the top.

Development of the wire fence was gradual and many people contributed. The earliest effort was a smooth iron wire, sometimes flat, coated with a film of zinc. Iron wire was inexpensive, easily transported, and simple to erect, and it guarded property well. It was popular in the fast-growing regions of the South and West where timber was scarce. Because it often sagged in hot weather or tightened up to a point of snapping in cold weather, there were many who never were quite satisfied with it. It did not completely restrain cattle. The catalog of an early barbed wire manufacturer graphically stated the case against smooth wire as follows:

The animals pressed up to the boundaries of the pasture and, sticking their heads between the wires, calmly lunched off the adjacent crop. Growing more resolute, they broke bounds altogether, or contentedly sawed their itching necks on the smooth wire until the fence gave way.

The advantages of wire fence were sufficient to attract numerous inventors who attempted to overcome its shortcomings.

Following the general idea of attaching to the wire a sharp point or barb to keep livestock from rubbing against it, more than four hundred designs were developed. Perhaps the earliest attempt to apply barbs to wire consisted of driving nails through a wooden rod and attaching this rod to the smooth fence wire. High cost prevented widespread use of this method, even though it was effective.

These inventors were widely scattered. In 1859, Samuel Freeman built a fence of smooth wire in Scott County, Iowa. Two years later his son, Pembroke, perhaps tiring of the continual repair, attached wire barbs to this fence, making it highly effective as compared with smooth wire. If he were the inventor of barbed wire, he made no attempt to patent his idea and produced no wire commercially.

Three patents were issued in 1867 to Alonzo Dabb, Lucien B. Smith, and William D. Hunt, respectively. Numerous others followed shortly thereafter.

Three pioneers, Joseph Glidden, Isaac Ellwood, and Jacob Haish, residents of the same community in Illinois, were working independently during this period attempting to develop a barbed wire for farm

fences. When Haish had developed a satisfactory design, he transformed the second story of his carpentry shop into a barbed wire factory. A twisting device was placed at one end of the shop, the spool at the other end, and a worktable in the center where the barbs were spaced and firmly attached by a tap of the hammer. A special machine was devised to cut and shape the "S" barbs. According to Haish, similar devices are used today in the manufacture of barbed wire.

The Glidden-Ellwood firm formed their barbs in such a manner that they had to be slipped over the end of one wire before twisting. This was accomplished by carrying the end of the wire to the top of a windmill tower from which elevation the barbs slid down the wire to the workmen who pinched them tightly in place at the proper spacing as the wire was twisted. Protection against rusting was first furnished by dipping the wire in linseed oil alone, but this proved unsatisfactory.

During the period of the suits regarding the patents on the barbed wire, farmers and stockmen became antagonistic to the use of barbed wire, calling it "inhuman, barbarous, and cruel to animals." State legislatures were asked to pass laws prohibiting its use. Cattle soon learned to stay away from this new fence, however, and these charges were forgotten.

The development of an inexpensive, effective fence changed the entire picture of agriculture in Iowa from a wheat and range to a cattle state. Well-fenced pastures and fields encouraged the production of corn, hogs, and dairy cattle.

Woven wire fence was first produced in 1883 in a wagon shop on a farm in Michigan. The original process was crude, but the principle of continuous vertical wires is still used in making wire fences today. In recent years one wire charged with electric current has attained great popularity, especially for temporary fences.

BUILDING PROBLEMS

The development of livestock raising to an extent not equaled by any other state has brought with it demand for more and better buildings. Breeding and selection has emphasized certain beneficial characteristics with consequent loss of some others. Most farm animals, although able to withstand the rigors of an Iowa winter, are not profitable to their owners without adequate housing.

In raising more and more hogs and chickens in the same place year after year, the farmer faces the choice between adopting rigid sanitary measures to avoid outbreaks of disease or moving them about

to keep them on ground that is not infected. The former requires good buildings that can be kept sanitary and the second, structures that can be moved.

Storage is another modern problem. Modern agriculture and modern living require carrying products from one season or year to another. A century ago, corn storage did not present a serious problem since the farmer had so little of it that he could leave it in the shock until spring if necessary, husking it out as he needed it. The increase in livestock brought with it corresponding increases in corn acreage. Several developments in corn itself and in the methods of handling it have added problems in storage. Early cribs were made by piling split rails to form a square so that spaces for ventilation were provided between the rails. Corn frequently is too wet at the time of harvest to keep through the following summer without further drying. The tendency of farmers to raise corn requiring a long growing season in an attempt to get larger yields means that many are caught with wet, immature corn. Cribs with cracks between the siding boards facilitate drying when conditions are favorable. All early cribs were low so that they could be filled by scooping from the wagon box. Many, if covered at all, were thatched with straw. High losses from rain and snow encouraged thrifty farmers to provide a roof.

Larger acreages demanded more cribs or larger cribs, with the general tendency toward the latter. The development of the elevator encouraged the farmer to make his cribs higher rather than to spread them out over a larger area. A high crib takes no more foundation or roof than a low one. But this, together with the development of a successful picker, brought on more structural problems. When corn was picked by hand and scooped by hand, the crib was filled slowly and the corn well distributed along its entire length. Some drying took place as the crib was filled. The corn was relatively clean with little husks, silks, or shelled corn. The picker plus the elevator meant rapid filling, more husks, silks, and shelled corn, and a tendency to concentrate them in one place under the elevator spout. High cribs required interior braces. Rapid filling piled the corn well above the braces before it had the chance to settle. When it did settle, as it must as it dries, the braces were broken out by the settling corn. Corn packs more densely in the bottom of high cribs, hence the farmer is faced with a ventilation problem and a loss of corn which he did not have before. Nevertheless, the modern crib, while it may still lack in perfect performance, is a great improvement over anything in use a century ago.

The trench silo is a comparatively recent development. Trenches dug in well-drained ground function satisfactorily when the owner cannot afford or justify the above-ground structures.

The growing popularity of leguminous hays has added another storage problem. Timothy had so few leaves that it appeared to make little difference if the hay were dried in the field sufficiently to keep well in storage. Small mows of open construction provided sufficient ventilation. But with legume hay, if it is dried sufficiently in the field to avoid spoilage in storage, many valuable leaves, which dry first, are dropped in the field. Hay that is completely field dried loses much of its value as feed even though no further spoilage results. Modern methods of handling include field chopping and baling. In either case, the hay stores much more compactly with less opportunity of satisfactory drying in the mow. Larger mows, like larger cribs, only add to the problem. The spontaneous ignition of leguminous hays in storage has become the principal cause of barn fires in the state. Various attempts are now being made to avoid the difficulty. One of them is the making of the hay into silage. Another provides for forcing air through the hay in the mow to dry it further.

As farming changed from a subsistence basis which required the efforts of perhaps 75 per cent of the population to a point where fewer than 20 per cent of the population can produce a surplus, buildings have done much to make the change possible. Improved farming methods require better buildings. Better buildings in turn make possible further developments in agriculture. The influence of buildings, however, is not limited to farm production. Great progress in mechanical equipment has resulted in both labor-saving and labor-easing. Improvements in buildings and building equipment have not kept pace. The result is that a farmer spends nearly half his working time in and around his buildings, often quite inefficiently. Good buildings save labor. They can also make farm living standards comparable to those of urban areas. Good buildings are not necessarily high-cost buildings and cheap buildings are not necessarily poor buildings. What is needed are buildings which are low in cost when measured against production. As the lowest priced automobiles are made possible only by efficient and well-equipped factories, so the cost of agricultural production can be lowered by means of buildings that do the job better and last longer. Structural stability is a matter of skill in design and construction and often requires no additional expense.

The problem becomes more acute because most structures are built and often planned on the farm. One can seldom go to his mer-

chant, buy a ready-made structure, and move it out to his farm. The decision to build is only the beginning of a farmer's problem. Most farmers get so little experience that it does not carry over from one building job to the next, as is true in the case of equipment purchased at frequent intervals.

Early writers in the agricultural field "hand-set" their advice to farmers at the type cases. Sometimes it was based upon practical farm experience, but again it originated from pure hearsay. Now, trained writers with a farm background give factual reporting of the practices of successful farmers.

23. Agricultural Journalism in Iowa

K. R. MARVIN, *Technical Journalism*

ABOUT THE TIME IOWA WAS FIRST EMBRACING STATEHOOD, Horace Greeley made his oft-quoted statement, "Go west, young man; go west." Greeley first proffered this advice to Josiah B. Grinnell, New York clergyman and journalist. Grinnell accepted the advice, visited the Midwest, reported the Illinois Fair for Greeley's *New York Tribune*, and became infatuated with the prairie country.

A few years later Grinnell came to Poweshiek County, helped found the city of Grinnell (1854) and Grinnell College. He exerted an important influence on Midwest agriculture and its journalism. His leadership in Iowa husbandry, particularly sheep raising, pointed the way to his election as president of the American Agricultural Association in 1885. Grinnell was one of many leaders directed toward the black soil of Iowa by the enthusiasm of eastern editors of early newspapers and farm journals.

The thirty farm periodicals published in the East had a total circulation of one hundred thousand during the 1840's. Until 1853 Iowa had no farm papers of its own. Farmers who subscribed to any could choose between the *American Farmer*, established in Baltimore in 1819; the *American Agriculturist*, first published in New York City in 1842; the *Genesee Farmer*, originated in Rochester in 1831; the *Cultivator*, founded in Albany in 1834; the *Prairie Farmer*, one of the earlier "western" journals published in Chicago in 1840 as the official organ of the Union Agricultural Society.

Regarding the influence of these journals, the discouraged editor of the *American Farmer* remarked in 1831 that farmers were "unbelievers in book farming. They will neither take an agricultural

paper, read it when given them, nor believe in its contents if by chance they hear it read."

Popularity of the farm journals already was on its upward swing, however. By the advent of the Civil War fifty or sixty agricultural periodicals had a circulation of a quarter of a million and Iowa already had launched a few.

EARLY NEWSPAPERS

Prior to the advent of the farm journals several newspapers were on hand in the Territory to advocate or oppose Iowa's admission to the Union. Their editors, though inexperienced in farm practices, frequently offered advice to the early farmers.

The *Du Buque Visitor* was established at the Dubuque lead mines by John King in 1836, only three years after the first newspaper was founded in the muddy village of Chicago—the *Weekly Democrat*. Burlington had its *Gazette* in 1837, Fort Madison its *Patriot* in 1838 and its *Plain Dealer* in 1841, Muscatine its *Journal* in 1840, Davenport its *Gazette* in 1841. Printers pushed westward into the territory and brought forth three papers in Iowa City in 1841, the *Reporter*, the *Standard*, and the *Argus*. The first of these lasted twenty years, the second seven, and the third less than two years. In Keosauqua two newspapers were launched in 1843, the *Iowa Democrat* and the *Des Moines River Intelligencer*. At Ottumwa the *Copperhead* appeared in 1844. At Keokuk the *Gate City Weekly* was brought out in 1846, the *Daily Gate City* in 1847, and the *Saturday Post* in 1848.

A short-lived *Western Adventurer and Herald of Upper Mississippi* appeared at Montrose in 1837 and suspended in 1838. In 1847 Montrose had another newspaper with a specific title, the *Advocate and Half-Breed Journal*.

These early territorial publications reprinted many of their articles for farmers from almanacs or periodicals printed in the East. Articles on the selection and storage of seed, curing of home-killed meats, or the report of a plowing match usually were written and first printed in the older settlements before being "lifted" by the Iowa newspapers. Complete enactments of public land laws sometimes filled the entire front page of the hand-set Iowa papers.

The first issue of the *Du Buque Visitor*, May 11, 1836, carried a farm market report. This occupied a space one column wide and about four inches deep. It was headed DU BUQUE WHOLESALE PRICES CURRENT (corrected weekly). Some items included were:

Beef, fresh	lb.	8a	10cts.	none
Lard	"	12a	15 "	scarce
Butter	"	12a	31 "	"
Bacon	"	12a	15 "	"
Beef hides dried	"	9a	10 "	"
Eggs	dozen	12a	25 "	"

Ownership of newspapers changed often and their titles almost as often. Within the first year of publication the names of four owners had appeared on the masthead of the *Du Buque Visitor* and by June 3, 1837, the name of the paper was changed to the *Iowa News*. This was nine and a half years before President Polk was to sign the act admitting Iowa to the Union.

The diverse responsibilities of the country editor were semi-seriously portrayed in a reprinted paragraph of the second issue of the *Du Buque Visitor*:

A Country Editor—Is one who reads newspapers, selects miscellany, writes articles on all subjects, sets type, reads proof, folds papers, and sometimes carries them, prints jobs, runs on errands, cuts wood, works in the garden, talks to all his patrons who call, patiently receives blame for a thousand things that never were and never can be done, gets little money, has scarce time and materials to satisfy his hunger, or to enjoy the quiet of nature's sweet restorer, sleep, and esteems himself peculiarly happy if he is not assaulted and battered by some unprincipled demagogue who loves puppet shows and hires the rabble with a treat of cider brandy to vote him into some petty office. A man who does all this and much more, not here recorded, you will know must be a rather busy animal; and as he performs the work of so many different persons, he may justly be supposed their representative, and to have an indisputable right, when speaking of himself, to use the plural number, and to say *we* on all occasions and in all places.—*Williamstown Advocate*.

EARLY FARM JOURNALS

The lofty purpose of the early farm journals was well expressed by John Stuart Skinner, father of American agricultural journalism. The first issue of Skinner's pioneer journal, dated April 2, 1819, carried the following:

The great aim and the chief pride of the *American Farmer* will be to collect information from every source, from every branch of husbandry, thus to enable the reader to study the various systems which experience has proved to be the best, under given circumstances.

Early Iowa farm journals adhered to this policy, limiting it only to territory served or to a particular branch of agriculture which they attempted to cover. As in the early newspapers, the names of editors and publishers on the mastheads of the early farm journals changed frequently. So did the titles of the journals themselves. Few of the

pioneer editors were practical farmers or horticulturists. Yet their journals contained advice on how to treat barn itch, grow willow fence posts, raise Italian queen bees, make rhubarb wine, cause cows to deliver their calves in the daytime, or to plant desirable varieties of fruit. Frequently the advice was reprinted from an eastern or British journal. Occasionally the editors reported successful operations of individual farmers with cost and profit figures. Colorful reports of reaper field trials made their appearance early along with etchings of farm machinery in the advertising.

IOWA HOMESTEAD

G. L. Seaman, in his *A History of Some Early Iowa Farm Journals*, an unpublished thesis on file in the Iowa State College Library, credits the *Iowa Homestead* as the oldest Iowa farm journal still published. The constant change of its owners, editors, and titles is typical of contemporary farm publications. Predecessor of the *Homestead* was the *Iowa Farmer and Horticulturist*, edited by James W. Grimes and J. F. Tallant and first published in Burlington in May, 1853. By 1855 the name of Milton L. Comstock had replaced that of Grimes on the masthead of the *Iowa Farmer and Horticulturist*. In co-operation with Suel Foster, a horticultural writer of Muscatine, Editor Wilson published a specific "Plan of an Agricultural School" in the issue of this journal for June, 1856. A few months later William Duane Wilson, uncle of Woodrow Wilson, replaced Tallant. By 1857 this journal was published in Muscatine under the name, the *Iowa Farmer*.

In 1858 Wilson moved the magazine to Des Moines. With each move its frequency of publication had been increased, from a monthly in Burlington to a semi-monthly in Muscatine and to a weekly in Des Moines. Mills and Company was listed as the publishers, with Wilson as editor. In 1860 Hiram Torrey became publisher and changed the name to *Pioneer Farmer*. By 1862 Torrey had sold to Mark Miller who changed the name to the *Iowa Homestead and Northwest Farmer*. Miller had joined the western movement in 1849, coming from Massachusetts to Wisconsin where he founded the *Wisconsin Farmer*. Miller is also credited with founding the *Homestead* at Racine, Wisconsin, in 1855. In 1856 he moved on to Dubuque and started the *Northwestern Farmer and Horticulturist* which he brought to Des Moines in two prairie wagons to consolidate with the *Pioneer Farmer*.

The *Dubuque Daily Times* for January 15, 1861, carries the following about this journal and its editor:

The *Northwestern Farmer* for January has been lying on our table for several days. It is replete with useful and entertaining matter. We are happy to state that

the *Farmer* has become one of the institutions of our State and its success is placed beyond a peradventure. Mr. Miller deserves all the popularity and respect in agricultural matters he receives, and more; for he has made it a life-long study to inform himself upon this one point so as to be able to place the most reliable knowledge and latest discoveries before his numerous readers. One dollar a year. Address, Mark Miller, Dubuque. P.S. Mr. Miller has just returned from Fort Des Moines where he has been to attend the Annual Election of the State Agricultural Society. He brought back with him \$200, drawn from the State treasury for our County Agricultural Society for our own County Society.

Miller announced in his first issue of the consolidated 5-column journal which he began publishing as a weekly in Des Moines: "The doings of our State and County Agricultural Societies and Farmer's Clubs all justly claim ten-fold more attention than can be given through a monthly."

Proceedings of the Iowa Legislature were reported in detail also, and legislators had copies sent to their constituents. Wives of editors of these early farm journals frequently conducted a "Ladies' Department" as did Mrs. Abby A. Miller at Dubuque.

In 1864 Miller sold the *Homestead* to Henry W. Pettit, but continued as "agricultural editor." He devoted much of his time to his farm and nursery, but was called back to manage the paper, now called the *Iowa Homestead and Western Farm Journal*, in 1886 upon the death of Pettit. The next publisher listed was Dr. G. Sprague, who had become editor in 1868.

In July, 1869, Sprague announced that William Duane Wilson had returned to his home in Des Moines to assume the editorship. Wilson had published newspapers in Philadelphia and was co-owner of the *Chicago Tribune*. He had served in the Department of Agriculture in Washington and as secretary of the Iowa Board of Agriculture, which also made him secretary of the Agricultural College in Ames in 1859.

The firm of Mills and Company is given intermittently as publishers and co-publishers from the time the journal was moved to Des Moines until 1872 when it was sold to Wilson after the latter had become involved in a controversy with the state fair committee. Ex-Lieutenant Governor B. F. Gue, of Fort Dodge, publisher of the *Iowa North West*, became a partner and managing editor for a few months, but soon sold his interest to Wilson, Dr. G. Sprague, and Frank R. Sprague.

The title, *Iowa Homestead*, and subtitle, *Western Farm Journal* or *Iowa Farm Journal*, alternated in usage from 1868 to 1880, evidently according to the whims of the changing owners. For several years the name *Homestead* disappeared entirely, but came back when B. F. Gue repurchased the journal in 1880.

The names of Seaman A. Knapp, professor of practical agriculture, and J. L. Budd, professor of horticulture at the Iowa Agricultural College, appear as associate editors in 1882.

Gue sold the *Iowa Homestead* to J. H. Duffus for \$16,000 in 1883. Henry Wallace became editor-in-chief soon thereafter. Believing that the new publisher had paid too much for the publication, Wallace set his own salary at five hundred dollars a year. When Duffus sold to James Melville Pierce and his partner, Mr. Lucas, for \$20,000 in 1885, Wallace was asked to continue as editor. He still thought the price too high and continued to work for ten dollars a week with the understanding that he have the privilege of buying stock in the publication.

Pierce and Lucas had published newspapers first in Missouri and later at Bedford and Osceola, Iowa. Wallace had studied for the Presbyterian ministry, contracted tuberculosis, and was operating a farm for his health in Madison County when he attracted the spotlight of public controversy in a Fourth of July speech in 1878. He became agricultural editor of the *Madisonian* at Winterset, then purchased the competing paper, the *Winterset Chronicle*, and built its circulation from four hundred to fourteen hundred in a short time.

With Pierce as business manager and Wallace as editor, the *Homestead* widened its influence to serve neighboring states, built circulation rapidly, and increased its income. The partnership continued to flourish for ten years until Pierce opposed Wallace's editorial criticism of advancing railroad rates and refused to permit the publication of his editorials.

DAIRY JOURNALS

Wallace's name disappeared from the masthead March 9, 1894, when he left for a tour of Europe. Pierce took over the editorship in addition to his position as business manager. Assisted by his son, Dante, he continued to guide the policies of the magazine until his death. Wallace soon joined his sons, Henry C. and John P., who were publishing the *Farm and Dairy* at Ames. This publication was the successor to the *Farmer and Breeder*, published in Cedar Rapids by Fred Faulkes and later edited and partly owned by N. B. Ashby, son-in-law of Henry Wallace.

The *Farmer and Breeder* had first been issued in Iowa City in 1875 as the *Iowa Farmer and Breeder* by B. F. Gue who had purchased and consolidated six other farm publications. (This is evidently the episode from which the magazine now designates its origin. i.e. Vol. 71 in 1946.) These were the *Northwestern Stock, Field and Farm*, the *Iowa*

Stockman and Farmer, the *Iowa Farmer and Stockman*, the *Farm Journal and Livestock Review*, the *Western Stock Raiser*, and the *Western Stock Journal*. The latter is distinct from the journal by the same name founded earlier by J. H. Sanders, of Sigourney, and later consolidated with the *National Live Stock Journal* in Chicago.

When Ashby was appointed to the American Consulate in Dublin he sold the *Farmer and Breeder* to Henry C. Wallace and C. F. Curtiss, both of the Iowa Agricultural College at Ames. Its name was changed to the *Farm and Dairy*.

Another dairy paper, called the *Dairy Farmer*, had been published since 1883 at Chariton by Robert Marshall, a practical dairyman, and the Temple Brothers. This was sold to the *Farm and Dairy* at Ames in 1891. John P. Wallace dropped his studies at Ames to sell advertising for the *Farm and Dairy*. He would board a train with his bicycle, disembark, and ride inland to call on stockmen.

The elder Henry Wallace purchased the Curtiss interest, agreed to serve as editor, changed the name to *Wallaces' Farm and Dairy*, and soon moved the publication to Des Moines. Later the name was changed again to *Wallaces' Farmer*.

Subsequent years witnessed an intensive struggle between the Wallace and Pierce interests to dominate the farm magazine field in Iowa, with the Meredith family entering the lists in the nineties.

The Wallace Publishing Company purchased the *Homestead* in 1929 at an evaluation of two million dollars. The depression which followed brought receivership and purchase at auction by the J. M. Pierce estate in 1935. Henry A. Wallace continued as editor and his name was carried on the masthead of the magazine even while he served in the Franklin D. Roosevelt cabinet as Secretary of Agriculture, Vice-President, and Secretary of Commerce. Dante M. Pierce became publisher again in 1935 and has continued as such to date with Donald Murphy serving as capable editor.

BRIEF APPEARANCES

While the *Iowa Homestead* and *Wallaces' Farmer* were waging their battle for leadership in the state's thriving industry by consolidations, by enticing new capital, and by keeping abreast editorially of a progressing science, many of their contemporaries sprang up, struggled with varying success, and faded into obscurity.

One of the earliest of these was the *Cedar Valley Farmer*, started by James L. Enos in Cedar Rapids in 1853. It survived less than two years. It may be that the *Farmers' Advocate*, said to have been pub-

lished as a monthly at Burlington prior to August 27, 1847, has a just claim to the title of Iowa's oldest farm paper, but little of its history is preserved. H. Gates is given as its editor and James Tizzard and Company as its publisher.

Other farm papers that struggled briefly and expired or were absorbed are: the *Dubuque Farmer*, 1861; *Pioneer Farmer*, Des Moines, 1861; *Western Pomologist*, published during 1870 in Des Moines by Mark Miller who conducted his own backyard experiments with fruit; *Progressive Farmer*, Cedar Rapids, 1873; the *Western Farmer and Patrons' Helper*; official organ of the Iowa Grange, Des Moines, 1874; *Western Farmer and Horticulturist*, Ainsworth, 1878; *Farm Journal and Livestock Review*, Cedar Rapids, 1879; *Advance Farmer*, 1880, by C. M. Adams; *Dairy and Farm Journal*, West Liberty, 1881; *Amerikas Hønsseavler*, started at West Branch in the early nineties by Mads Larsen as pamphlets on poultry raising printed in Danish, later blossoming briefly as a monthly magazine; the *Creamery Gazette*, Ames, 1895, by Henry C. Wallace; *Fjærkre og Biavl*, Cedar Rapids, 1894, printed in Norwegian, changed to the *Farmeren* in 1895, N. F. Hansen, publisher and John A. Jensen, a brother-in-law, editor. This publication was discontinued in 1898.

The second *Farmer and Breeder*, started in northwestern Iowa in 1895, was edited by M. L. Steele, of Ireton, and C. I. Hood, of Battle Creek, and later printed in Sioux City by the Tribune. It was eventually consolidated with the *Farmers' Tribune*.

PUBLISHING CENTERS

Many of the farm journals that sprang up throughout Iowa found their way eventually to Des Moines. Here they were swallowed up, discontinued, or greatly expanded. Some were absorbed by Des Moines publishers motivated by a desire to acquire the services of an editor who had built up a reader following. This migration succeeded in identifying Des Moines as both an infirmary for senile journals and as an important hub for the farm press.

Waterloo withstood the magnetic pull of the capital long enough to establish itself as the seat of dairy publishing. This was strikingly due to the early efforts and ideals of one man, Fred L. Kimball. In 1890 he established the *Creamery Journal*, which still is edited in Waterloo by E. S. Estel and is now published by the Buttermakers' Publishing Company. In 1893 Kimball added another trade publication, the *Egg Reporter*, which continued until 1926. In 1903, a year before he died, Kimball brought out the *Kimball's Dairy Farmer* "for

the man who milks the cows." After his death publication of these journals was continued by the Fred L. Kimball Company, Inc., and a fourth one was added, *Milk Magazine*. *Kimball's Dairy Farmer* under a succession of editors—Alson Secor, H. E. Colby, and H. G. van Pelt—continued to exert a strong influence toward improved breeding of dairy cattle, balanced rations, and improved pasture and forage culture. This publication enjoyed at one time the largest circulation of any dairy journal in the United States. It fostered the first cow-testing association in Iowa and the organizing of the Waterloo Dairy Cattle Congress. With the suspension of the National Dairy Show during World War II and its official discontinuance in 1946, the thirty-fourth annual Dairy Cattle Congress in 1946 became the only dairy cattle exposition of national scope in the United States. This national status came as well-earned recognition of the efficient management of the Waterloo Congress by Editor E. S. Estel.

In 1923 the *Kimball's Dairy Farmer* was purchased by E. T. Meredith, moved to Des Moines, the name changed to the *Dairy Farmer*, and Chester A. Goss was appointed editor. E. M. Harmon succeeded Goss in 1928. The *Dairy Farmer* was merged with *Successful Farming* in 1929.

Waverly established itself as a publishing center for poultry journals between the two World Wars. The Poultry Breeders' Publishing Company there issued the *Cornish Chronicle*, the *Wyandotte Herald*, the *Leghorn World*, the *Plymouth Rock Monthly*, the *Rhode Island Red Journal*, and the *Western Poultry Journal* for several years. These were either discontinued or their subscription lists were sold in 1941 to the *Poultry Tribune* after poultry interests had shifted from fancy stock to commercial stock. The name of the firm was then changed to Waverly Publishing Company. In 1946 this company was printing the *Soybean Digest* (1940—), George Strayer, Hudson, editor; the *Poland China World* (1913—), Walter J. Evans, editor; and *Your Farm* (1943—), James A. Rice, Chicago, publisher.

Much of the history of four farm journals that bore the name the *Iowa Farmer* is obscure. The earliest one was published in Muscatine and moved to Des Moines in 1858. The origin of the second one is credited to Alex Charles in Cedar Rapids in 1879. Charles already had been publishing the *Western Stock Journal and Farmer* which he and Seaman Knapp had begun at West Liberty in 1871. This *Iowa Farmer* may have been consolidated with the *Farmer and Breeder*, which B. F. Gue founded at Iowa City around 1875. Or it may have been sold to Meredith Publishing Company in Des Moines, which was buying up farm journals in the nineties.

Frank Mott in his *History of American Magazines*, however, holds that the *Iowa Farmer*, Cedar Rapids, 1878-92, was edited for some years by James Wilson, later (and for 16 years) the first Secretary of Agriculture. Mott adds, "Apparently this was the forerunner of *Wallaces' Farmer*, which furnished two more Secretaries of Agriculture."

Another *Iowa Farmer* was started in Dubuque in 1902 and later moved to Des Moines. It was edited successively by Glen F. Cook, James L. Lavin, George Gerling, (name changed to *Safe Farming* in 1918), and Fred W. Clute. Publication ceased in 1925. A fourth journal that adopted the title, *Iowa Farmer*, about the time the title was discarded in Dubuque, appears in the history of the *State Register* later in this chapter.

The *Iowa Tribune*, originated as an organ of the Greenback Party in 1878 by General James B. Weaver, Congressman E. H. Gillette, and Thomas Meredith, was changed to the *Iowa Farmers' Tribune* in 1892. Meredith gave it as a wedding gift in 1895 to his grandson, E. T. Meredith, later Secretary of Agriculture under Wilson. Meredith moved the paper from Atlantic to Des Moines. J. M. Gass served as editor. Meredith sold the paper in 1904 to a group of bankers in Sioux City. In 1905 H. G. McMillan bought it and shortened the name to the *Farmers' Tribune*. McMillan was co-publisher of the *Cedar Rapids Republican* with Cyrenus Cole. He was also a breeder of Percherons and judged them at the first International Livestock Exposition in Chicago. McMillan moved the *Farmers' Tribune* to Sioux City and bought and consolidated with it the *Farmer and Breeder*, discarding the former name in 1911. In 1921 he moved the *Farmer and Breeder* to Sioux Falls, South Dakota, and absorbed the *South Dakota Farmer*. Shortly thereafter the paper was sold to a group in Sioux Falls and was consolidated in 1929 with the *St. Paul Farmer*, St. Paul, Minnesota.

Cedar Rapids had a specialized journal in the *Western Poultry Journal*, edited and published by E. E. Richards in 1888.

The *Student's Farm Journal* was edited and published by the Agricultural and Horticultural Association of Iowa Agricultural College from September, 1884, to August, 1887.

The *Western Garden and Poultry Journal* was established in 1890 in Des Moines, with Charles N. Page as editor. It was still published in 1898, when Emerson Dupuy was listed as editor and publisher.

The *Western Iowa Farm Journal* was started in Carroll in 1891 to promote interest in farm lands. It was published later for a few years by John B. Kniest, who attempted to develop it into a legitimate farm paper.

Other journals of this period were: the *Creamery and Dairy*, Waterloo, 1891, E. C. Wilcox, editor, Ed Madigan, publisher; *Modern Farmer*, Creston, 1892; the *Western Farmer*, Dubuque, founded in 1895 by McCook and Standacher; the *Fruitman and Gardener*, launched in 1897 by Lloyd McCutcheon of Mt. Vernon (It still claimed a circulation of 40,000 at the time of World War I); *Farm Topics*, Davenport, 1899, G. H. Greene, editor; *Poultry, Bees and Fruit*, 1899, Davenport, J. J. Feeney and H. A. Skelly, editors.

The *Knoxville Educator* stimulated southeastern Iowa's interest in the Farmers' Alliance movement in the nineties, but the publication faded and expired as enthusiasm in the movement waned. It was edited by J. R. Norman, of Knoxville. *Spirit of the West* was launched by the Iowa Turf Publishing Company in Des Moines in 1890 and continued for three decades.

A short-lived *Dairy Journal* appeared at New Hampton in 1892, published by E. T. Runion and edited by R. S. McKee. H. G. Gue, son of Lieutenant Governor B. F. Gue, brought forth the *Polk County Farmer* as a monthly in 1889, but publication ceased soon after the editor was elected to the board of trustees of the Iowa Agricultural College.

Rural Life emerged in 1890 under the guidance and financing of Matt Parrott and Sons Company at Waterloo. Its departmental editors included Professor C. F. Curtiss in charge of horses; Professor J. L. Budd, horticulturist; E. C. Bennett of Tripoli, dairy editor; and C. L. Gabrielson, as sheep editor. By 1894 the publishers found the competition too severe and sold to J. M. Pierce, of the *Iowa Homestead*.

George H. van Houten, an influential horticulturist of Lenox, edited the *Rural Northwest*, started in Des Moines in 1883 and suspended in 1894. Van Houten was also a trustee of the Iowa Agricultural College at Ames, as well as secretary of the Iowa State Fair and a member of the general assembly.

Western Soil Culture, edited by H. W. Campbell in Sioux City in 1895, was launched to promote conserving soil moisture by use of a roller of some merit which Campbell had developed.

A number of other agricultural publications that flourished temporarily, some of them brought out primarily to promote the sale of farm lands, were: *Black Loam Journal*, semi-monthly, started at Arion in Crawford County in 1906 and still published in 1909; *Farm Gazette*, monthly, Des Moines, 1904, James M. Pierce, editor, audited circulation: 60,859 in 1909; *Homemaker*, monthly, (family and poultry) Des Moines, 1897, by Homestead Publishing Company, audited circulation: 80,132 in 1909.

At the close of the last century farm papers were drawing more subject matter from the Iowa Agricultural College, promoting the educational value of fairs, advocating better breeding of livestock and diversified cropping. Advertisers were demanding more circulation and forcing consolidations. Publishers were investing more capital in printing equipment and making it more costly for new journals to enter the competition. Readers were profiting from a more reliable product.

Two years before selling the *Iowa Farmers' Tribune*, E. T. Meredith started *Successful Farming* (1902) in Des Moines. This was the journal of his dreams, a regional magazine to serve all farms and farm homes. Paid advertising was not accepted until circulation had risen to one hundred thousand, high enough to establish a rate of 50 cents per agate line. Volume I, No. 1 carried a statement guaranteeing paid subscribers against fraudulent advertising. Later this guarantee promised to refund the money paid for any goods advertised in the magazine if those goods were not as represented.

Through the pages of *Successful Farming*, Meredith fostered better living on the farm, urged adoption of modern farming methods, campaigned for improved farm-to-market highways, and promoted 4-H club work by establishing a two hundred thousand dollar loan fund from which farm boys and girls could borrow money to buy livestock.

The publisher was chosen to serve as Secretary of Agriculture in President Wilson's wartime cabinet. In 1923, five years before he died, he launched *Better Homes and Gardens* "to bring to city and urban homes the better living that *Successful Farming* (now come 'of age') was advocating for the farm." The newer magazine, however, had no regional restrictions to its editorial bow. Before it had celebrated its twenty-first birthday this magazine had passed the quarter of a million mark in circulation, twice that of its regional partner.

BREED PUBLICATIONS

One of the oldest breed papers published in Iowa was the *Duroc Bulletin*, established in Peoria, Illinois, in 1904. It was moved to Chicago in 1913 and to Des Moines in 1920 when the name, *Live Stock Farmer*, was added to the title. M. N. Gordon was editor and James Doty was publisher. B. R. Evans became editor the following year. The *Bulletin* was consolidated with the *Duroc Journal* in 1925 in Omaha, Nebraska, and in 1930 with the *Duroc News*. The consolidated publication returned to Des Moines that year. Two rival Duroc registry associations, the American and National, were then competing.

The *Sentinel* was started in Chicago in 1925 and consolidated with the *Duroc News* in 1934. R. J. Evans edited the *Sentinel* until he died in 1930. His son, B. R. Evans, has edited three of these publications and now edits the survivor of the consolidations, *Duroc News*, at Peoria, Illinois. He also is secretary of the United Duroc Record Association. Another son, Walter J., is editor of the *Poland China World*.

Other breed journals published in Iowa include the *Poland China World* (1913-), Webster City, which absorbed the *Swine World* in 1943 and moved to Waverly in 1945; *Chester White Post* (1920-26); *Chester White World* (1919-), L. W. Drennen, editor; and *Aberdeen-Angus Journal* (1919-), Fred Hahne, editor and publisher.

NEWSPAPER FARM NEWS

One of the best-known early farm pages in an Iowa daily newspaper was edited by Coker F. (Father) Clarkson, who came to a Grundy County farm from Brookville, Indiana, in 1856 and soon began writing about farming in the *State Register*, published in Des Moines. A weekly edition containing Clarkson's farm page gained a wide readership and influence. After the Civil War, Clarkson and his two sons, Richard P. and James S., purchased the *State Register*. The father continued for many years to edit his farm page, drawing upon his own practical experience in advocating improved practices and in championing the farmers' cause against the Barb Wire Trust and other "predatory industrialists."

The *State Register* continued publication as a weekly for many years, adding *and Farmer* to the name and evolving into the farm-journal type of publication. In 1909 George W. Franklin was editor and the Iowa Farmer Publishing Company was owner. By World War I the name became the *Iowa Farmer*. J. W. Jarnagin was editor. In the early twenties it was consolidated by Paul R. Talbot, editor and publisher, with the *Corn Belt Farmer*. The latter was originated in Waterloo in 1912 and moved to Des Moines in 1919 by H. B. Clark, editor. Publication was continued monthly through 1942 under the title, *Iowa Farmer and Corn Belt Farmer*.

Other early journalists who made distinct contributions in their newspapers to the development of Iowa's agriculture were Peter Melendy, of the *Cedar Falls Banner* prior to the Civil War, and later on the *Cedar Rapids Gazette*; Lorenzo S. Coffin of the *Fort Dodge Chronicle*; John Scott of the *Davenport Gazette*; Andrew Failor of the *Newton Journal*; J. G. Brown of the *Marshalltown Republican*; and E. C. Bennett of the *Waverly Republican*.

A pioneer farm page in the country weekly was written by "Tama Jim" Wilson for Elmer Taylor's Traer *Star Clipper*. Taylor comments upon this partnership enterprise in his autobiography published in 1923, the fiftieth anniversary of the *Clipper*:

Mr. Wilson was an easy writer, and a gifted man in many respects. I have seen him sit at my table and write a column without a stop. It seemed to me that he did not stop to think, but the quality of his articles showed careful thought. He edited a farm department for the *Star Clipper* several years. His articles were popular, and Iowa being a purely agricultural state I conceived the idea of syndicating his page—that is, selling it to other Iowa papers. I proposed it to him, and he readily consented to the partnership, he to be the editor, I the manager. I was to do all the business of the concern, and he was to write three columns per week. I set the type in my office, shipped it to Des Moines where it was cast into plates, called stereotypes, and from there sent by express to such papers as I had secured as members of the syndicate. . . .

We charged \$100 per year in most cases for the franchise. I succeeded in working up quite a list, one time having around 70 members. Mr. Wilson got half the profits, and I half. He drew as high as \$2,000 to \$2,200 per year from his efforts in writing three columns a week, while he had been furnishing me the same amount for a fraction of that sum. The syndicate was maintained until he was called to Ames, and he could not give the business proper attention.

Other weeklies and several dailies have conducted farm pages or farm supplements somewhat spasmodically during more recent years. One of the more consistent farm pages is that of the *Cedar Rapids Gazette*. This was started as a weekly farm page by Vance McCray in 1921. It developed into a daily feature when Carroll Streeter became farm editor in 1924. Streeter left to join the *Farmer's Wife* and later became managing editor of the *Farm Journal* when the two publications were consolidated in Philadelphia. Streeter's successor, Ray Anderson, conducted one of the outstanding farm pages of the Midwest. When he left also to join the *Farm Journal* in 1944, the *Gazette* appointed Rex Conn, who had served as county agent of Linn County for nearly two decades. These editors succeeded in bringing to the farm page the kind of on-the-farm factual reporting and camera coverage that the city editor's staff has long employed in urban reporting. The *Gazette's* rural circulation and prestige responded appreciatively.

In addition to their farm pages several Iowa dailies have published monthly, quarterly, or semi-annual farm supplements, frequently in tabloid size. Some dailies have purchased and continued to publish weekly newspapers to serve the rural areas. Under such arrangement the *Mt. Pleasant News* issued the *Free Press* on Thursdays; the *Carroll Herald*, the *Times*; the *Perry Chief*, the *Advertiser and Press*; the *Newton News*, the *Jasper County Record*; and the *Creston News Advertiser*, a Wednesday rural edition. These weekly editions were

usually maintained to satisfy the demand of advertisers for rural coverage. Rural reader interest was held by inserting generous supplies of farm correspondence and by accumulating farm information stories from daily issues.

The *Waterloo Courier* employed a farm editor, Walter J. Hunt, and carried a farm page in the twenties. The *Mason City Globe Gazette* added a farm editor, Rodney Fox, in the thirties and published a monthly farm-magazine supplement with liberal use of on-the-farm pictures and reporting as well as technical information stories. Davenport papers have had their farm editors including Herb Plambeck, now WHO farm editor.

With its remarkable rural coverage the *Des Moines Register*, under the guidance of Farm Editor James Russell, has kept the Iowa farmer well informed on national, regional, and state farm policy, trends, and farm organization activities. The *Register* was first in establishing Sunday morning delivery to rural homes. In 1946 the Sunday *Register* introduced a well-illustrated farm magazine once a month and entitled it *Iowa Farm and Home Register*.

The Iowa Press Association has conducted annual contests and presented awards since 1937 for the best service to agriculture by newspapers in towns under and in towns over 2,500 population. Trophies for these contests have been provided by the Iowa State College chapter of Sigma Delta Chi, professional journalistic fraternity. Newspapers that have won the 14 awards presented are: *Toledo Chronicle*, *Iowa Falls Citizen* (twice), *Pocahontas Record Democrat* (three times), *Fayette County Union*, *Pella Chronicle* (three times), *Denison Review* (twice), *Hopkinton Leader*, *Harlan Tribune*.

Newspapers and farm journals have consistently supported and reported the activities of significant farm organizations as they emerged, flourished sometimes temporarily, and faded. The most influential of these movements were the Grange, Farmers' Alliance, Farm Institute, and Farm Bureau. It was in Iowa that the Farm Institute was first taken to the farmers when President A. S. Welch, of the Agricultural College at Ames, conducted the first Iowa institute at Cedar Falls in December, 1870.

The *Nation's Agriculture*, published in Chicago (1925-), by J. J. Lacey, editor, and the Farm Bureau as publisher, attempted to serve all of the state Federations. In 1937, however, the Iowa Bureau decided to publish its own magazine for its members under the title the *Iowa Bureau Farmer*. This was edited and managed by the Fairall Advertising Agency in Des Moines until 1945 when Clarence Wilson

of the state office took over the editorship. The magazine at that time reported a circulation of 91,000.

Several sectional Farm Bureau publications had appeared in the state earlier. These carried local news, information about Bureau activities and Extension Service releases. One of these, the *Farm Bureau Spokesman*, was edited by Don Ashby and published at Grundy Center by the Spokesman Press. Beginning in 1934, the *Spokesman* widened its scope to serve members in sixty-eight counties by publishing four regional editions weekly. Ralph Anderson took over the *Spokesman* in 1946. Subscription revenue for both the *Spokesman* and the *Bureau Farmer* came from Federation membership dues.

The *Farm Bureau World*, published by R. E. Cunningham at Shenandoah, has been serving members in about ten counties in southwestern Iowa since 1931. It is issued weekly in tabloid newspaper format with a page devoted to each county Farm Bureau. In 1945 James Henderson, publisher of the *Hog Breeder*, Peoria, Illinois, opened a western office for that magazine in Shenandoah, his boyhood home, and procured an interest in the *Farm Bureau World*, serving also as co-editor of the latter with Obe Bay.

EDUCATION FOR AGRICULTURAL JOURNALISM

Until after the turn of the century, agricultural publications drew their editors from country newspapers or from farmer correspondents who had shown an aptitude for writing. A group of livestock men, gathered around the fireplace in the Stock Yard Inn at the International Livestock show in 1904, voiced the need for college-trained agricultural writers. C. F. Curtiss, dean of agriculture at Iowa State, a member of this group, was ready to offer such instruction if means could be found. John Clay, head of a large livestock commission firm, proffered an annual gift to help finance the instruction.

As an outgrowth of this discussion, a group of friends and editors met on the Iowa State College campus on May 30, 1905, to formulate plans. In the fall of 1905 the first course in agricultural journalism, taught by Will H. Ogilvie, editor for the Iowa Agricultural Experiment Station, attracted a score of agricultural students. This was the first course in technical journalism offered anywhere. Journalistic education in college of any nature was just beginning to take form in two or three schools.

By 1911 eight classes were offered to two hundred students, and a course in home economics writing was added that year at the request of women students. By 1920 the courses were broadened to offer a

four-year curriculum leading to the degree of bachelor of science in agricultural journalism.

Following Ogilvie the department was directed successively by L. E. Carter (1906-08); C. V. Gregory (1908-11); F. W. Beckman (1911-27); Blair Converse (1927-38); Charles E. Rogers (1939-44); K. R. Marvin (1945-). The head of the journalism department also served as bulletin editor for the Iowa Experiment Station and Extension Service until 1944 when the duties were divided and Fred Ferguson was appointed bulletin editor. After World War I the curriculum permitted students majoring in engineering and science to elect sequences in journalism.

John Clay continued his annual contributions toward instruction in agricultural journalism until in the twenties when he endowed a research fellowship in the department with a grant of \$7,000.

The idea, conceived by Clay at the Stock Yard Inn, transplanted to the Iowa State campus by Dean Curtiss and friends in 1905, was to exert wide influence upon technical writing. Graduates became editors of the leading agricultural journals. Many acquired their own rural newspapers, livestock papers, and agricultural advertising agencies. Others found their way into radio as farm and market editors, several becoming executives of the leading networks.

During Iowa's century of progress agricultural journalism has evolved through a number of fairly distinct periods. Early writers were printers who "hand-set" their *advice* to farmers at the type cases. Occasionally this advice was based upon their own practical farm experience. Frequently it was purely hearsay.

Toward the close of the last century more writers were drawn from the farm. Information was more reliable but still based upon limited experimentation. Factual reporting of the practices of successful farmers was mainly a Twentieth Century development. Since World War I, federal and state experimentation and research have become the source of more and more how-to-do copy. By World War II the federal government was spending in co-operation with the states forty million dollars a year on agricultural research and about a million dollars a year in preparing and distributing resultant information. The value of that investment in research to taxpayers and to society has expanded greatly through the reliable reporting of the farm press.

Studies of the Information Service of the United States Department of Agriculture indicate that the news story is the cheapest and most efficient method of influencing farm and home practices:

"The cost of influencing the adoption of practices through news

stories was 50 per cent less than that of any other agency," states *Technical Bulletin* 106.

"In a study of 8,700 farms in twelve states, news stories (farmers said) were responsible in 10 per cent of the instances in which they adopted new practices, bulletins in 7 per cent." *Agricultural Extension System* by Smith and Wilson.

"News service took 4.6 per cent of expenditures, was responsible for 12.8 per cent of changed practices, brought 2.8 times the average returns per dollar of expenditure. Bulletins took 6.2 per cent of expenditures, brought 8.6 per cent of changed practices, or 1.4 times the average return." *op. cit.*

STATE PUBLICATIONS

To aid and supplement this distribution of useful information for farm and home, the publishing activities of the Iowa Experiment Station and Extension Service have kept pace with the progress of the farm press.

Biennial reports of the Iowa Agricultural College carried results of experimentation as early as 1875. A catalogue of Phaenogamous plants was issued by Joseph C. Arthur in 1876. A catalogue of the Orthoptera of Iowa by Charles E. Bessey appeared the same year and the same author issued a publication two years later on the seventeen-year cicada, brood of 1878. A modest special series of bulletins was published by the Iowa Agricultural College from 1883 to 1888.

The first publication of the Experiment Station appeared in May, 1888, a year after the enactment of the Hatch Act which founded the stations. This Bulletin No. 1 contained a brief article by Professor A. A. Crozier on the use of hybridizing in obtaining desirable characteristics of plants.

This regular series of bulletins of the Station was continued until September, 1939, then consolidated into a joint series with popular bulletins of the Extension Service. In June, 1911, the Station established the Research Series of bulletins, dealing with technical subjects and written primarily for scientists. That series has continued since.

Publications of the Extension Service (known in the beginning as the Extension Department of Iowa State College) began in October, 1907, about a year after the federal government made its first appropriation for extension teaching. Its second bulletin was entitled "Healthful Homes."

The two branches of Iowa State College, separately and jointly, had issued 1,971 publications prior to 1946. In addition to a joint

popular series of bulletins, two periodicals were established, the *Iowa Farm Economist* (quarterly 1935-40, and then monthly) and the *Farm Science Reporter* (as a quarterly since 1940). These two magazines were combined in July, 1946, and issued monthly as the *Iowa Farm Science*. The *4-H Leader*, a monthly magazine for leaders of the organization, was first printed in 1942. *Better Iowa*, a two-page printed clip sheet of farm and farm home information stories, has gone weekly to all weekly newspapers in the state since 1914.

Information publications of Iowa State College now number more than a million copies each year and reach into practically every farm home of Iowa as well as into homes in towns, cities, and outside the state. The larger and more costly publications are distributed free, but only upon request.

Throughout Iowa's history her agricultural journalists have, in the words of Cyrenus Cole, "... week by week, preached the gospel of new farming, farming by diversification and with improved livestock. Their followers multiplied."

Their profession also has contributed secretaries of agriculture through half the years since the office was established in 1889: James Wilson under McKinley, T. Roosevelt, and Taft; E. T. Meredith under Wilson; Henry C. Wallace under Harding; and Henry A. Wallace under F. D. Roosevelt. In addition, the last named editor has, of course, served the nation as vice-president and as secretary of commerce.

TABLE 13
IOWA FARM PUBLICATIONS, 1846-1946

Journal	Location	Years Published *	Frequency	Estimated Maximum Circulation	Editors and/or Publishers
Aberdeen-Angus Journal	Webster City	1919-	Mo.	11,000	Fred Hahne, American Aberdeen-Angus Breeders Assoc.
Advance Farmer	.....	1880	.....	.....	C. M. Adams
Agricultural Education	Des Moines	1928-	Mo.	7,000	W. F. Stewart, Agricultural Section of American Vocation Assoc.
Amerikas Honseavler	West Branch	1891-92	Mo.	.....	Mads Larsen
Better Homes and Gardens	Des Moines	1923-	Mo.	2,380,031	Frank McDonough, Meredith Publishing Co.
Black Loam Journal	Arion	1906	S.-Mo.	.....	.....
Cedar Valley Farmer	Cedar Rapids	1853-55	Mo.	.....	James L. Enos
Cerro Gordo County Farmers' Institute	Mason City	1890	Mo.	.....	L. L. Klinefelter
Chester White Post	Des Moines	1920-26	Mo.	.....	Chester White Post
Chester White World	Des Moines	1919-	9 ti. yr.	7,500	L. W. Drennen; Chester White World Co., Ted F. Jones
Cornish Chronicle	Waverly	.....	.....	.....	.....
Creamery Gazette (first published in con- junction with Farm and Dairy)	Ames	1895	S.-Mo.	.....	Henry C. Wallace
Creamery Journal	Waterloo	1890	Mo.	5,000	E. S. Estel; Buttermakers Pub. Co., Inc., W. A. Gordon
Dairy and Farm Journal	West Liberty	1881	Mo.	.....	James Morgan; J. Maxon and Co.
Dairy Journal	New Hampton	1892	.....	.....	R. S. McKee; E. T. Runion
Dallas County Farm Bureau Messenger	Adel	1918-39	Wkly.	1,100	D. E. Fish
Dubuque Farmer	†Perry Dubuque	Prior to 1861	.....	.....	.....

* Years Published indicates starting publication date and termination date, if known. Journals still being published are indicated with a dash after the starting date.

† Indentation of city indicates moving of journal to city not indented.

‡ Indentation of journal name indicates it was absorbed by the publication not indented.

§ Title in parentheses designates a variant name for the same magazine.

TABLE 13—continued

Journal	Location	Years Published *	Frequency	Estimated Maximum Circulation	Editors and/or Publishers
Duroc News	Peoria, Ill.	1904—	.....	7,000	B. R. Evans, R. J. Evans, M. N. Gordon, James Doty
†Sentinel	†Des Moines,				
Duroc Journal	Chicago,				
§Duroc Bulletin (and Live Stock Farmer)	Omaha				
Egg Reporter	Waterloo	1893–1926	Mo. & S.-Mo.	4,700	E. R. Shoemaker; Fred L. Kimball Co., Inc.
Farm and Real Estate Journal	Mt. Vernon	1896–1931	Mo.	9,000	Charles Wood and Son
	†Traer				
Farm Boys and Girls Leader and Club					
Achievements	Des Moines	1919–23	Mo.	.....	E. N. Hopkins; E. T. Meredith
Farm Bureau Advocate	Iowa City	1920–27	S.-Mo.	12,749	Johnson County Farm Bureau
Farm Bureau Advocate	Randolph	1930–42	Wkly.	3,600	William Zentz; Enterprise Pub. Co.
Farm Bureau Bulletin	Oakland	1926–33	Wkly.	5,680	E. P. Harrison; Harrison Printing Co.
Farm Bureau Courier	Reinbeck	1924–36	Wkly.	3,670	Thomas J. Emmett; Leroy A. Moser, Courier Pub. Co.
Farm Bureau Review	Ogden	1932–35	S.-Mo.	2,000	Stanley Heggen; Ogden Reporter
Farm Bureau Spokesman	Grundy Center	1934—	Wkly.	54,422	Ralph Anderson; Spokesman Press
Farm Bureau World	Shenandoah	.....	Wkly.	.....	James Henderson, Obe Bay, R. E. Cun- ningham
Farm Gazette	Des Moines	1904	Mo.	60,859	James M. Pierce
Farm Gist	Davenport	1925–34	Mo.	9,900	R. B. Murray; Farm Gist Pub. Co.
Farm Journal and Livestock Review	Cedar Rapids	1879	Mo.	.....	Journal Pub. Co.
Farm Sense	Des Moines	1910	.....	.....	.....
Farm Topics	Davenport	1899	Mo.	.....	G. H. Greene; Topics Pub. Co.
Farmeren (§Fjaerkre og Biavl)	Cedar Rapids	1894–98	.....	.....	John A. Jensen; N. F. Hansen
Farmer-Labor Press	Council Bluffs	1927–38	Wkly.	3,261	Soren M. Nelson; Farmer-Labor Press
Farmers' Advocate	Burlington	Prior to 1847	Mo.	.....	H. Gates; James Tizzard and Co.
Farmers' Exponent	Smithland	1889–90	.....	.....	Jenness and Hill
4-H Leader	Ames	1942—	Mo.	.....	A. P. Parsons; Iowa State College
Fruit, Garden and Home	Des Moines	1922–23	Mo.	.....	C. C. Sherlock; E. T. Meredith
Fruitman and Gardener	Mt. Vernon	1897	.....	40,000	Lloyd McCutcheon

TABLE 13—*continued*

Journal	Location	Years Published *	Frequency	Estimated Maximum Circulation	Editors and/or Publishers
Golden Egg	Des Moines	1911	.....	.....	.....
Harrison's Home Farmer	Oakland	1920-40	Wkly.	5,640	E. P. Harrison
Home Journal	Davenport	1880	.....	.....	.....
Homemaker	Des Moines	1897	Mo.	80,132	Homestead Pub. Co.
Interstate Farmer	Sioux City	1922-40	S.-Mo.	475	Edward Gable and J. G. Carpenter, Woodbury County Farm Bureau
Iowa Agriculturist	Ames	1901-	Mo.	2,500	Students of Div. of Ag., Iowa State Coll.
Iowa Bureau Farmer	Des Moines	1937-	.....	91,000	Clarence Wilson, Fairall Advertising Agency, C. R. Dudley; Iowa Farm Bureau Federation
Iowa Farm and Home Register	Des Moines	1946-	Mo.	.....	Des Moines Sunday Register
Iowa Farm Science	Ames	1935-	Mo.	26,000	Fred E. Ferguson, Iowa State College, Lauren Soth
†Iowa Farm Economist					
†Farm Science Reporter					
Iowa Farmer (§State Register and Farmer) and Corn Belt Farmer	Des Moines †Waterloo	1856-1943	Mo.	253,264	H. B. Clark, Paul R. Talbot, J. W. Jarnagin, George W. Franklin; Iowa Farmer Pub. Co., C. F. Clarkson, R. P. and J. S. Clarkson
Iowa Future Farmer	Ames	1929-	.....	.....	Agricultural Education Club and State Board for Vocational Education
Iowa State Poultry Journal	Delta †Grimes	1916-22	Mo.	9,000	G. R. Osborn
Iowa Union Farmer	Columbus Junction	1918-	S.-Mo.	8,500	Ed Roelofs; B. H. Shearer, Page Hawthorne, A. J. Johnson; Iowa Farmers Union
Iowa Wool News	Grundy Center	1940-	Mo.	6,379	Charles Sexton; Don Ashby
Johnson County Farm Bureau Exchange	Oxford	1930-41	Mo.	500 free 3,600	R. N. Spencer
Johnson County Farmer	Oxford	1934-	Mo.	free 4,000	M. E. Baker
Knoxville Educator	Knoxville	1890's	.....	.....	J. R. Norman
Leghorn World	Waverly	1916-41	Mo.	46,711	Emil G. Glaser; Waverly Pub. Co., H. V. Tormohlen, O. R. Ernst, A. G. Studier; Poultry Publications, Inc., Poultry Breeders Pub. Co.

TABLE 13—*continued*

Journal	Location	Years Published *	Frequency	Estimated Maximum Circulation	Editors and/or Publishers
Live Stock Record	Sioux City	1901-37	Daily	8,000	Y. A. Hartman; Record Pub. Co.
Live Stock Truth	Ottumwa	1915-18	.....	.....	.....
Milk Magazine	Waterloo	1913-25	Mo.	6,093	Fred L. Kimball Co., Inc.
‡Milk Trade Journal					
Milking Shorthorn Journal	Independence	1919-42	Mo.	10,000	Roy A. Cook; Milking Shorthorn Soc.
Modern Agriculture	Waterloo	1929-38	Mo.	75,000 free 435,000	Charles R. Hutcheson, Agriculture Pub. Co., Inc.
Modern Farmer	Creston	1892	S.-Mo.	.....	Farmer Publishing Co.
National Horticulturist	Council Bluffs	1909	.....	.....	.....
National Live Stock Journal	Chicago, Ill.	.....	.....	.....	.....
‡Western Stock Journal	‡Sigourney	.....	.....	.....	.....
Page County Farm Bureau Exchange	Clarinda	1919-26	Mo.	1,250	Page County Farm Bureau
Pioneer Farmer	Des Moines	Prior to 1861	Wkly.	.....	.....
Plymouth Rock Monthly	Waverly	1924-41	Mo.	36,338	Emil G. Glaser; Waverly Pub. Co., O. R. Ernst, A. G. Studier; Poultry Pub. Inc., Frank Gruber, Poultry Breeders Pub. Co.
Poland China World	Waverly	1913-	Mo.	4,373	Walter R. Evans, Fred Hahne, W. C. Williams, W. V. Gousseff; Swine World Pub. Co., Inc., Boyd Morgan, Merritt S. McFadden; James J. Doty
‡Swine World	‡Webster City	.....	.....	.....	.....
Polk County Farmer		1889	Mo.	.....	H. G. Gue; Northwest Co.
Posten (§Posten og Ved Arnen)	Decorah	1874-	Wkly.	43,579	Kristian Prestgard; Anundsen Pub. Co.
Poultry, Bees and Fruit	Davenport	1899	.....	.....	J. J. Feeney, H. A. Skelly
Poultry Post	Elkader	1908	.....	.....	.....
Producer and Consumer	Des Moines	1910-31	Mo.	.....	William Wilkinson
Producer. For the Farm, Garden, Work- shop, Business, Live Stock, and House- hold	Ames	1876-77	.....	.....	Iowa Agricultural College
Profitable Breeding and Farming	Nevada	1911	.....	.....	.....
Progressive Farmer; A Journal of Me- chanic Arts, Practical Agriculture, Hor- ticulture, and Literature	Cedar Rapids	1873-76	Mo.	.....	E. R. Bradford, Progressive Farmer Pub. Co.

TABLE 13—*continued*

Journal	Location	Years Published *	Frequency	Estimated Maximum Circulation	Editors and/or Publishers
Progressive Union Farmer Rhode Island Red Journal	Sioux Center Waverly	1932-39 1911-41	Mo. Mo.	2,250 44,918	Carl Wilkin; Sioux Center News O. R. Ernst; Waverly Pub. Co., Emil G. Glaser, A. G. Studier, Poultry Pub., Inc., Poultry Breeders Pub. Co.
Rural Northwest	Des Moines	1883-94	Mo.	.....	George H. van Houten; Rural North- west Co.
Safe Farming (§Iowa Farmer)	Des Moines †Dubuque	1902-25	Mo.	.....	Fred W. Clute, George Gerling, James L. Lavin, Glen F. Cook
Small Stock Magazine †Pet Stock Journal	Lamoni	1916-	Mo.	18,500	L. G. Blair; Small Stock Magazine, W. H. Blair
Soybean Digest	Hudson	1940-	Mo.	5,712	Geo. M. Strayer; American Soybean Assoc.
Spirit of the West St. Paul Farmer (Minn.) [26] †Farmer and Breeder of Iowa consoli- dated with South Dakota Farmer at Sioux Falls, S. Dak. †Farmers' Tribune (§Iowa Farmers' Tribune) (§Iowa Tribune)	Des Moines	1890-1920	.....	.....	Iowa Turf Pub. Co.
Students' Farm Journal	Ames	1884-87	Mo.	.....	Agricultural and Horticultural Assoc. of Iowa Agricultural College
Successful Farming †Dairy Farmer (§Kimball's)	Des Moines †Waterloo	1902-	Mo.	1,242,964	Kirk Fox; Meredith Pub. Co., A. H. Snyder, Alson Secor, Successful Farm- ing Pub. Co., E. M. Harmon; E. T. Meredith, C. A. Goss, Hugh G. van Pelt; Fred L. Kimball Co., Inc., Alson Secor, H. E. Colby, Fred L. Kimball, E. R. Shoemaker
Union Advocate	Sioux City	1895-40	Wkly.	4,250	W. H. Bastian; Union Advocate Pub. Co., Inc.
Unionist and Public Forum	Sioux City	1927-	Wkly.	3,500	Wallace M. Short; Unionist and Public Forum
Wallaces' Farmer (§and Iowa Homestead)	Des Moines	1853-	S.-Mo.	274,394	Wallace Pub. Co., J. M. Pierce Corp.

TABLE 13—*continued*

Journal	Location	Years Published *	Frequency	Estimated Maximum Circulation	Editors and/or Publishers
† Journals that were consolidated to form Wallaces' Farmer were: Wallaces' Farm and Dairy (§ Farm and Dairy) (§ Farmer and Dairy Breeder) (§ Iowa Farmer and Breeder), Dairy Farmer, Iowa Farmer and Stockman, Western Stock Raiser, Farm Journal and Live Stock Review, Western Stock Journal, Iowa Stockman and Farmer, Northwestern Stock, Field and Farm (see text for further information about these journals)					
† Journals that were consolidated to form Iowa Homestead: Iowa Homestead and Western Farm Journal or Iowa Farm Journal (Northwestern § Farmer and Horticulturist) Northwestern Farmer and Iowa Homestead (§ Pioneer Farmer) (§ Iowa Farmer) (§ Iowa Farmer Extra) (§ Iowa Farmer and Horticulturist) Rural Life					
Warren County Farm Bureau Exchange	Indianola	1920-23	Mo.	.....	Fred L. Overley; Warren County Farm Bureau Assoc.
Webster County Farmer	Lehigh	1928-34	Wkly.	1,000	Kent L. and Marie S. Pellett
Western Farmer	Dubuque	1895	.....	.....	McCook and Standacher
Western Farmer and Horticulturist	Ainsworth	1878	Mo.	5,616	J. H. Pearson
Western Farmer and Patrons' Helper	Des Moines	1874	.....	2,880	George W. Jones; Jones and Thompson
Western Farmer and Stockman	Sioux City	1887	Mo.	.....	W. S. Preston; Western Farmer Pub. Co.
Western Garden and Poultry Journal († Poultry Farmer may have been start of this journal)	Des Moines	1890	Mo.	.....	Emerson Depuy, Chas. N. Page; Western Garden Pub. Co.
Western Iowa Farm Journal	Carroll	1891	.....	.....	John B. Kniest, Bowman and Kelly
Western Pomologist	Des Moines	1870-71	.....	.....	J. Stoyman, Mark Miller
Western Poultry Journal	Waverly	1888-1924	Mo.	30,000	A. G. Studier; Poultry Breeders Pub. Co., Richards, Carver
	† Cedar Rapids				
Western Soil Culture	Sioux City	1895	.....	.....	H. W. Campbell
Wyandotte Herald	Waverly	1919-29	Mo.	23,000	Poultry Breeders Pub. Co.

Pioneers coming into Iowa expressed the faith of Americans in their future. Iowa farmers now live in relative prosperity and security. Their daily living has been made easier, and has been enriched in practically every phase.

24. The Farm Standard of Living in Iowa

ELIZABETH E. HOYT, *Consumer Economics*

THE COVERED WAGONS WHICH MOVED SLOWLY FROM THE East in 1846 had to camp on the Illinois side of the Mississippi until the ferry could take them over. The crossing of the Mississippi was not merely the crossing of a river. More than any other single step in the long trek of western migration it stood for the faith of Americans in their future. Their experience told them only one thing about that future; it was to be full of labor and hardship. There was no sure evidence of prosperity to come from the rolling plains beyond the river. The crossing of the Mississippi was a transition point not only in the lives of the individual men and women but in the history of the United States. It was in this year, 1846, that Herman Melville put into words the spirit that consciously or unconsciously expressed itself in Americans:

God has predestinated, mankind expects, great things from our race; and great things we feel in our souls. The rest of the nations must soon be in our rear. We are the pioneers of the world, the advance guard, sent on through the wilderness of untried things to break a path in the New World that is ours.

PIONEER PERIOD TO THE CIVIL WAR

Many times in their after lives the pioneers told the story of their search for home sites in the new country. If they arrived, as they tried to do, in the spring, it was hard to choose because every place was full of promise. The Indians had called Iowa the beautiful land. In the spring the fertility of the soil made the plains green early, and the song of redwings, meadow larks, and bobolinks welcomed the settlers. Walnuts, oaks, and poplars fringed the water courses and stood in groves among the hills. Masses of white hawthorne and pink crab apple filled the hollows. The children shouted with joy at

the wealth of flowers and begged father and mother to stop where the wild phlox grew.

Early settlers chose their homes for the most part near the water courses, for here the springs were more common and here also were trees from which their homes could be made. Flat and treeless areas were settled last, for, although they were most fertile, the houses there had to be made of sod. Furthermore, the first settlers sought the protection of the hills from the winds and storms that blew across the country. Early settlers speak often of the terrific tempests of spring and summer, the blinding blizzards of winter. So their homes, first log and then frame, were built with windbreaks around them and cyclone shelters in the dooryard.

FOOD

Even in the earliest days almost no one writes of being hungry in Iowa: Iowa has always been a country of the well fed. The food had not much variety, perhaps, but almost always, even in the hard times of '57, there was plenty. In early days wild game was added to beef and pork produced at home. There was even venison in some sections. At one time deer were sold at \$1 each in Scott County and even up to 1870 wild venison came to the table in Monroe County. Some of the early settlers speak of the continuous Boo-hoo! Boo-hoo! Boo-hoo! of prairie chickens (now almost vanished from Iowa) around their doors. The staple of the diet, after the first harvest, was of course corn, which was served in a dozen ways we have now forgotten. The English traveler, Mrs. Trollope, tells that Americans even made various kinds of cakes with cornmeal, "in my opinion all bad." But Iowa girls and boys did not think so.

Cabbages and root crops were the vegetable standbys because they could be stored in the cyclone cellars against the winter. The wild crabs and haws were preserved as apple butter before domestic fruit trees could bear. Wild plums and grapes made jam. It is true, however, that the fruit and vegetable part of the diet had grown limited and monotonous by springtime. When children got the curious disease called spring fever, which sometimes means being in love and sometimes lack of vitamins, mothers dosed them with sulphur and molasses; but the children found a better remedy by roaming the hills and nibbling the first fresh leaves of the pennyroyal.

In the early days sugar was a scarce article, and molasses, sorghum, and honey were used much more than now. It was a great day for the children when mother could spare sugar enough for homemade candy.

There was no dearth of children's labor to crack hazelnuts, hickory nuts, and black walnuts for such a rare feast.

Travelers in Iowa in this period reported a price of fifty cents commonly charged for all meals. There was often little difference in type of foods for different meals; at least meat, cake, and pie all were reported as served for breakfast.

Prices for food in Muscatine in 1854 were these: corn, twenty to twenty-five cents a bushel; flour, six to six and a half dollars a barrel (all families bought flour by the barrel in those days); beef, six and seven cents a pound; pork, five and six cents; chickens, fifteen cents each; quail, two for five cents; turkeys, fifty cents; butter, ten and twelve cents a pound; milk, four cents a quart; potatoes, twenty-five cents a bushel; peaches, a dollar a bushel; muskmelons, five cents; watermelons, five and ten cents. "Tomatoes they will give you all you want." In the same year eggs were sold at five cents a dozen in Fairfield.

CLOTHING

So far as clothing was concerned, the chief aim of the first settlers was to keep warm and keep covered. Children, one writer says "were not then annoyed with shoes and boots, or hats and bonnets. . . It was no uncommon thing to see small boys trapping for birds or hunting rabbits in the snow without shoes or hats . . . all the very pictures of health." As for style, as one man wrote back to his eastern relatives, "anything goes out here in the West." The men trapped muskrats and tanned their skins for mittens and caps. As long as the deer held out, most men wore buckskin. At first the women made their cloth from flax and wool, all their own clothes and some of the clothes of the men folks. They plaited straw for their hats. Everyone's stockings were home knit. Even very little girls often knit their own. The native dyes were walnut, which makes a dark brown, and smartweed, which makes yellow. The girls were happy if with the egg money they could sometimes get a red or blue ribbon from the store or a peddler. Before 1860, however, calicos and muslins had supplanted home-woven goods in almost all parts of the state, and men had some store clothes. Grandmother Brown, born in Keokuk about this time, made a great point of the fact she kept clean collars and cuffs on hand and always changed her dress in the afternoon though most of her neighbors did not.

FURNISHINGS

It is hard to imagine today the vast amount of production that went on in the home itself. Food and clothing were only a small part

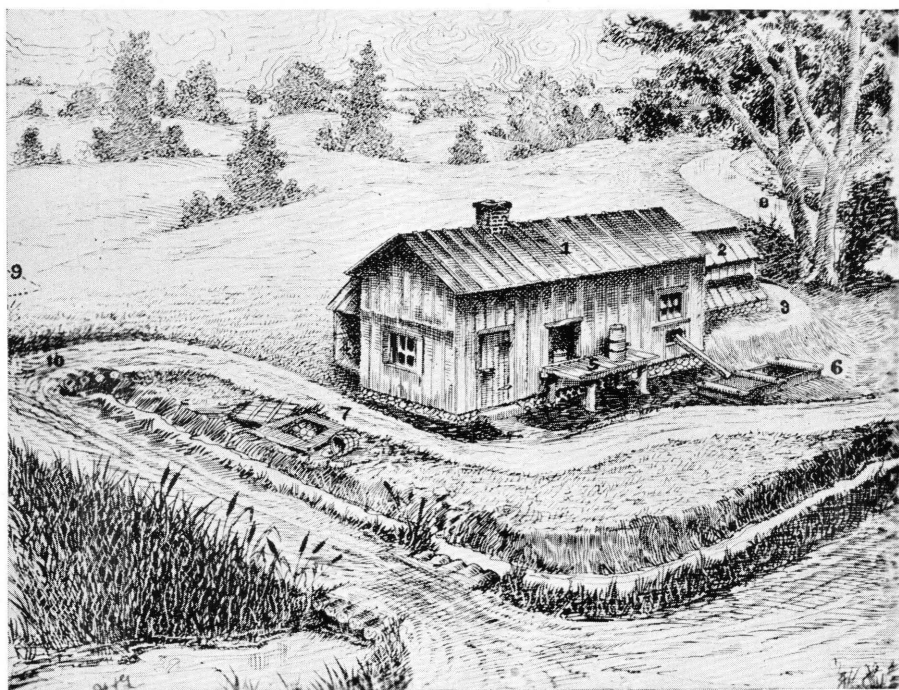
of it. Men and boys made their own tools and built homes and all but the best pieces of furniture. The mattresses were made at home of corn husks, with possibly a featherbed on top. Carpets and rugs, if there were any, were made of rags or yarn. A Brussels carpet in a pioneer house was so rare as to call for comment for miles around. The brooms were homemade, and chicken wings were used to sweep up the dust. All this work at home would have been impossible if children had not helped. "They have to scratch as soon as they're out of their shell," one mother said. At four years old little Lizzie Brown washed and wiped the dishes of a big family and she did it right.

In 1846 Bishop Thomas A. Morris, for thirty years an itinerant preacher, contrasted western homes with those in the East. In the East, he said, there must be a parlor, sitting room, dining room, with Scotch or Brussels carpets, rocking chairs, sofas, "elegant bedsteads with testers or canopies, dressed with curtains and valances," dressing tables and mirrors, very likely also "mantle ornaments, such as artificial flowers, with glass covers, or some specimens of conchology and geological formations. Besides, the walls must not only be papered, but beautiful with portraits, landscapes, etc." In the West, however, ordinary homes had not a single one of these comforts or elegancies. One or two rooms were all. Furnishings were one poplar slab table, two poplar or oak rail bedsteads, one of which was for visitors; six splint-bottomed chairs, one long bench, and a few three-legged stools; a half dozen pewter plates, some tin cups, one dish large enough to hold a piece of pork with turnips, hominy, or stewed pumpkin. "For mantle ornaments they had the tin grater . . . and the cornsplitter," while the walls were sufficiently beautified by the families' surplus garments and Sunday clothes hung on pegs. All of this, thought the Bishop, was to the credit of the western pioneers, and he observed that while the "real wants of man are comparatively few and simple, the imaginary ones scarcely have any bounds."

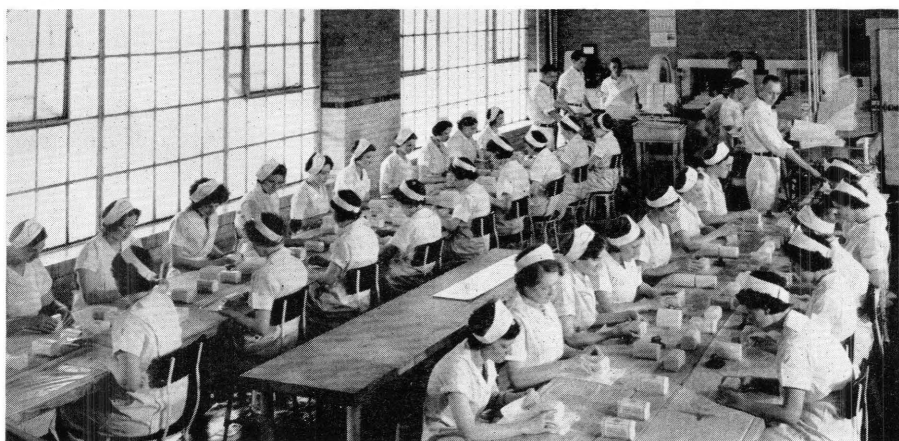
RECREATION

Recreation was not a matter of spending money for either shows or equipment. If they had made budgets in those days, some families would not have planned to give recreation one cent. The family made their own or went out and shared with the community. The Fourth of July always justified a social celebration. A speaker from town orated in the style of Patrick Henry, the people sang, and everybody enjoyed a picnic dinner.

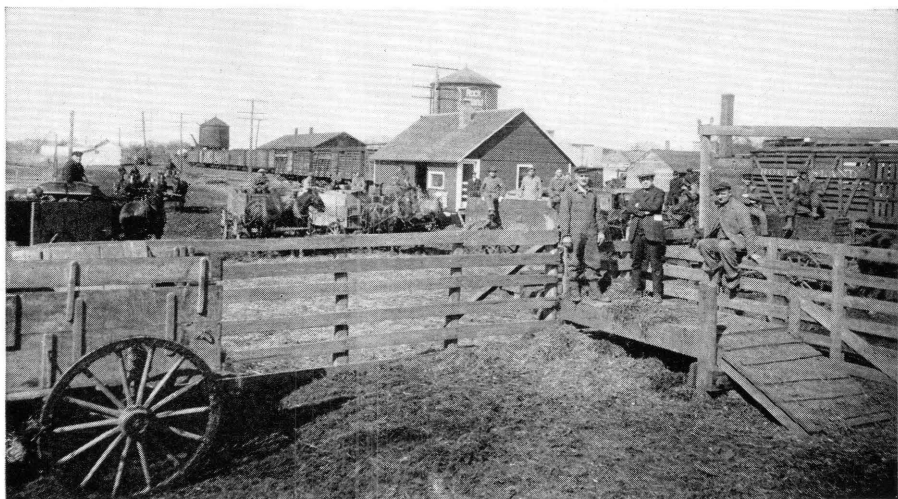
Bobsledding was a great winter sport. Fathers helped their sons



The first creamery in Iowa was started in April, 1872, by John Stewart at Spring Branch, three miles southeast of Manchester.—CHAPTER 19, DAIRY PRODUCT OUTPUT FROM IOWA FARMS.



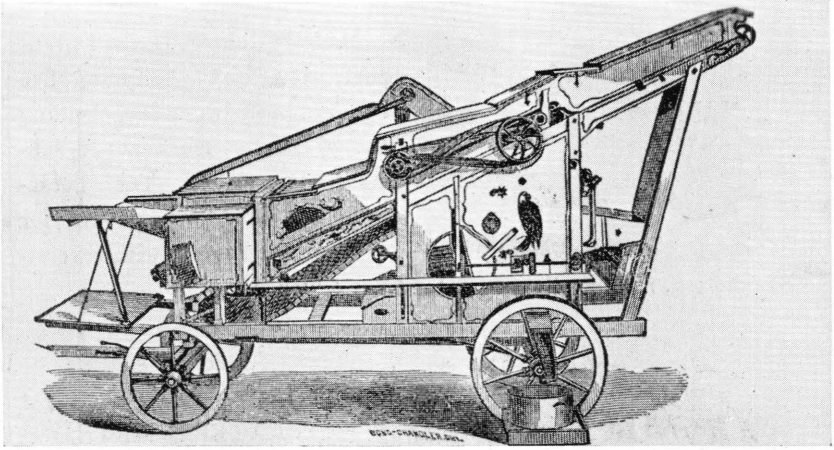
A central print room for creameries in north-central Iowa manufacturing Iowa State Brand butter was set up in Mason City headquarters established in 1927, and a campaign was started to sell butter throughout the United States.—CHAPTER 19, DAIRY PRODUCT OUTPUT FROM IOWA FARMS.



Before World War I, livestock transportation was almost entirely by rail, with deliveries at country points made by team. By 1940, nearly all of Iowa's livestock was moved from the farm by truck, mainly by common carriers.—CHAPTER 20, THE MARKETING PHASE OF IOWA FARM LIVING.



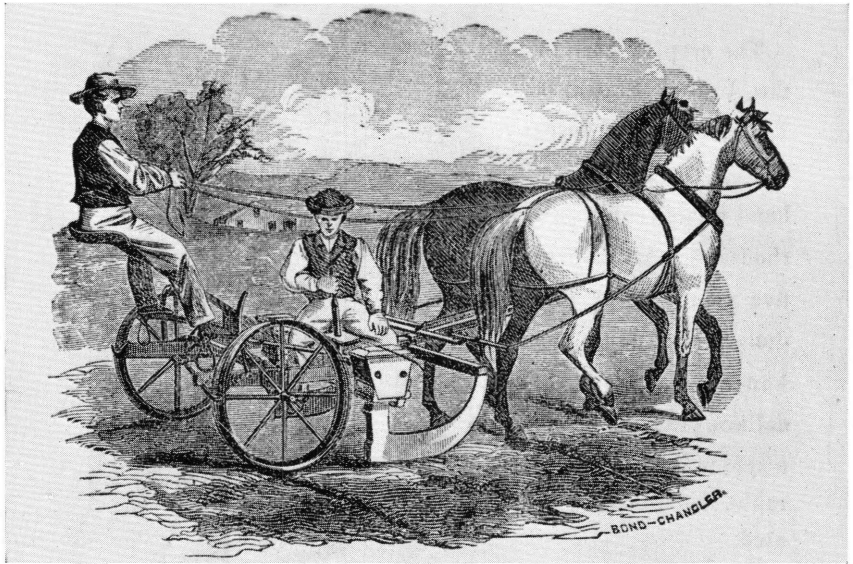
Transportation . . . was always a key factor in Iowa marketing problems. Here is one of the earlier arteries for motor flow, before the days of hard surfacing.—CHAPTER 20, THE MARKETING PHASE OF IOWA FARM LIVING.



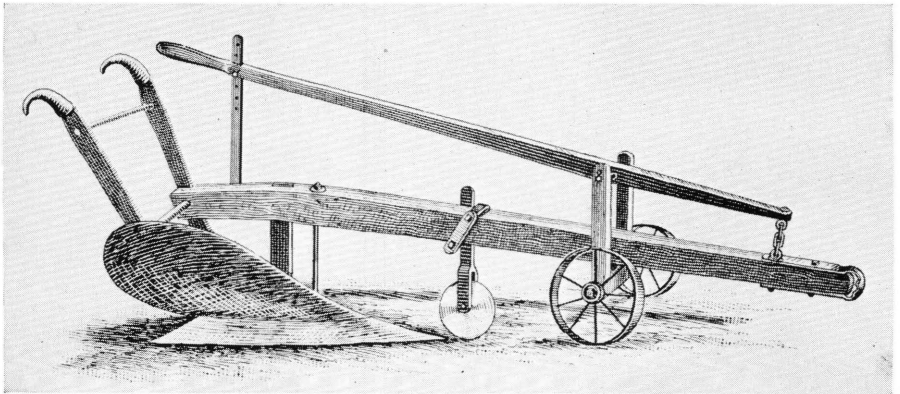
About 270 of these threshers were sold in Iowa in 1867 (\$640 complete). The machine was said to have the capacity to thresh three bushels of wheat per minute.—CHAPTER 21, THE ROLE OF MACHINERY IN IOWA FARMING.



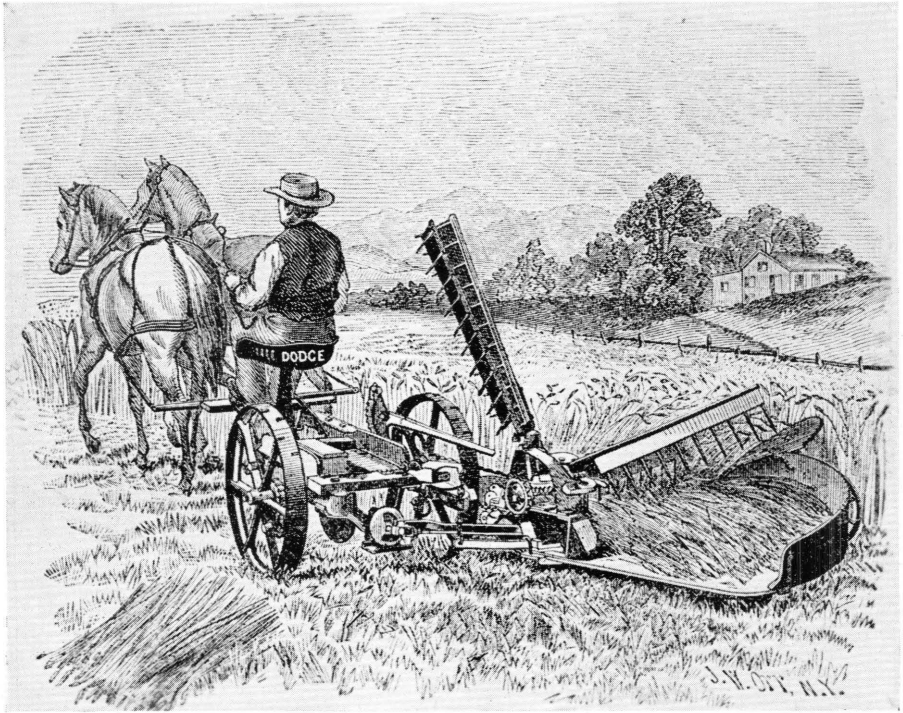
The harvesting of ear corn with a machine was one of the last operations to be mechanized. But with the improvement of the machines and also the breeding of corn hybrids which were better adapted to mechanical harvesting, the corn picker has for the most part replaced hand picking except on very small areas.—CHAPTER 21, THE ROLE OF MACHINERY IN IOWA FARMING.



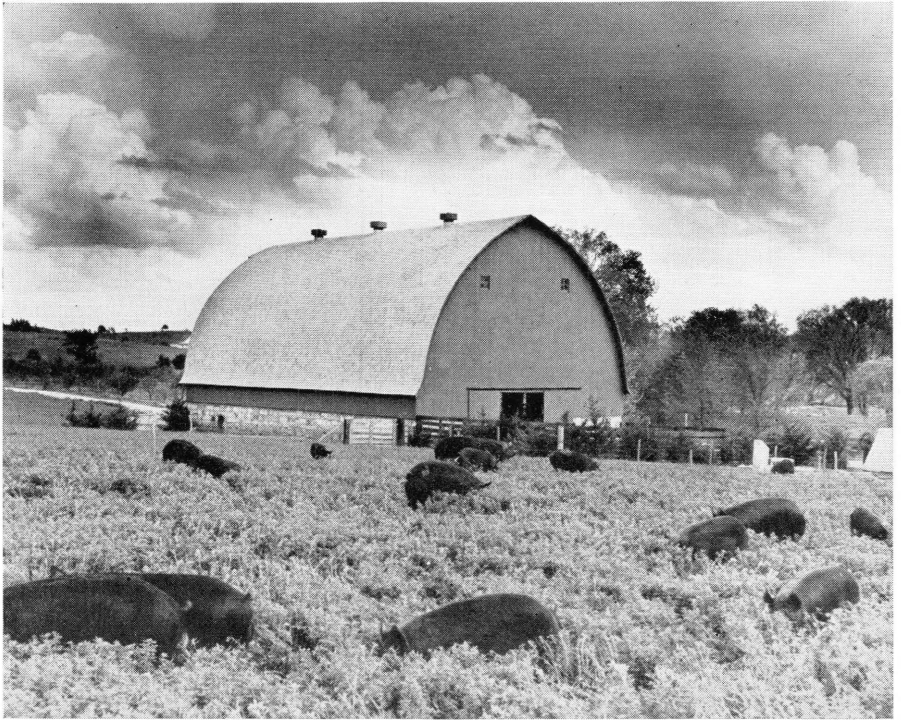
In 1867, 416 of these corn planters were sold in Iowa for seventy dollars each. Two operators were needed, one to drive the team and manage the raising and lowering of the furrow openers, and one to operate the dropping mechanism.—CHAPTER 21, THE ROLE OF MACHINERY IN IOWA FARMING.



It took a plow with a long, sloping moldboard to do the job of breaking the prairie sod in Iowa. "It is . . . like other plows but much larger, being 10 feet long and cutting a furrow some 22 to 24 inches in width. When the plow is once set in, it needs no further attention in good prairie, as it runs alone, and the driver has only to attend to his team, which consists of some five yoke of oxen."—CHAPTER 21, THE ROLE OF MACHINERY IN IOWA FARMING.



A popular machine with the early Iowa farmer was the self-rake, reaper, and mower combined. When used as a reaper the grain fell behind the cutter bar on a table from which the grain was raked at intervals and deposited in even gavels on the stubble. The self-rake and platform were removed when mowing grass.—CHAPTER 21, THE ROLE OF MACHINERY IN IOWA FARMING.



*During the latter part of the Nineteenth Century, a type of barn construction appeared which promised to be the most popular of all—the curved or so-called “Gothic roof.”—*CHAPTER 22, TRENDS IN FARM STRUCTURES.

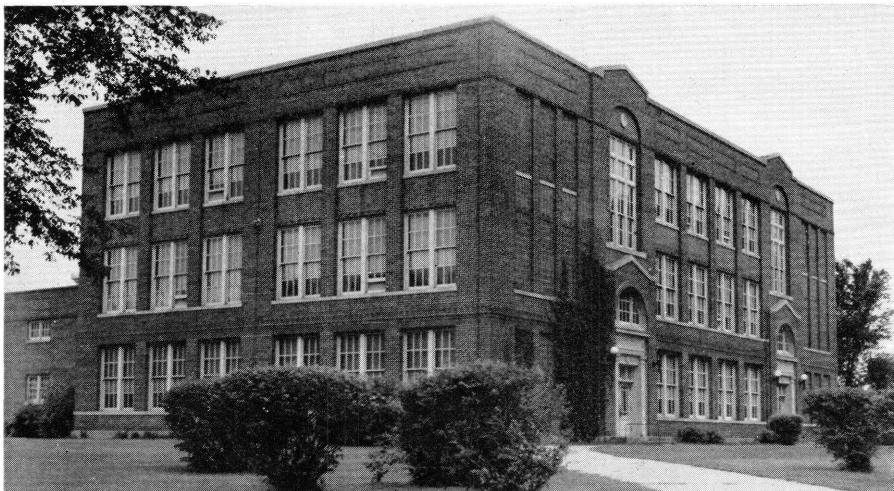


A group of livestock men in 1904 voiced the need for college-trained agricultural writers. As an outgrowth of this preliminary discussion, a group of friends and editors met on the Iowa State College campus on May 30, 1905, to formulate plans for the first course in agricultural journalism, opening in the fall of 1905.

Those agricultural leaders were: (back row, left to right) Alvin H. Sanders, C. F. Curtiss, J. A. Rutherford, Will H. Ogilvie, Mr. Farwell, R. Merrick, W. J. Kennedy, W. E. Skinner, R. B. Ogilvie; (front row, left to right) John Rigg, W. A. Harris, Mortimer Levering, Arthur G. Leonard, John Clay.—CHAPTER 23, AGRICULTURAL JOURNALISM IN IOWA.



After the act of 1919 providing for the standardization of one-room schools, there was a conscious attempt to improve qualifications of teachers, usefulness of the one-room building, and the quantity of equipment.—CHAPTER 25, SCHOOLS FOR THE FARM BOY AND FARM GIRL.



In the consolidated school, the farmer found his answer to the century-old problem of adequate education for his children. By September 21, 1921, the number of consolidated school districts authorized by vote totaled 439. This consolidated school at Crawfordsville, Washington County, is typical of those which replaced more than two thousand one-room rural schools after the turn of the century.—CHAPTER 25, SCHOOLS FOR THE FARM BOY AND FARM GIRL.

make sleds and sometimes were not too busy to build playhouses for their little girls. Corncocks found a new use: they made good dolls, which the girls dressed in scraps of their own dresses. No children were too poor to have teeters. The best games of all were games of running and of skill. If the children worked harder then—and they did—they seem to have played harder also.

As for the grownups, they got a great deal of pleasure from their sometimes infrequent social gatherings. Amusements were most justified when they followed hard work, especially the community efforts of mill- and house-raising, husking bees, and quilting bees. These were followed not only by good meals, but by dances, races, and community sings. Everyone, young and old, delighted in the recreation that came from hospitality. The settlers' houses stood open to travelers, and many were the exciting evenings when travelers' tales were told by open fire or airtight stove.

Much of the recreation was connected with social gatherings fostered by church groups. The social atmosphere was permeated by religious feeling. Children were strictly limited in their play activities on Sunday. Typical of the attitude of many good parents was that of Mrs. Maria Brown whose little boy asked that, provided he sang a hymn all the time, could he not pick out hazelnut meats on Sunday. "Certainly not," said Mrs. Brown. One traveler in Washington County reports being unable to sleep because drunks in the tavern kept arguing about theology.

Though the church was only a little behind the schoolhouse, there were yet years in some places before people had the service of a regular minister. They traveled miles to hear the circuit riders and the more devout met frequently to pray in one another's homes.

In those days of much more religious observance, there was also much more whisky. Three hundred barrels came into Des Moines on one day, April 11, 1857. The temperance movement was not yet fairly under way.

Those who write of health in the pioneer period almost always emphasize the prevalence of malaria. In those early days many undrained swamps fostered the *Anopheles* mosquito. Fevers and agues were so common as to be taken almost as a matter of course. In 1841 one doctor, the only one in a large area, went on his rounds with malaria himself. He said he "just took quinine and let her shake." Most communities, of course, had no doctors. Bishop Morris says that if a man had a severe attack of settled fever "he laid himself in a cool place, drank abundance of cold water, his wife or sister fanned him with the

wing or tail of a turkey; and he committed himself to the keeping of a kind providence, without being plied with blisters or dosed with poison." In some homes the only two books were the Bible and the "doctor's book," in which mothers looked up their children's symptoms, and treated the illness with herbs and poultices according to the book. Fortunately, the constitutions of the early Iowans appear to have been good, and strong men and women lived to a good age. However, although we have no statistics, we know that infant mortality was high.

PROSPERITY INCREASES

The main lines along with the farmers' standard of living was to develop already were laid out by the Civil War. The decades following the war were a period of slowly increasing prosperity in most parts of the country, in spite of various periods of hard times. It became clear that Iowa, by and large, had the richest soil in the United States, and the fertility of the soil began to show up in dollars and cents—although a large part of these dollars and cents were invested in new land or stock or equipment, not spent on consumption goods and services.

Emphasis on saving is the most outstanding single thing in the farmer's use of money income. This emphasis on saving is not limited to Iowa. It stands out everywhere in the United States where farmers' opportunities for productive increase have been great. The reason for this is partly the great irregularity of farm income, which influences farm families to set their standards by the income of poor years and save the rest. There is a deeper reason, however. When the town man saves, the money goes into the bank or into securities where it ceases to play a colorful part, but if the farmer puts by wisely, he gains twice; he continues to enjoy his money in the new combine, the new Hereford, the waving corn on the new forty.

The farmer's wife does not enjoy these savings quite so much as her husband, but still she usually participates. When in 1870 the Browns sold their farm near Keokuk for \$10,000, Mrs. Brown was sure a considerable part of the \$10,000 was hers. "All our married life I was just saving, saving. We shouldn't have had anything if I hadn't been saving. The secret of the whole thing was just dimes, dimes. I never got anything I didn't need, and, when I had it, I took care of it." There have been, however, some family conflicts in Iowa where the woman wanted more spent for equipment, electricity, or the improvement of the house.

FARM HOMES

Farm homes became larger and somewhat more comfortable though not generally well equipped or attractive. A state-wide survey showed the condition of farm houses about 1930. The survey took in nearly nineteen thousand home in the counties of Benton, Davis, Fayette, Madison, Mitchell, Scott, Shelby, Sioux, Story, and Webster. The average value of farm homes was estimated to be \$2,375. Highest of all was \$3,266, in an eastern Iowa county; lowest, \$1,676 in a southern Iowa county. These figures are low considering the high average value of farms in Iowa. The Agricultural Census of 1940 reported that the average value of farms in Iowa was 227 per cent of the value of United States farms; the average value of owner-occupied farm homes in Iowa was 137 per cent of the average value of United States farm homes. The survey in 1930 showed that most homes were in need of some repair, particularly of paint, and the enumerators estimated that one out of eight needed replacement. There was little overcrowding, however.

Housing includes also the beauty of the home setting. Some of the older settlers have said that more attention was paid to shrubs and flowers in the pioneer period than in that which immediately followed. Women lately arrived from the East took particular pains to cultivate their lilacs and their gardens of hollyhocks and marigolds, to make their places look like their old homes. Landscape architecture, as an Extension activity, came to Iowa farms with the first full-time specialist in 1919, the first home landscape short course in 1920. The response from farm people, though slow, has been steadily increasing. Toward the end of the thirties every Sunday in May and June would see cars from all over Iowa parked by the State College gardens in Ames, with farm men and women examining the plants and flowers, asking questions about layout. Of the nineteen thousand houses covered in the state survey previously referred to, three in four had some plantings.

The first generally-adopted piece of important household equipment, the sewing machine, arrived in the sixties. With the exception of the washing machine, most other important household equipment waited for the introduction of electricity. During the twenties and early thirties there was much complaint from Extension workers that either farm men would not give, or farm women would not demand, the money to purchase equipment for their homes, even though farm incomes would amply justify it. A study at the end of the period showed that telephones and various pieces of patented household equipment such as washing machines were much more common in farm homes than water systems and bathrooms.

DIETS CHANGE

Between the Civil War and the thirties the variety in diet greatly increased, though it is not certain that its food value became improved. These years are those of the type of food technology that devitalized flour and increased the use of sugar with its protective elements removed. The great development of education in nutrition was not to come until after 1930. Yet Iowa families were presumably well fed. The diets of 143 typical families in a 1925-28 study were analyzed in detail and found abundant in calories and rich in protein, calcium, and phosphorus. These farmers produced about 40 per cent of their food on their farms.

Prices reported for food in 1878 indicate the same low prices reported for 1854. The biggest change came after 1900.

More and more of the families' clothing was bought ready-made, until finally almost all the men's and boys' clothing was purchased and a large part of the women's and girls'. The 1925-28 study showed that about one-fourth of the amount spent for women's and girls' dresses, aprons, and underwear was for materials to make these garments at home. These comprised practically all the home garment-making for the family.

The recreation enjoyed by farm families in this period continued, and in fact still continues, to be home and community-made to a much greater extent than is true of the recreation of town and city families. Social events at school, church, lodge, and farm organization play a large part in most farm families' lives, and most farm families belong to social organizations. Investigation of family accounts in 1925-28 showed that an average of only \$6.90 per family was spent for motion pictures and concerts in an entire year. In the decades immediately following the Civil War a good proportion of the American people took part in informal recreation where they made their own music and sang songs like "The Arkansas Traveler" and "Don't Leave the Farm, Boys"; participated in Virginia Reel and Grand Right and Left; and applauded their own shows and skits. On Iowa farms the Farm Bureau and Farmers' Union encouraged the continuance of community entertainment, and in the twenties the Extension Service began to include music and drama among its programs for farm people.

This same 1925-28 study made special comment on medical care for Iowa farm families. Many families in cases of illness "sought medical care tardily or not at all, and most of them failed to make regular periodic use of medical and dental examinations. . . It was found that families neglected their health, in part from lack of knowledge, in

part from ideas of economy, and in part because of a lack of health facilities in their community."

The narrower religious views of the earlier period softened. Dancing, card playing, smoking ceased to be so frowned upon. There was much less argument about theology. The liberalization of thought, which in some parts of the country has been marked by departure from religious observance, in Iowa has taken place to a large extent within the church itself. The church has become to a much greater extent a place not so much where dogma is handed out as where men seek the truth. For example, a Methodist Sunday School discussed whether there was a God or not, and followed it by asking a Hindu and a Buddhist studying at Iowa State College to present their views on the subject.

BROADENED INTERESTS

It was once said of Iowa farmers and their wives in the pioneer period that though they wanted to keep up with current events from the newspaper, they did not have much "hankering after book learning." Several field studies showed that though Iowa farm families spent little for books, they generally subscribed to several magazines and newspapers. The 1925-28 study previously referred to reported an average per family of \$1.20 for books and \$12.13 for periodicals within a year. There were few local libraries and about three-fourths of the families never used a library.

The period of increasing prosperity was accompanied in the United States as a whole by a desire for "culture," "refinement," contact with European art and music, budding emphasis on manners and general sophistication. Iowa farm families were not greatly interested in this movement. They did not look back much either to the East or to Europe. The 1925-28 study of 147 typical families showed, for example, that in spite of ties with the East, the farm women who had had a chance to travel had generally chosen to travel west. There is a close relation between the farm families' distrust of "culture" and leisure, and their emphasis on good hard work. By this they were saved from the superficial or false sophistication that characterized some portions of American society during this period and led to a spirit of social defeatism after the first World War. There was never any defeatism in rural Iowa, and Iowa farm men and women were never soft. It is true, however, that a little more emphasis on spare-time occupations would have helped them when, in old age after they had retired from the farm, some of them were at a loss because they

had developed few of the interests which can flourish in leisure.

The early part of this period brought the practically universal acceptance of a common school system in Iowa. Its over-all educational rating is among the highest in the nation.

College and university education expanded rapidly. The 1925-28 study showed that most farm families at least wanted to send their children to college.

The one particular form of education that was most significant in differentiating the farmer's and particularly the Midwest farmer's standard of living from other standards was Extension education in agriculture and home economics. The first Farmers' Short Course in Iowa, believed to be the first held anywhere, was in 1902; two years later the farmers brought their wives, who studied home economics. Formal Extension instruction had begun at the State College in 1904, and the federal act of 1906 provided for a permanent Extension Service. At present in Iowa the rural Extension movement touches in some formal way half the families of the state; indirectly and informally it influences them all.

The real beginnings of the Extension movement precede the formation of the present large farm organizations that support it, the Farm Bureau, the Farmers' Union, and the Grange, and long precede the federal government's active concern in agricultural education. The real beginnings were found in the vigorous interest of Iowa farm families from the first in improving their material condition and in the many opportunities they made to advance better practices on their own initiative. When men met among themselves on social occasions for any purpose, the discussion of crops and live-stock was sure to enter, and when women met, their chief topic was the home.

The lyceum and literary society movement, which swept the country in the years following the Civil War, became in Iowa another significant agency for agricultural education, and in the problems of citizenship as well. To be sure, such diverting topics as "Resolved: the works of nature are more beautiful than the works of art," were argued, but farmers generally wanted something more practical when they came together.

In the nineties visiting delegations of farmers and their wives began to come to the Iowa State College campus in the summer, sometimes as many as five thousand in a single day. The railroads gave low rates and advertised excursions. The farm families brought picnic lunches and spent their day inspecting the work of the college.

A farmer was heard trying to drag his wife away from her home economics observations by calling, "Ma, you've got to look at this cattle barn. It's cleaner than any room in our house."

Complete records are shown of a society of farmers' wives which carried on in Harrison County from 1872 to 1897. To these meetings women brought their health problems, their household problems, and their recipes. Often, since they came from long distances, these recipes were in the form of food ready to eat. The husbands of these ladies inclined at first to make fun of them because they had a bylaw against gossip. Any woman who spoke disparagingly of another had to pay a fine. We read, however, that when the ladies put on one of their good dinners "quite a number of gentlemen assisted" by sitting at the tables while the ladies brought on the food. Plain sewing was to be encouraged, but fashions were disapproved of. One of the bylaws specified that in order to discourage emulation the women must come to meetings in a "plain home dress." The purpose of these farmers' wives' meetings was primarily to discover the science of homemaking, food preparation, candle-dipping, quilt piecing, cleaning, and sanitation.

By such movements arising directly among the people the way was prepared for Extension education in agriculture and home economics.

A NEW PATTERN—SINCE 1930

Since 1930 the farm standard of living, especially in the Midwest, and specifically in Iowa, has begun to stand out as a new and distinctive pattern, with its goals emerging from within rather than set from without. Its foundations, of course, lay in the independence of the pioneers. We have seen how, in the middle period, children of these pioneers consciously or unconsciously declined to be drawn at all deeply into the somewhat superficial refinements that were spreading over city and town in the United States. Furthermore, they escaped any rapid transformation from the impact of a complete machine culture. In this middle period some writers spoke of the farm standard as having a cultural lag because it was not urbanized. Actually, the farmers did not want the kind of urbanization available; their ignorance was not so significant as their independence. They were quite capable of moving, but first they wanted to be sure where they were going.

In recent years large increases in income have come to Iowa farm families. In the past there have normally been great fluctuations in farm incomes, so no one can say how permanent the recent increases

will be. But for the time, at least, Iowa farm families are better off in money terms than any other large group of people in any state.

The average Iowa net farm income in 1944 was \$3,856, compared with an average \$2,269 farm income in the United States as a whole. In other words the average of Iowa farmers' incomes was 70 per cent more than the average for the nation's farmers. Iowa farmers have had a relatively large share of government payments for crops and livestock. In 1940 and 1941 Iowa farmers, although only 3 per cent of all American farmers, received 8 per cent of the total of a billion dollars.

Iowa farms stand a little higher than other American farms in respect to certain conveniences reported to the Census, as shown in Table 14.

TABLE 14
PROPORTION OF IOWA FARMS AND OF ALL UNITED STATES FARMS
HAVING CERTAIN CONVENIENCES, 1940
(U. S. Bureau of the Census)

Conveniences	Percentage on All Farms	Percentage on Iowa Farms
Running water.....	18	22
Flush toilets.....	11	15
Bathrooms.....	12	15
Electricity.....	31	40
Mechanical refrigeration.....	15	16
Radios.....	60	87

In 1940 the United States Department of Agriculture drew up a scale to measure the level of living on farms. Iowa led the nation with a rating of 131. Illinois came next, ten points below Iowa. The lowest states were Alabama and Louisiana, with 64. Iowa's lowest county ranked as high as or higher than the highest county in nine of the states.

The scale, known as the Hagood Index, gave farms points for having a radio, a car less than five years old, gross income of more than \$600, the grade in school completed by farm adults, and the number of rooms per person.

It must be pointed out, however, that while the over-all standing of Iowa farmers is high, there are considerable differences of income among them. The last year for which we have figures is 1941, when the lowest third in incomes received less than one-fifth as much as the highest third. The low-income farmers received much less in govern-

ment payments also. In 1939-40 an Iowa State College study of a selected group of farmers showed that the upper third in income received \$350 from the government, the middle third \$179, and the lower third \$152. The net effect of government payments to farmers was therefore not to make their incomes more equal but to give most to those who already had the most.

Differences in levels of living within Iowa itself also are brought out by the Hagood Index. It has been said that the average for all counties in Iowa was 131. The highest county rated at 145, the lowest at 115.

With means for an Iowa farm family scale of living well above the American minimum, the chief material problems today are not monetary but rather those of wise choice and of availability of goods and services.

It has been said that farmers are great savers. During and immediately after World War I, farmers who put their savings into land bid up its price and, by this overcapitalization of their plant, some of them in the end reaped bankruptcy and disaster. At the end of World War II the same danger showed up, and was the more serious because many of the things farmers would like to have bought were not on the market.

In 1946 the fields of living in which Iowa farm families were most conscious of need for improvement were housing, equipment, health, and education. Food was already good; clothing was adequate. Farmers and their wives were not especially interested in expenditures for showing off. State Extension workers in 1946 reported that farmers were particularly anxious to improve their homes. Unfortunately, housing materials and equipment were only to a small extent available. Cars were hard to get, also.

Improvement in health also was to a large extent a matter of availability. In a study of Iowa's rural health facilities in 1945 it was shown that in villages under one thousand, there was but one physician for fifteen hundred people (1940 statistics), less than half the standard of the Committee on the Cost of Medical Care, and even below the war emergency standard of the War Manpower Commission. Iowa as a whole stood low also in hospital beds. Expenditures for public health by the state increased from \$150,000 in 1932-33 to \$665,000 ten years later, mostly as a result of federal grants. The individual, whatever his money income, can do little to draw physician and hospital services into his locality; social action is required. Farm organizations are now taking active steps in Iowa to bring about more adequate health facilities.

EDUCATIONAL DEVELOPMENTS

Iowa schools are getting better and more children are going to college. The educational developments must characteristic of farm Iowa, however, are those closest to the corn roots, those of the people by and for themselves, and these are very broad. There is less of a separation between work and education, and recreation and education, among farm families than among others. Not only on the farm but in the topics and programs for state and local groups of farmers it is often hard to tell where work leaves off and recreation and education begin. In this broad sense the chief educational agencies in rural Iowa continue to be the farms and homes themselves; their work and play are supplemented by radio programs, and by the general reading of newspapers and agricultural journals, and to a small extent by the use of public libraries.

Public library services for Iowa rural people are rather limited. In 1941, 77 per cent were without free public library service, although urban people were well supplied.

Beyond what is done in the home, on the farm, and at the school, the chief agencies of education are Extension programs for farm men and women, boys and girls, and township and county meetings for everyone together.

Basically the chief purpose of these programs is as it always was—better preparation for the duties of the farm and home, with emphasis on topics like control of the cattle grub, kitchen planning and child feeding, systematically presented. But with this there is much more. Marjorie Patten, in *The Arts Workshop of Rural America*, says that Iowa has probably gone further than most states in an integrated arts program. These arts include not only landscape architecture and interior decoration but appreciation of poetry, picture-study, crafts, flower arrangement, and drama. The farm people have a full-time specialist in the last. Miss Patten is especially impressed by Iowa's farm music. Orchestras and choruses, even opera, are fostered by the Extension Service. In 1935 and 1936 farm people gave remarkable performances of "The Bohemian Girl" before audiences of twelve thousand at Ames and Des Moines. Further, the study and appreciation of music has been used to develop international understanding. Music from many lands, music from the homes of all nations, and Latin-American pageants are themes serving a double purpose.

Finally, and most striking among the latest developments in the interests of Iowa farm people, these interests are moving more surely into the problems of citizenship, national and international. This

also has a background in earlier periods, for meetings of farm people were always places to argue when some dramatic issue like free silver was in the air. Also, of course, they have always been concerned with national issues that related immediately to their own prosperity. There has been at times some criticism of the Extension Service for teaching, and of farmers for promoting, certain narrow policies of the United States Department of Agriculture without regard for the larger interests of the nation as a whole. More of a menace are the still narrower policies of some very vocal agricultural pressure groups. These dangers are recognized by the more farsighted leaders of Extension and by the more farsighted farm people. On a farm leaders' guide for township meetings in 1945, for example, we find this subject for discussion: How can we get away from special government aid?

Interest in international problems has grown rapidly in the last decade. In most if not all of the ninety-nine counties there is now some formal attention to world peace and international organization, discussed not only in general but in relation to specific current topics. In 1946, a number of Extension leaders told the writer that they considered this international concern to be the most noteworthy single thing in the expanding interests of Iowa farm families. Such interests were particularly marked among rural young people. The 4-H Clubs had in 1937 put on their first annual World Citizenship Program, in which Iowa led the other states by several years. International needs were made more real to many Iowa farm people by the forming of the United Nations Food and Agriculture Organization and the visit of its head, Sir John Orr, to Iowa.

One hundred years is a short time in terms of history; in terms of change on Iowa farms it covers a great deal. Where Iowa farm families formerly lived in hardship and poverty they now live in prosperity and relative security. Where they formerly worked long days at a score of different tasks they now purchase equipment and farm and household goods formerly produced at home; their days are shortened and their tasks are lighter.

Where they formerly lived in isolation they now have cars and telephones, friends near to them, social opportunities within easy reach. Where they formerly were unschooled they now have education brought to their very doors. Their daily living has been enriched by the arts in a dozen ways, by science in a hundred.

This is partly due to their vision, their integrity, and their hard labor. It is partly due to the fortunate accident that Iowa is blessed with much of the country's richest soil. It is partly due to the fact that the

whole world has moved in the last hundred years at a faster rate than it ever did before, and the world has become a smaller unit. Iowa has experienced chiefly the beneficial side of world changes.

The standard of living on Iowa farms, to advance indefinitely, even to survive, will be related more than it has been in the past to the course of events in the United States as a whole—even to the course of events of the world outside the United States. Already, to some extent, Iowa people know this, as is shown by their increased interest in national and international affairs. The problem ahead for them in the next hundred years is to express this larger citizenship.

In the days of early settlers, parents paid the cost of education themselves, both in money and by donating firewood to the school's fireplace and taking turns in boarding the teacher.

25. Schools for the Farm Boy and Farm Girl

M. L. CUSHMAN, *Rural Education*

WHEN IOWA ENTERED THE UNION IT BROUGHT WITH IT A number of schools and even a school "system" established during the territorial period. The first school in Iowa was taught by Berryman Jennings between October and December, 1830. The school, located on the Half-Breed Tract close to Nashville in Lee County, was a one-room log cabin with greased paper windows, a fireplace, dirt floors, clapboard roof, and rough-hewn split-log desks along the wall.

By 1848 there were 673 organized districts in the state, although only 105 schools were actually operating. Of more than forty thousand persons between 5 and 21 years of age, only about seven thousand or less than one in five were attending school. Ten years later 2,200 district schools were in operation. By 1858 there were 1,725 school-houses in the state. At least 375 were made of logs, 852 of frame construction, and 119 of brick or stone. Many of the first teachers were men. In 1848 there were four men to every woman teacher. By 1858, however, women teachers outnumbered men three to one.

Such pioneer schools as that conducted by Berryman Jennings lasted many years. As the frontier moved westward across Iowa in the fifties and sixties, schools were established by the initiative of the pioneers. Many of the county superintendents of this period were ministers. Rev. C. Taylor, superintendent in Kossuth County in 1867, reported on conditions of the rural schools of his county as follows:

But the inhabitants in the county do not wait for the public to provide school-houses. Schools they *must have*, houses or no houses. In visiting the schools in the county, I have found two in private houses, with only a slight partition between the school and the family. One was in a forsaken log shanty, which needed neither door nor window to let in light and air, the crevices between the logs answering for windows, though not quite large enough for a door. One school was in a

mere temporary board shanty, without any floor, put up just for the summer. They have a new house nearly or quite completed. Two schools were kept in sod houses, a style of building which is becoming very fashionable in this country, and which will become more common in other places when people learn how comfortable such houses are.—*Report of Superintendent of Public Instruction, 1868.*

By 1857 a legal school organization and a method of financing it had been developed. Under laws enacted prior to the adoption of the new Constitution in 1857, school districts had been of two kinds—township districts and city, town, or village independent districts. These districts, when authorized by a vote of the electors, could borrow money to erect buildings, levy taxes, and otherwise provide for the maintenance of schools. There was considerable dissatisfaction with the organization of local school districts in rural areas. The seventh session of the Iowa General Assembly provided that "Each Civil Township is hereby declared a school district and such districts as at present organized shall become subdistricts." The effect of this law was to reduce the number of districts from 3,500 to less than 900, but there followed quickly a demand for independent district organization. The General Assembly in 1872 enacted a law whereby all township subdistricts might by a vote of the electors of the township at large become independent. This resulted in the creation of almost innumerable school offices.

The local independent district plan was expensive from the standpoint of having too many salaried officials. It also left many districts so weak and with such reduced support that the maintenance of schools became exceedingly burdensome, while other districts were able to maintain much better schools at a very low assessment upon the property of the districts because of their greater population and greater property valuation. In 1900, there were 330 schools in the state that had fewer than five pupils in attendance; 3,600 with less than ten; 6,370 with less than fifteen; and 9,300 with less than twenty.

Not only was the organization of school districts for rural people divided among a large number of independent districts, but after 1860 there was a tendency to separate the education of farm people from the education of those people who lived in Iowa's budding villages. The legislature permitted each village to organize independently. The minimum population of the village varied from year to year as is shown:

1856.....	200	1868.....	200
1860.....	1,000	1895.....	100
1866.....	300	1915.....	75

The general trend was downward, so that more and more smaller and smaller districts could be organized. Thus, when the movement for school consolidation was well under way just prior to World War I, school districts for rural people were exceedingly small in area, in number of pupils, and in assessed valuation. The history of rural education in Iowa is largely the history of a struggle to overcome the difficulties imposed by the one-room school district system. Until 1900 lack of transportation and such other factors as the tendency for pupils to leave school after the completion of the eighth grade made the one-room school system rather feasible. Hence, efforts to improve education up to 1900 were largely efforts to make the one-room school system function effectively.

THE ROLE OF THE COUNTY

The most important single agency for improving the established one-room district system was the county. The "free school" act of March 12, 1858, which made the civil township the basis of local district organization, also provided for the election of a county superintendent of schools biennially in March. The county superintendent had authority to issue teaching certificates, to conduct examinations in such subjects as orthography, reading, writing, arithmetic, geography, and grammar, and to organize teachers' institutes. In 1859 the supervisory powers of the county superintendent were repealed, but in 1866 the Iowa Legislature restored them and required the county superintendent to visit each school in his county at least once in each term and to remain at least one half day at each visit. His minimum salary was established at three dollars a day.

In 1890 a law provided for county-wide uniformity of text books. This was an attempt to overcome the difficulty previously encountered where the pupils in many country schools each had a different text book, usually inherited from older brothers and sisters or even parents. This year also saw the creation of the county board of education, consisting at that time of the county superintendent, the county auditor, and the county board of supervisors.

The qualifications of the county superintendent were progressively raised after 1900. In recent times the office of the county superintendent has been given greater permanency, a greater degree of prominent standing, and a more adequate compensation. But the many clerical duties with which the county superintendent is confronted, the lack of fiscal independence by the county board of education, and the lack of assistant superintendents specializing in

various aspects of rural school supervision has made the office less effective than it might be in improving the education of rural people.

FINANCE

Paying for the education of rural boys and girls in Iowa has always been a difficult problem. Originally, when Iowa became a state, parents paid the cost of education themselves both in money and by donating firewood to the school's fireplace and taking turns in boarding the teacher. Also early in Iowa's history, when practically all education was rural, the permanent state fund was an important source of income for local school districts. But owing to the mismanagement of this fund, it ceased to be important soon after Iowa became a state.

In 1913 the Iowa General Assembly authorized state aid to encourage formation of consolidated schools. Additional state aid for rural schools was made available in 1919 in the act providing for the standardization of the one-room schools. After that time there was a conscious attempt to improve qualifications of teachers, usefulness of the one-room building, and the quantity of equipment. The program was only partially successful, however, since on the average no more than 20 per cent of the one-room schools in the state had achieved the standard school rating between 1919 and 1942. During the depression of the thirties, the legislature required all school districts in the state to reduce tax rates.

In general, throughout the history of rural education in Iowa, rural people have had to depend upon the rural property tax for financing the education of their children.

TEACHER PREPARATION

When Iowa became a state, teachers for rural children were not required to have professional training. The first provision for professional training of teachers is found in the act of 1847 establishing the State University. This act provided for free instruction of fifty students each year "in the theory and practice of teaching." At this time no legal requirements for the examination of teachers were made, but the legislature in 1858 provided scholarships in the high schools and in the University for selection and education of youth for the teaching profession. "It was the design," explained M. L. Fisher, superintendent of public instruction, "to make teaching the most honorable, the most intellectual profession; to attract talent from the barren, rugged, boisterous field of political strife, to the quiet, fertile, flowery gardens of science."

In general, most rural teachers were certified by the county superintendent, but certification of teachers was centered in the state by an act of 1882, which created the State Board of Educational Examiners. In 1890 this board was authorized to issue certificates to graduates of the State Normal School at Cedar Falls, which had been established in 1876. That county superintendents found it difficult to secure well-qualified teachers is evident from the report made by T. R. Eastman, superintendent of Linn County in 1868:

It is preposterous to attempt to employ qualified, efficient, industrious workers, at this time, at one hundred and seventy dollars per year. . . . We pay thirty thousand dollars annually for the education of ten thousand children, \$3 for each child—not half what is required to keep a steer so long. Now if we pay double for the raising of steers that we pay for the education of children, we must not be surprised if the oxen make the best appearance in the world, and discharge their duty best.—*Report of the Superintendent of Public Instruction, 1868.*

In 1911 normal training programs in the high schools of the state were established, and in 1913 state aid was granted to the approved normal training high schools with twelve weeks of normal training required of all applicants for teachers' certificates. In 1929, completion of a four-year high school course was required of all applicants for the teacher's certificate.

The law of 1945 provided for the discontinuance, by September 1, 1948, of the high school normal training courses. After September 1, 1952, the lowest certificate recognized in the state will be the standard elementary teaching certificate which requires a minimum of two years of college credit. It seems certain, therefore, that after 1952 rural people may be sure that their children in the one-room schools will be taught by teachers with a minimum of two years' professional preparation. Throughout the one hundred years of the history of rural education in Iowa, country people have had to be satisfied with teachers with little training who frequently used the one-room schools as a training ground for teaching in the village and city schools. The example set by Iowa's first rural teacher, Berryman Jennings, who in 1830 went from the teaching of the one-room log cabin school in Lee County into the profession of medicine, has been followed too frequently throughout the century.

IMPROVING THE CURRICULUM

From early days there have been many attempts to improve the program of studies for rural boys and girls. Readin', 'ritin', and 'rithmetic, the three R's, characterized the earliest log cabin school program of studies. It was not until 1878 that the first state course of

study for graded elementary and high schools and for rural schools was established. In 1886 the teaching of physiology and hygiene, with special reference to the effects of narcotics and stimulants, was required. In 1900 a law required the teaching of music in all public schools, and one in 1913 required the teaching of agriculture, domestic science, and manual training. This provision was changed in 1917 so as to make the teaching of such courses optional in the one-room rural schools. The teaching of American citizenship was required by law after 1919, and the teaching of the Constitution of the United States was required in all Iowa schools after 1921. Ten years later all elementary schools were required to teach Iowa history.

Iowa's acceptance of the provisions of the federal Smith-Hughes Law in 1917 greatly stimulated vocational education in agriculture and home economics in the rural high schools. By 1942 approximately two hundred high schools in Iowa were offering vocational courses in agriculture, and somewhat less than this number vocational courses in homemaking. With approximately eight hundred rural high schools in the state, the vocational education programs in agriculture, homemaking, and farm shop are probably reaching not more than 25 per cent of the rural youth who might take advantage of such courses of study. It is fairly certain that, particularly because of their smallness, Iowa's rural high schools are still dominated by an academic curriculum.

HIGH SCHOOLS

It has been a struggle just to get high schools established in rural areas. Cities established high schools before rural towns did, but in 1858 a law authorized counties to establish a county high school. Modifications of this law in 1870 and 1873 authorized each county to provide a county high school with instruction in any subject and a tax sufficient to pay tuition of any pupil in the county. Only one high school was ever organized under these statutes, the Guthrie County High School at Panora. At its opening session in 1876, fifty pupils were enrolled under two teachers and throughout most of its history as a county high school, Panora trained many teachers for the county's one-room schools. When the legislature repealed the law in 1933, Panora became by law the village independent district—which it had long been in fact.

Because the county was too large an area for high school attendance, several township high schools were established in the sixties and seventies. The law of 1858 appeared to grant full authority for the

establishment of township high schools. A township grade school was developed in 1865 for St. Charles Township in Floyd County, and in 1866 a high school department was established in Monticello Township in Jones County, with classes for special instruction and drill in the theory and art of teaching. During the fall and winter terms following 1866, the school recorded a total attendance of a little less than four hundred pupils, most of whom came from the rural districts. Clarence Aurner reports:

In 1903 the township high school at Moorehead in Monona County held its first commencement, which seems to have been of such importance that it attracted wide attention. Indeed it was considered an event in Iowa school history inasmuch as it was experimental. The school having been opened in 1900 in a village of 200 population, it was noted that of the 16 pupils who completed its course of study, only three resided in the town. Its curriculum, however, included not more than two years of high school subjects, but the fact that some of those in attendance had come from long distances without losing a recitation indicated the value placed upon such instruction. Graduation exercises were an event entirely new to many parents and friends. As a matter of fact the whole undertaking had to overcome considerable opposition.—*History of Education in Iowa*, Vol. 3.

The period around 1900 seems to be the time when rural people began to recognize that if their children were to receive secondary education, it would be necessary to make use of the high schools which were rapidly becoming established in the towns and villages.

Since the towns and villages had been permitted early in the century to establish school districts independent of the surrounding farm territory, it was necessary for farm people to pay tuition to the high schools in the growing villages. At first this tuition was paid by the parents, but after 1911 tuition was paid by the district of the pupil's residence. In 1904 and 1905 State Superintendent John F. Riggs reported 560 public high schools offering two years or more of high school work. A great many doubtless accommodated pupils from outlying rural districts. Since 1911 attempts to provide high school education for rural youth have taken two forms: nonresident attendance at the village high school by farm boys and girls with tuition paid by their sending districts, or a reuniting of farm territory with the town and village in order to make a single high school district.

POPULAR ATTEMPTS TO IMPROVE EDUCATION

That the state and its rural people have been aware of many shortcomings of rural education in Iowa is evident by the numerous survey commissions proposing remedies for improvement. The First Iowa School Commission in 1839 recommended a system of education for the new territory. The Second Iowa School Commission in 1856,

with Horace Mann as chairman, urged revision of the school laws, but many of its recommendations were ignored, particularly those calling for a larger rural school district. The Third Iowa School Commission in 1907 revised the school laws, but the proposed code was rejected by the Thirty-third General Assembly. In 1911 the "Better Iowa Schools" Commission made a study of current educational problems. In 1942 the General Assembly created an Iowa School Code Commission to revise and recodify the school laws, but its recommendations were not enacted into law. In 1944 another School Code Commission made a report to the General Assembly and thirteen of its twenty proposed bills were enacted by the Fifty-first General Assembly. Many of these were designed to assist in improvement of rural education. These included agricultural land tax credit, discontinuance of school facilities and transportation to graded districts, fixing of tuition rates, state aid for transportation, and the school district reorganization law by which the initiative for reorganization was given to county boards of education. It is now generally recognized that reorganization of rural school districts into larger units is a prerequisite to further improvement of conditions of rural education in Iowa.

SINCE 1900: SEEKING LARGER SCHOOLS

Until 1900, rural people were able to get better education for their children by improving the curriculum, providing better training for teachers, and other measures. Since 1900 it has become increasingly clear that better rural education depends upon larger schools.

A hundred years ago, even fifty years ago, the farm and its immediate neighborhood were self-sufficient. The farm family produced nearly all its food except salt and sugar, and nearly all its own clothing. Local grist mills ground the farmer's grain into flour. Local blacksmith shops fashioned his plows and wagons. But railroads came, and automobiles and telephones, and with them a breakdown of local self-sufficiency. Once the district formed around the one-room school was the center for box socials, husking bees, threshing crews, barn-raising, and house-warmings. Today the rural social center has moved to the village. Village-centered high schools and a decline in farm population made the small school district less and less a natural unit.

At the same time, as the farm population fell, each farm taxpayer had to pay a larger share of school costs. Education offered was poor and pupils' progress slow and uncertain. Many schools had fewer than ten pupils, and their attendance was often irregular. Low salaries

meant poorly-trained teachers, sometimes two or three different teachers in a single year.

It was out of these conditions that the consolidated school movement in Iowa developed. Though many other states had established the system, Iowa did not make a beginning until 1896, when the first consolidated school in Iowa was organized at Buffalo Center in Winnebago County. Previous to this time Buffalo Township had been divided into nine subdistricts. Since there were no consolidation laws on the statute books at this time, the township first organized into an independent district with five directors in place of the nine. The purpose was apparently to centralize administration, for at first it was not proposed to close the country schools and transport the children. There arose at once a demand by the people in the rural districts for better school facilities, and in 1897 all outlying districts except three sent their pupils to the centralized school at Buffalo Center with transportation provided by horse-drawn vehicles. In that same year a law was passed which legalized the transportation of children to and from school in the same or in other school districts, with expenses paid from the school's contingent fund.

The second consolidated school was organized at Terril in Dickenson County where nine subdistricts were closed in Lloyd Township in 1901. The third was at Marathon in Buena Vista County in 1902, and the fourth was in Lake Township in Clay County in 1903.

Though it was a voluntary union of subdistricts, such an organization was technically illegal until adoption in 1906 of a law legalizing the organization of the consolidated independent school district. The act required a contiguous territory of not less than sixteen government sections of land. It required also that a petition requesting consolidation be signed by one-third of the electors residing in such territory, approved by the county superintendent of schools and filed with the school district board having the largest number of electors. This board had to call an election within ten days. If the proposed district included a town, rural voters were allowed to vote separately by presenting a petition signed by 25 per cent of the voters. A majority vote was necessary in both town and in rural farm territory. This law has since been modified many times, but these basic features have been retained and they are the foundation of the consolidated school movement in Iowa.

Rural people were becoming convinced that a larger school district was the solution to the perplexing country school problem because it gave advantages of organization and classification of the pupils that

was impossible in the one-room school. It offered high school provision within easy reach of children's homes. Most important, it made the school the community center, and people began to take more interest in education.

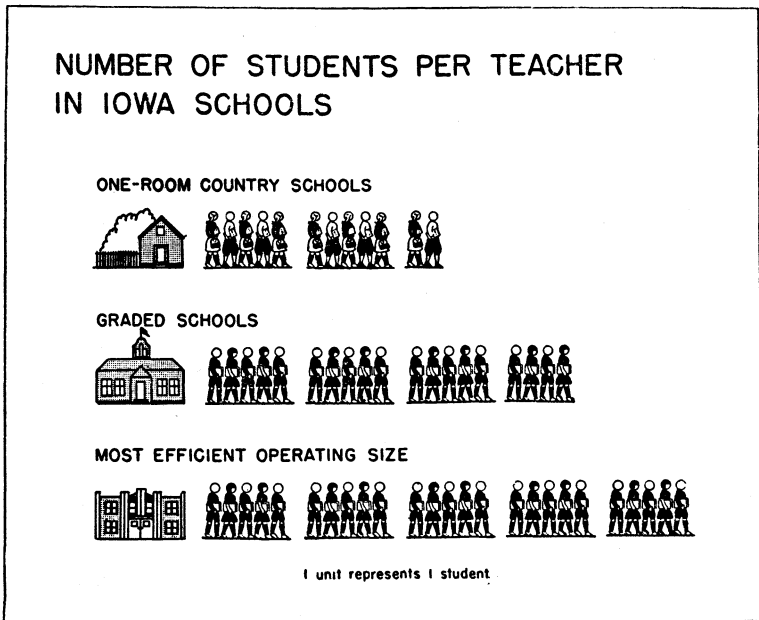


FIG. 9.—Farmers have learned that per pupil costs to teachers' salaries are lower in larger schools.

Much of the prejudice against consolidation at that time was overcome by the fair-minded investigation of taxpayers. Best information was obtained by visiting some of the successful consolidated schools such as those at Milford, Marathon, Buffalo Center, and Crawfordsville. The winter of 1910 was a good time to test the question of transportation because it was unusually severe. Investigation showed that attendance was as good from the farm areas as from town in consolidated districts. Approximately fifteen consolidated schools had been formed when the General Assembly in 1913 provided state aid to schools which maintained certain standards. State funds were provided amounting to \$200 annually for a two-room building plus \$250 for equipment; \$500 annually for a three-room building plus \$350 for equipment, and up to \$750 annually plus \$500 towards equipment for buildings of four rooms or more. Other conditions

pertained to size of grounds; equipment for teaching agriculture, home economics, manual training and other vocational subjects; and the certification of teachers.

SPREAD OF CONSOLIDATED SCHOOLS

The effectiveness of this law is evidenced by the fact that up to April, 1913, only eighteen consolidated schools had been established, but from that time to September, 1914, nearly sixty were organized. The law of 1913 had appropriated only \$25,000 for consolidated schools for 1913 and \$30,000 for the four years following, but a new law was passed in 1915 increasing the total amount to \$100,000. By June 30, 1916, the number of consolidated districts had increased to 187, and at that time no school that had ever completed its district organization and transported children had gone back to the one-room school. These 187 schools were located in seventy counties.

There was some tendency at this time to increase the size of the districts beyond the minimum requirements of sixteen sections; the average at this time was approximately twenty-four. Several districts had over forty sections and the Whiting Consolidated School District in Monona County had over fifty sections. Even so, many students in consolidated schools came from outside the consolidated district. Surrounding neighborhood one-room districts paid tuition to these schools in the amount of \$17,000 a year for nonresident pupils. High school advantages were provided in practically every instance. One hundred and two schools reported an average or thirty-five pupils per high school.

From 1917 to 1921, growth was even more rapid. Up to July 1, 1917, the number of consolidated schools had increased to 238, and they were found in all but seventeen of Iowa's ninety-nine counties. Twenty-seven of these schools were in the open country; 179 were in towns of five hundred to one thousand, and 14 in towns of over one thousand inhabitants.

Transportation to these schools was mostly by wagon, although drivers sometimes used their own automobiles. One district purchased motor buses in 1916 and depended upon them entirely for transportation. Some districts provided wagons with heater attachments, but most depended upon proper clothing, robes, and foot-warmers. In most cases the length of the ride to school need be no longer in a 36-section district than in a 16-section district, if transportation routes were properly organized.

World War I prosperity influenced farmers to establish larger

districts and better schools. By June 30, 1917, 235 districts had been organized. During the year ending June 30, 1920, there were ten new consolidated districts formed every nine school days, on the average. For two months an average of one a day was formed. Horse-drawn vehicles changed to motor trucks and this change overcame much of the real objection to transportation. Up to July 1, 1920, 430 schools had voted to organize; 350 were maintaining a centralized school and transporting pupils.

By September 1, 1921, the number of consolidated school districts authorized by vote totaled 439. As of June, 1921, 68,619 pupils were enrolled in these schools, 34,743 of them transported. The total cost of transportation was over \$1,600,000 with an average cost per pupil of \$47.23. Ninety-three new consolidated school buildings had been erected at a cost of ten million dollars since January, 1920.

A survey of sixty-nine Iowa counties showed that only 58 per cent of the pupils completing the eighth grade in one-room schools in 1932 entered high school and that only 44 per cent were graduated. In consolidated districts 91 per cent entered high schools and 73 per cent were graduated, a better showing than towns and cities made. There the figures were 91 and 68.

Naturally, financing the increased cost of all these services—transportation, new buildings, better teachers—and of such new subjects as manual arts, agriculture, home economics, music, and athletics—cost town and country people alike more for school operation than the system of little village and one-room country schools which consolidations had replaced. Costs also were high because a larger number of pupils attended these better schools and remained through the full twelve grades, and because buildings were erected at a time when materials were exceedingly costly. The farmer had found the answer to the century-old problem of adequate education for his children, but when hard times came he discovered he could not pay the cost. As a result, the movement for consolidation of school districts in Iowa came to an abrupt end after 1922.

OPPOSITION

During this period of rapid organization of consolidated school districts there was more opposition to the movement than figures above indicate. The *Lamont Leader* gave the attitude of one community toward the movement in 1921.

The country schools that had so long served as a place of public meeting . . . as a church in pioneer days [and] . . . where the children of our sturdy pioneer

farmers received the first elements of knowledge were closed by the strong arm of the law (so called). The flag, the emblem of liberty, ceased to wave from the time-honored landmarks. With it has gone the rights of the people. Schoolhouses were padlocked and farmers were forbidden to enter for any purpose. They were threatened with arrest if they did. Schoolhouses were junked, the fixtures hauled to Lamont and thrown in a promiscuous heap behind the high school to lie there exposed to the elements, a mute inglorious monument to the rights of wronged and outraged people. Taxes have soared to an alarming note and the end is not yet reached. The farmers have become aroused over the high handed way that the affairs of the school have been run. . .

Children are taken from their warm beds in the gray dawn of a winter morning (against the will of their parents), hurtled into a kid wagon, hauled seven or eight miles through all kinds of weather to spend the day in an improvised schoolhouse, hauled back again in the evening [and] dumped out along the route long after the sun has set. This is the new way of educating the farmers' children. . . . A sure way of subjecting a child at an impressionable age to the evils of town and weaning him away from the wholesomeness of country life. John M. Freeman. *The Consolidated School Movement in Buchanan County Iowa*. Master's thesis. State University of Iowa, 1939.

In spite of opposition such as this in several communities, the attitude of most patrons toward the reorganization of Iowa's rural school districts has generally been favorable. When more than eleven hundred people were interviewed it was found that 71 per cent had voted in favor of the consolidation and that in 1943, 84 per cent were favorable. When another group of nine hundred people were interviewed, 90 per cent indicated that they would prefer to rent inside consolidated districts, and 85 per cent of the people with children and 65 per cent of the people without children indicated that they would not avoid buying farms in consolidated districts. Approximately 90 per cent believed that the social advantages, the quality of instruction, and the extracurricular program were all superior in the consolidated districts to what the children previously had in the one-room schools.

During the thirties Barton Morgan and W. H. Lancelot found that a majority of ungraded rural schools had enrollments too small to operate economically. They proposed that a number of one-room schools be closed and their children sent to the nearest community center. If their proposed reorganization had been carried out in the 227 communities studied, the pupils from 1,341 rural schools—44 per cent of the one-room schools in the 30 counties studied—could have been transferred to existing graded school systems without increasing the cost in any community over 3 per cent.

The closing of one-room schools and the attendance of rural elementary pupils at graded schools has resulted in an increase in the number of tuition pupils below the ninth grade from fewer than seven thousand in 1931 to more than ten thousand in 1945. These ten

thousand pupils come from nearly one thousand districts where rural people have no schools of their own, either elementary or high school. From four to five times as many farm children now attend high school under the tuition plan as attend consolidated schools in their districts.

FINANCIAL DIFFICULTIES

The nature of the financial difficulty which caused the consolidation movement to come to an end in 1922 was revealed by Lancelot in 1943 when he discovered:

The taxable property per child in the farm communities was found to be roughly three times as great as in adjoining towns and cities. . . It follows that if farm and nonfarm communities should unite for school purposes and a uniform millage rate be applied to all property, there would be a substantial reduction in the taxes paid on nonfarm property and a considerable increase in many communities in the taxes paid on farm property. This would mean an arbitrary shift of the burden from the owners of nonfarm property to the owners of farm property. —*Bulletin P-55, Iowa State College.*

Farmers could pay three times as much school tax as town people if they had three times the income, but their per capita income is even less than that of their town neighbors.

In spite of the financial handicap under which they must form larger community-type school districts, rural people find the necessity for school district reorganization greater than ever before. The Iowa State Education Association in 1943 showed that 472 of Iowa's 7,907 one-room rural schools had five or fewer pupils and that the average daily attendance of all one-room schools was fewer than eleven pupils. The association's study indicated that small schools with five or fewer pupils cost Iowa farmers four times as much as schools with twenty or more pupils. Although a four-year high school, including grades nine to twelve, should have a minimum of two hundred pupils, 17 high schools had fewer than ten pupils; 28 fewer than twenty-five, and 624 fewer than one hundred pupils.

Since rural education in the public schools was developed on a small-district basis, it has been quite impossible for rural people to obtain through their school system many types of the informal educational services which they desired. For example, the informal education of rural people through public libraries has been much less successful than it has through the medium of the Extension Service. Many rural communities have a village library for village people and a high school library for youth, but there are few libraries for farmers. In general, farmers have not organized library districts. Only twenty-three out of every one hundred Iowans

living on farms or in small villages are in a free public library district. The family bookshelf since territorial days has been and still remains the only source of reading material for more than three-fourths of the rural folk of this state. Iowa farmers are far above those of other states on the income scale, yet Iowa ranks thirty-eighth among the states for rural library service. A possible solution would be to make the new community unit school district the area for rural library service by combining the village and school libraries.

The early farmers' institutes recognized the need for a more satisfactory method of interesting farm boys and girls in the appreciation of rural life. A plan was developed for assisting farm boys and girls in conducting demonstrations on their farms. In many cases the county superintendent of schools organized boys' and girls' clubs, and farmers' institutes supplied a high-quality seed. The county fair association co-operated by offering prizes to boys and girls who exhibited products which they had made or grown. An important step in the early development of such club work in Iowa was the inauguration of a seed corn contest for boys by *Wallaces' Farmer* in 1902. The magazine furnished boys with seed corn and offered prizes for corn produced.

The first boys' club in Iowa was organized in March, 1904, in Keokuk County by C. E. Miller, county superintendent of schools. In 1905, O. H. Benson, county superintendent of schools in Wright County, and Mrs. Jessie Field Shambaugh, superintendent of schools in Page County, introduced club work in their schools. Benson can properly be considered the founder of the 4-H Club movement in the United States. This movement was established officially in 1914 with the passage of the Smith-Lever Act. In 1942 there were twenty-five thousand boys and girls enrolled in 4-H clubs in Iowa, ten thousand in home economics clubs and fifteen thousand in agricultural clubs.

Judging by the number of people reached and the educational programs carried on, such informal educational agencies as the Agricultural Extension Service, rural libraries, Farm and Home Bureaus, newspapers and journals, the radio, and motion pictures appear to have made contributions to rural education which have compensated to a considerable extent for the deficiencies of the rural public schools.

TO LOOK AT IT NOW

When the one-room school was originally organized, it corresponded to the rural neighborhood. However, since the period World War I, the social organization of rural people has changed from the rural neighborhood to the village-centered town-country community. In

their social and economic relationships farmers are today integrated with their nearest towns or villages, but their schools no longer correspond to their method of social organization. Until the administrative organization of rural education in Iowa more nearly corresponds to the natural social grouping of rural farm and village people, their schools will continue to be both expensive and ineffective.

One cannot study the century-long history of rural education in Iowa without acquiring a profound admiration for the men who have labored so industriously to find the solution to "the rural school problem," and without at the same time noting that many of their efforts were almost tragically pathetic. It is clearly evident today that the solution is by reorganization into rural community units, and not by the temporary patchwork devices so frequently used throughout the century. Enough experience has been gained in the last three decades in the use of the rural consolidated school to point the way toward a better system of education for rural people. Such rural community schools as Alta, Grand Junction, Jessup, Mediapolis, Reinbeck, Shelby, Tipton, Whiting, and others are bringing to the children and adults in their respective communities a type of modern education that is remolding and redirecting rural life, and the path which they lighted is clear for others to follow.

The farmer grew up to be independent in thought and in action. But he recognized the value of joining with others to help bring recognition of his problems and betterment of some of his conditions.

26. Farmers' Organizations

LOUIS BERNARD SCHMIDT, *History*

FARMERS' ORGANIZATIONS MAY BE DIVIDED INTO TWO groups: first, those that are designed to promote the special interests of the farming population; and, second, those that seek to unite farmers as a class in the crusade for economic and social justice. The first group includes farmers' elevator companies, the co-operative creamery associations, and the fruit growers' unions. The second group may further be divided into nonpartisan organizations represented by the Grange, American Farm Bureau Federation, and Farmers' Union; and political third-party organizations represented by the Greenback, Populist, and Farmer-Labor movements.

Both major groups may be identified as private organizations based on voluntary effort as distinguished from public organizations implementing state action, such as the United States Department of Agriculture and the Land-Grant College. This chapter is concerned with the organizations that endeavor to unite the farmers as a class in the pursuit of their common aims.

EARLY AGRICULTURAL SOCIETIES AND FAIRS

The earliest organization of farmers in the United States was the agricultural society which began with the Philadelphia Society for the Promotion of Agriculture in 1785 of which George Washington was one of the founders. The agricultural society was the predominant form of association among the farmers during the middle Nineteenth Century. A rapidly-expanding economy was accompanied by a rapidly-expanding social organization. Agricultural societies were organized in nearly every county of the nation. In 1858 the United States Patent Office listed seventy-four in Iowa. These societies—township, county, and district—were the prelude to the organization of the state agricultural societies which underwent the transition from

private to semi-public and then to public organizations under the name of the State Department of Agriculture. The Iowa State Agricultural Society was organized in 1853 and transformed into the Department of Agriculture in 1900.

The agricultural fair was the institutionalized expression of the agricultural society, both educationally and recreationally. It was the chief agency of the society in the diffusion of new ideas, the introduction of better farming practices, new types of livestock, grains, and fruits, and the development of social unity. The first state fair of Iowa was held at Fairfield, October 25-27, 1854, and annually thereafter in different sections of the state until 1879 when it was established permanently in Des Moines. Evening meetings were held for discussions and formal addresses were given by prominent men invited for the occasion. Newspapers gave full accounts of the fair and annual reports were published.

This period also marks the beginning of concerted movements of farmers with declarations of grievances and proposed remedies that were interrupted by the Civil War, only to be revived and intensified as the nation entered upon an era of economic, political, and social reconstruction. This is the era of the great national farm organizations that constitute the farmers' movement in their crusade for economic and social justice.

The economic ills of the farmer were laid at the doors of the legislature and Congress. The farmer complained that he was not adequately represented in the law-making bodies, which he charged were controlled by the corporations and whose legislation favored the railroads. To remedy this situation the farmer felt he must express himself politically, and to do this effectively he organized. The formation of nonpartisan organizations and political third-parties enabled the farmer by group action to exert pressure on the major parties and in time to translate his demands into remedial legislation.

The environmental conditions that gave rise to agrarian discontent were supplemented by another factor inherent in the farmers' movement: the psychology of the farmer. The farmer is an individualist. His extreme individualism is the outgrowth of his pioneering experience, the soil in which independence of thought and action were nurtured. Only when environmental conditions bore down heavily upon him was he ready to join any organization that gave fiery utterance to his grievances and proposed remedies for his economic and social ills. But the extreme individualism of the farmer also explains a lack of social consciousness based on real class sympathy. It has

served as a barrier to the promotion of the solidarity of the farmers as a class.

THE GRANGER MOVEMENT AND THE ANTI-MONOPOLY PARTY

The first stage of the farmers' movement against the new industrialism threatening the foundations of pioneer agrarian democracy was the Grange or Patrons of Husbandry, founded in 1867 by O. H. Kelley and six associates in the United States Department of Agriculture. The Grange was a secret fraternal society, open to both men and women, for the promotion of social exchange of ideas and the educational advancement. Provision was made for the organization of local granges, state granges, and a National Grange. Regarded at first with suspicion, the farmers joined it in large numbers in the depression of the seventies.

The first Grange in Iowa was organized at Newton on May 2, 1868, and the second at Postville in October, 1869. The Iowa State Grange was established January 12, 1871, with Dudley W. Adams as its first State Master. The next three years witnessed rapid growth which swept the country, reaching the high tide by January, 1875, with 21,696 local granges composed of 858,050 members representing thirty-two states and territories. The Midwest was the center of agricultural discontent and the stronghold of the Granger movement. Missouri led with 2,009 local granges; Indiana came next with 2,000; and Iowa third with 1,891. These three states alone had more than one-fourth of the local granges reported for the United States in 1875.

The general program of the National Grange was set forth in the following "Declaration of Purposes" adopted at the seventh annual meeting held in St. Louis in 1874:

We shall endeavor . . . to enhance the comforts and attractions of our homes, and strengthen our attachment to our pursuits; to foster co-operation . . . to diversify our crops; to discountenance of the credit system, the mortgage system, the fashion system and every other system tending to prodigality and bankruptcy. We propose meeting together, buying together, selling together. We wage no aggressive warfare against any other interest whatever. . . We hold that transportation companies are necessary to our success, that their interests are intimately connected with our interests, and that harmonious action is mutually advantageous. *We are not enemies of the railroads.* In our noble order there is no communism, no agrarianism; we emphatically assert that the truth is taught in our organic law and that the Grange is not a political or party organization. No Grange, if true to its obligations, can discuss political or religious questions, nor call conventions, nor nominate candidates, nor even discuss their merits in its meetings.

The Grange was nominally a nonpolitical organization but it opened the way for the independent farmers' parties—the Anti-Monop-

oly and Greenback parties—that were organized in eleven western states, some of which won elections through fusion with the minority party.

THE RAILROAD QUESTION

The most significant aspect of the Granger movement in the Midwest was the railroad question which commanded more attention than any other issue. The rapid expansion of agriculture into the prairie states and the high war prices of wheat and corn were followed in the late sixties and early seventies by falling prices which were blamed on the railroads, the bankers, and the middlemen. When wheat dropped to fifty cents and corn to fifteen cents a bushel on the farm and sold again for four or five times the farm price, the farmers complained that "something was wrong" with the distribution system. The railroads, which bore the brunt of Granger protest, were charged with unfair treatment in the transportation of farm products and of discriminations between persons and shipping points. To eliminate these abuses and compel the railroads to observe the principle of fair and equal treatment of their patrons, the Grangers adopted the policy of state regulation through legislation, contending that the railroads were quasi-public corporations and as such were subject to public control. This was the real issue behind the Anti-Monopoly and Granger movements in Iowa: "the right of the state to regulate rates in the interest of the people."

The Republican party which was in control of the state government ignored this demand while the Democratic party was hopelessly in the minority; consequently the farmers inaugurated a movement for the organization of a new political party. This was the Anti-Monopoly party which was formed in the panic year of 1873. It conducted a vigorous campaign and elected ten of the fifty senators and forty-nine of the one hundred representatives to the legislature. Governor Carpenter was re-elected by a reduced majority. The fact that he was an active Granger pledged to support railroad regulation probably saved the Republican party from defeat.

The fourth annual meeting of the State Grange, which was held in Des Moines the following December, devoted its attention largely to the transportation problem. It was attended by 309 delegates representing eighty-eight counties. The pressure the organized farmers brought to bear on the next Iowa General Assembly through this body and their elected representatives in the legislature resulted in the enactment of the Iowa Railroad Law of 1874. This provided for the

establishment of an official classification and the fixing of maximum rates. This legislation was repealed in 1878 and new legislation was enacted. Governor Larrabee later gave appraisal of this legislation in his book on *The Railroad Question*, in which he concluded that:

The Granger laws have been and are still severely criticized by those opposed to the principles of state control and by the ignorant. It is nevertheless true that those laws were moderate, just and reasonably well-adapted to remedy the evils of which the public complained. . . The Iowa law was imperfect in detail and yet its enactment proved one of the greatest legislative achievements in the history of the state. It demonstrated to the people their ability to correct by earnestness and perseverance the most far-reaching public abuses and led to an emphatic judicial declaration of the common-law principle that railroads are highways and as such are subject to any legislative control which may be deemed necessary for the public welfare.

The economic feature of the Granger Anti-Monopoly movement was co-operative buying and selling designed to eliminate the exorbitant profits of the middlemen. It included local, county, and state agencies for the sale of farm products and the purchase of implements and supplies, local grain elevators, co-operative stores, banking, insurance, and even the manufacture of farm machinery. These co-operative ventures were all best developed in Iowa. One-third of the grain elevators and warehouses in the state were owned or controlled by the Grange. Large shipments of grain, hogs, and cattle were shipped direct to Chicago through Grange agents at a saving of from 10 to 40 per cent. The state agency established at Des Moines in 1872 handled two hundred thousand dollars worth of machinery during the following year, reduced the cost of farm supplies, and realized large profits by direct shipments of grain and livestock to Chicago. Co-operative stores were established, some on the Rochdale plan. Farmers' mutual fire insurance companies were organized.

The Grange also ventured into the manufacture of farm implements and machinery, the most important attempts in this form of co-operative enterprise being undertaken by the Iowa Grange. The patent for the Werner harvester was purchased and Grange factories were established. Two hundred thirty-four machines were manufactured and sold to Iowa farmers in 1874; but the State Grange became involved in disputes with the Marsh Harvester Company for infringement on patents and the venture resulted in loss and failure. Patents on other implements and machines were bought and factories established for the manufacture of plows, seeders, cultivators, mowers, corn shellers, and the like.

These co-operative efforts in Iowa and other Midwest states saved

the farmers millions of dollars. It was claimed that they saved the Grangers twelve million dollars in one year; but they disappeared as quickly as they came, except for the farmers' mutual fire insurance companies and the co-operative creamery associations, which were more successful than the more ambitious farm implement factories.

The failure of the business ventures may be attributed to the fact that the Grangers attempted to organize them on the co-operative plan, thus creating large business enterprises requiring experience. They tended to place too much emphasis on immediate financial savings and returns and too little on expert and well-paid management. They were unable to compete with established business concerns. They were impatient of results. Suspicion, jealousy, and factionalism invaded their ranks. These factors and improvement in economic conditions were reflected in a rapid decline of the Grange which almost reached the vanishing point in Iowa—from the peak of 1,999 in 1874, to 1,018 in 1876, and a mere 8 in 1885. The Grange, returning to the original purpose of its founders as a social and educational organization, began a gradual recovery which it has maintained to the present while other organizations have appeared to command the allegiance of the farmer in his crusade for economic and social justice.

THE GREENBACK PARTY

The Greenback party in Iowa was the successor of the Anti-Monopoly party of the Granger period and the forerunner of the Populist party of the nineties. The continuance of general dissatisfaction with existing conditions led to the demand that the United States Government increase the circulating mediums needed by a rapidly-expanding rural economy. This demand became known as the Greenback movement, culminating in the formation of the Greenback party which gave attention to other issues besides the money question. The Iowa Greenback party was organized in Des Moines on May 10, 1876, which was the year of the lowest yield per acre of wheat in the history of the state. These were indeed the years of lowest prices and the greatest agricultural depression which, it may be observed, were also the years of the greatest strength of the Greenback party.

The state and national platforms of the Greenback party were devoted largely to general issues: "the three monopolies of money, land, and transportation." The monetary reforms demanded were the abolition of national banks, and the issue of legal tender paper by the government, the unlimited coinage of silver, the payment of the

interest-paying national debt as soon as possible, the payment of "the same money to the bondholder as to the plowholder," and government loans to "kill the mortgage business." Land monopoly was opposed by the declaration that the public lands should not be granted to railroads and other corporations or sold to speculators, but should be donated to actual settlers. On transportation the Greenback party demanded the repeal of the law of 1878 substituting a railroad commission for laws governing freight rates. The Iowa Greenback party also endorsed the national platform demanding a graduated income tax and direct election of President, Vice-President, and United States senators, and it supported universal suffrage.

The Iowa Greenback party was recruited largely from the ranks of the Republican party which was divided on major issues, although it received substantial support from the Democrats who composed the minority party. Among the more prominent leaders of the party may be mentioned L. Q. Hoggatt, of Ames, L. H. ("Calamity") Weller, E. H. ("Heifer-calf") Gillette, and James B. ("Jumping Jim") Weaver. The party achieved some conspicuous successes. In 1878, it elected Weaver and Gillette to Congress. Its greatest strength was registered in 1879 when its candidate for governor received over 15 per cent of the total votes cast. At the same time the party elected two state senators and five representatives. Thereafter, the Greenback party declined. In 1880 Weaver was nominated for President and in 1883 for governor, receiving in both instances an Iowa vote less than that cast for governor in 1879. In 1884 and again in 1886 he was elected to Congress by fusion with the Democrats. The decline of the party was now hastened by "factional wrangles and jealousies, lack of finances, and some tendency on the part of its leaders to exploit the rank and file." Prohibition proved to be somewhat of a dilemma to the party and fusion with the Democrats created further division. In 1889, the Democratic party elected its first governor since the Civil War. "Under the specious and seductive plea, 'Get your reforms inside the old parties,' the Greenback movement was stilettoed and put in its grave."

THE FARMERS' ALLIANCE

The Farmers' Alliance movement was the outgrowth of clubs that had grown up for various reasons alongside the Grange of the seventies. In time these clubs were formed into state alliances which in turn were united into two great alliances: one, the National Farmers' Alliance originating in Illinois in 1880 and commonly known as the

"Northern" or "Northwestern" Alliance; the other, the National Farmers' Alliance and Industrial Union which was started in Texas as early as 1875 and usually is referred to as the "Southern" Alliance. These two organizations attempted to effect a merger at conventions held in St. Louis in 1889, but the cleavage in the Farmers' Alliance movement on sectional lines prevented the merger. The programs of the Northern and Southern Alliances, however, were quite similar. Their general purpose was to unite the farmers for agricultural advancement and protection "against class legislation, monopoly, and swindling."

The Iowa Farmers' Alliance was organized in Des Moines, January 12, 1881, and immediately become affiliated with the Northern Alliance. The Southern Alliance did not gain entry into Iowa until 1891 when the Alliance movement gave way to Populism. The Alliance movement spread rapidly in Iowa, serving in part as a business agent for the farmer but devoting more attention to politics and legislation, on which it exerted considerable influence. The Iowa Alliance was officially connected with the Farmers' Protective Association organized in Des Moines in April, 1881, for the purpose of fighting the barbed wire trust. The Association established a factory in Des Moines to manufacture wire for sale at reasonable prices and when it began selling wire to the farmers for seven and one-half cents a pound it became involved in patent suits with the trust. The attorney for the Association was A. B. Cummins, who carried on a legal contest with the trust for five years. The general price of wire was finally reduced.

The Iowa Alliance also promoted the organization of farmers' mutual fire and tornado insurance companies inaugurated by the Grange. The rapid growth of these companies is attested by the fact that in 1889 there were 116 farmers' mutual fire and tornado insurance companies in Iowa. The Iowa Alliance also gave some attention to the organization of farmers' co-operative elevators and co-operative stores that were established in the eighties. But it was through political and legislative measures that the Iowa Farmers' Alliance in concert with the Anti-Monopoly and Greenback parties sought to remedy the ills of the farmers.

The Iowa Alliance had been growing steadily in political strength and influence since its inception in 1881, but it was during the latter part of the decade that it grew "with astonishing rapidity." One hundred forty delegates representing forty counties attended the annual state meeting in 1887. By 1890, county alliances had been established in fifty-two of the ninety-nine counties. More than seven-

teen hundred local alliances had been formed, with an estimated fifty thousand members. The number of local granges in Iowa meanwhile had dropped to fifty-two. While the Iowa Alliance did not champion the formation of a third party, fearful that this would lead to internal dissension and destruction of the order, it nevertheless tended to disregard party regularity and to threaten the continued ascendancy of the Republican party. It has been noted that the independent movement in politics continued to grow in various forms under a continuity of leadership from 1872 to 1890.

The Alliance became active politically in supporting the general demand of the farmers for both state and federal regulation of railroads. It continued the agitation of the railroad question in the state elections of 1885 and again in 1887 when both the Republican and Democratic parties inserted planks in their platforms supporting state regulation of railroads. The result was that the railroad forces were defeated by the election of a legislature which attacked the transportation problem under the leadership of Governor Larrabee (1886-1890). Under the pressure exerted by the Alliance and despite the opposition of the railroad lobby, a law was enacted in 1888 which provided for an elective commission with power to investigate the transportation question, to make freight classifications, to prepare schedules of "reasonable maximum rates," and to institute prosecutions for extortion. Rates fixed by the commission were subject to review by the courts. Discrimination between shippers, places, and kinds of traffic were prohibited and freight pools were forbidden. The law went into effect in 1889 and local freight rates were materially reduced.

Other remedial legislation demanded and secured by the Iowa Farmers' Alliance in 1888 included: "the prohibition of combinations fixing the price of oil, lumber, coal, grain, flour, provisions, or any other commodity"; the imposition of heavy penalties for selling grain and seed under fraudulent names; and the requirement that any article containing "any ingredient but the pure fat of healthy swine" and sold for use as lard must be labelled "compound lard." In 1890 the Iowa Alliance secured the enactment of a law reducing the legal interest rate from 10 to 8 per cent; it demanded the election of Larrabee to the United States Senate to succeed Allison; and it urged that more emphasis be placed on practical and experimental agriculture in the training of farmers at the Iowa Agricultural College.

In national affairs the Iowa Alliance urged the passage of the butter and oleomargarine bill, defining butter and imposing a tax

regulating the manufacture, sale, importation, and exportation of oleomargarine. This was enacted into law on July 20, 1886. Senators Allison and Wilson of Iowa voted for the measure. The vote in Congress was divided sharply on sectional lines, the Northern representatives supporting the dairy interests while the Southern representatives supported the cottonseed oil interests. This division is of significance in explaining the cleavage in the Farmers' Alliance and also in later and more recent phases of the butter versus oleomargarine controversy.

The Iowa Alliance demanded federal regulation of railroads by the passage of the Interstate Commerce Act of 1887 and the elevation of the Secretary of the United States Department of Agriculture to cabinet rank in 1889. It championed the Sherman Anti-trust Act of 1890. It favored the free coinage of silver, eventual government ownership of railway, telegraph and telephone lines, and the popular election of United States senators.

In the advocacy of state and national legislative reforms the Iowa Farmers' Alliance maintained a nonpartisan attitude on the assumption that the major parties could serve the interests of the farmers better than an independent farmers' party which would wreck rather than strengthen the Alliance. It was apparent by 1890, however, that an independent party spirit was rising in both the Northern and Southern alliances and the Iowa Alliance was no exception. Rural factions were developed favoring and opposing an independent party. The *Iowa Homestead*, owned by J. M. Pierce with Henry Wallace as editor, opposed the organization of the Alliance into a third party—urging that it could accomplish more through the major parties than by the third party method; while the *Iowa Tribune*, which became the *Iowa Farmers' Tribune*, controlled by Weaver and Gillette, championed the independent movement. In 1891 the Iowa Farmers' Alliance (Northern) was incorporated. In that year the Southern Alliance entered the state. Factionalism and rivalry were intensified. The question that gave the alliance leaders great concern was the extent to which the farmers would support an independent political party.

THE POPULIST PARTY

The Populist, or People's, party was a continuation of the independent party movements that have so far been considered in this chapter. More directly, it was the outgrowth of the Farmers' Alliance. It was "a movement against plutocracy; against accumulations and

combinations of capital; against the control of the country by moneyed monopolies." It was promoted by hard times, discontent, and dissatisfaction. It was prompted by the conviction that unjust burdens were being imposed upon the southern and western farmers; that wealth was being drained from the West and concentrated in the East. The economic evils of which the farmers complained were related to the three great monopolies of transportation, land, and money. These were the grievances that led the Farmers' Alliance in the South and West into politics and the organization of an independent political party under the name of the People's party.

The Iowa State Farmers' Alliance began to manifest tendencies toward independent political action in the elections of 1890. Local alliances were becoming unusually active with attention centered on national issues. The *Iowa State Register*, the leading Republican newspaper, emphasized the differences between the two Alliances, commending the Northern Alliance for its nonpartisan policy and assailing the Southern Alliance for coming into the state with its third party heresy. The *Iowa Homestead* denounced the Southern Alliance for its opposition to the Conger lard bill taxing the manufacture and sale of compound lard. The *Farmers' Tribune* became the official spokesman of the Southern Alliance with the declaration that it endorsed "that political organization which supports the Alliance principles and *no* others." This paper, a consolidation of four other papers, claimed a circulation of 11,520 which compared favorably with the Homestead's estimated circulation of 15,000. Under these conditions the People's party in Iowa was launched in 1891.

The Farmers' Alliance movement for an independent farmers' party culminated in a public call for a conference which met in Cincinnati in May, 1891, and adopted a resolution favoring the formation of the "People's Party of the United States." Pursuant to this action, which was supported by the Iowa delegation headed by Weaver and Gillette, a "People's Independent State Convention," composed of delegates from sixty counties, was held in Des Moines on June 3, 1891. This convention adopted the platform of the Cincinnati conference and nominated A. G. Westfall for governor. The state platform denounced the "moneyed oligarchy" and class legislation, and it supported the eight-hour day for miners. It demanded an increase in tax assessments for railroads, the two-cent fare, the taxation of mortgages, a uniform schoolbook system, and the Australian ballot. It avoided commitment on the liquor question, which was a leading issue between major parties. The Democratic platform was more

responsive to agrarian demands. The election turned largely on local issues. The entire Democratic ticket was elected, Governor Boies receiving a margin of more than eight thousand votes over his Republican opponent. Westfall on the Populist ticket received 12,303 of the 420,212 votes cast for governor. The Populists, drawing more supporters from the ranks of the Republican party, held the balance of power in favor of the Democratic party. They elected one senator and one representative in the General Assembly.

Political interest was now centered on the national elections of 1892. Iowa had two presidential possibilities: Governor Boies, a rival of Ex-President Cleveland for the Democratic nomination, and General Weaver, the chief spokesman of the Populist party. Party relations were becoming more fluid as indicated by tendencies of Republicans to leave their party and support the more progressive policies of the Democratic and independent or third parties. Weaver was nominated for President at the Omaha convention. In the general election, Weaver received 20,596 votes. This was less than 5 per cent of the total vote cast and less than two-thirds of the vote he received as the Greenback candidate for President in 1880. Weaver gained in the country at large, but he lost strength in Iowa while other candidates on the ticket received about the same percentages of the votes cast.

The financial crisis of 1893 brought monetary issues to the forefront during the next three years. The Populists were by no means alone in attributing the crisis to a lack of money and in demanding the free coinage of silver and more money as a solution of the difficulty. The hope of the Populists was to unite the dissatisfied elements of both parties into a political party committed to monetary and other reforms; but this hope was based more on "feelings of dissatisfaction and unfairness" than on "conditions of distress or calamity." The chief factors that tended to moderate the unrest were the hog and dairy cow. It was largely because of reasonably sure crops and the diversification of farming that the third party movement failed to make appreciable gains in Iowa. There was, however, a fringe of distress in the southern and western parts of the state during the drouth and labor troubles of 1894, which was reflected in the general election. The Republican party was developing solidarity while the Democratic party was threatened with division between the conservatives and the elements seeking fusion with the Populists, who immediately began making preparations for the national campaign of 1896. Monetary issues were pushed to the front. There was talk of Democratic-Populist fusion which was opposed by the conservative Democrats

and radical Populists. Weaver summed up the situation by the observation that the one difference of opinion within the Populists party related to "the method of securing a union of reform elements in 1896."

Any appraisal of the Populist party in Iowa must be measured not by its numerical strength in the general elections—which was negligible—but by its influence on the major parties. It held a potential balance of power that was a constant threat to the major parties. This was "due further to the fact that economic grievances of Iowa farmers were not a Populist monopoly and to the fears of the orthodox that the farmers might swell the ranks of the third party instead of trusting for results at the hands of the old parties." It may therefore be said that as a sign and a fringe of the larger current of unrest, the Populist party thus served as a sort of alarm signal to strengthen the left-wing elements of the major parties. This influence was more or less permanent, for as the Populist party dissolved, it furnished recruits to the left wings of the old parties. It centered its attention on national issues to the neglect of state issues. Viewed in broad historical perspective, the significance of the Populist party is attested by the fact that nearly all of the planks of the Omaha platform were enacted into law within a generation. It was, moreover, a political educator of the farmer.

THE GRANGE REVIVED

The phenomenal rise and growth of the Iowa State Grange to great power and influence and its rapid decline to almost the vanishing point from 1868 to 1885 have been reviewed in a preceding section of this chapter. Thereafter the Grange maintained a continuing, though somewhat precarious existence to 1907 when it began a gradual recovery in membership and activity. The leaders of the Grange determined to perpetuate the order. Mindful of the failure of its co-operative business ventures which precipitated its decline, the Grange returned to the original purpose of the founders: the development of its educational, social, and legislative functions. It should be remembered that the Grange was overshadowed during the eighties and early nineties by the Farmers' Alliance and the Populist party, which the embattled farmers joined in their demands for economic and social reforms. Grange libraries were established. The Grange advocated the teaching of agriculture in the primary schools of the state, a reading course for farmers, and the appointment of "Tama Jim" Wilson as Secretary of the United States Department of Agriculture.

The Grange became an active champion of the good roads movement, a permanent state highway commission, and federal and state aid for building roads. It recommended a law insuring to the tenant compensation for increased value of the farm or in the soil due to the management of the tenant, the guarantee of bank deposits, a state income tax and the reduction of the legal rate of interest to 6 per cent. The Iowa Grange further supported the principles of the McNary-Haugen bill and the export debenture plan for the disposal of surplus crops in the twenties, and the farm legislative program; but it has opposed the reciprocal agreements. It advocated the exemption from taxation of homesteads to the value of \$2,500. It contributed to the World War II effort by giving full support to the production of foods and fibers for the nation and our allies, and many of its members served on war bond, Red Cross, U.S.O. and other patriotic committees. Since the war, the Grange has opposed any decrease in the tax rate until the national debt has been materially reduced; and it has warned the farmers against the dangers of inflation of farm land values. It has favored legislation for the reorganization of the school districts with state aid and "an equalization program for financing our public schools."

THE FARMERS' UNION

The Farmers' Education and Co-operative Union, generally known as the National Farmers' Union, was founded at Point, Texas, in 1902 by Newt Gresham and others who had been organizers and leaders of the Farmers' Alliance. It grew rapidly at first, declined during World War I, and then expanded with the great depression in agriculture. In 1940, it represented a membership of one hundred thousand farm families in forty states.

The Farmers' Union constitutes the left wing of agrarian politics. While militantly active politically in demanding legislation to improve the economic and social status of the lower-income class of farmers, it endeavors to bring this about primarily by developing co-operatives and credit associations. It maintains that the economic structure of society must be fundamentally changed—that farmers must go into business and retain all the profits. Accordingly, the Union is interested in promoting co-operatives including the purchase of supplies, the sale of farm products, the conduct of fire, livestock, and life insurance companies, and the management of plants for processing farm products: packing plants, flour mills, phosphate plants, pickle factories, creameries, and canneries. Approximately three hundred thousand farmers

are members of the Union's co-operative associations. Membership is limited to farm owners and tenants, country school teachers, physicians, ministers, and newspaper editors.

The Iowa Farmers' Union was chartered October 8, 1917. It grew rapidly in the twenties, declined in the thirties, recovered again by 1945 with a membership of about 7,100. This does not include the nonmember farm families that are patrons of the Union's co-operatives.

The Iowa Farmers' Union has not taken much interest in state legislation. Its program is that of the National Farmers' Union of which it is a division. This program emphasizes particularly as its main objective, the preservation of the family-sized farm, the protection of which "should be a constant and primary policy and aim in the formulation, amendment, and administration of all farm legislation." It demands an adequate and effective legislation for the development of co-operatives owned by producers and consumers, as the only means by which the potential abundance of the nation may be made available to all the people and by which true democracy may be maintained and safeguarded. It urges the adoption by Congress of a federal program of rural education supported by an annual appropriation of one billion dollars, and the enactment of further legislation providing for a complete revision and integration of "all educational agencies now serving agriculture." It charges that present-day legislation and technology tend to exalt the "dominance of those already on top"—the upper income bracket of farmers—and it frankly declares itself the champion of the lower income bracket of marginal farmers who constitute its membership.

THE FARM BUREAU

The formation of the Farm Bureau is closely associated with the development of the county agent system which originated in the first decade of the century. This system came to assume primarily the function of bringing to the farmers the results of agricultural research carried on by the land-grant colleges, the state agricultural experiment stations, and the United States Department of Agriculture. It assumed its present administrative form by the passage of the Smith-Lever Act of 1914. This provided federal grants to the state extension services under the supervision of the land-grant colleges, which in turn made arrangements with the county authorities to employ county agricultural agents. The costs of the system thus came to be borne by federal, state, and county funds. In order to reach the farmers more effectively with scientific and practical instruction, voluntary

associations of farmers were formed—composed chiefly of farmers who were interested in improving their farming practices and who welcomed the help of scientifically-trained men. This form of association came to be called the Farm Bureau, which was originally designed merely as an agency to facilitate the work of the county agent. Both operating units spread rapidly during World War I. Meanwhile the Farm Bureaus began to assume new functions which gave them a wide sweep over agricultural interests. A number of state federations were formed. This movement led to the organization of the American Farm Bureau Federation at Chicago in 1919, and the adoption of a comprehensive program—educational, legislative, and economic—which was designed:

To develop, strengthen, and correlate the work of the state Farm Bureau Federations of the nation, to encourage and promote co-operation of all representative agricultural organizations in every effort to improve facilities and conditions for the economic production, conservation, marketing, transportation, and distribution of farm products; to further the study and enactment of constructive agricultural legislation; to advise with representatives of the public agricultural institutions co-operation with Farm Bureaus in the determination of nationwide policies and to inform Farm Bureau members regarding all movements that affect their interests.

The Federation immediately achieved political significance with the collapse of farm prices in 1920–21 and the coming on of the great depression in agriculture when it established a permanent lobby in Washington for the promotion of a comprehensive program of legislation.

The membership of the American Farm Bureau Federation has fluctuated from the high point of 466,421 in 1921 to a low of 163,246 in 1933. Since then, its growth has been steady and impressive with a membership of 444,485 in 1940 which was increased to 946,136 in 1945. Representing in the main the more prosperous farmers with an upper-class orientation, it has maintained close relationship with the land-grant colleges through the agricultural extension service; it has promoted co-operative marketing and the 4-H Club movement; and it has vigorously championed the farm legislative program of the thirties, the reciprocal trade agreements, and the United Nations' Organization.

The Iowa Farm Bureau Federation is one of the strongest state federations in the Union. Its origin and growth followed the general line of development outlined above. The first county agent in Iowa was employed by Clinton County in 1912. The county agent system was extended and Farm Bureaus were rapidly organized during World War I. By 1918 every county in Iowa had a county agent and a

County Farm Bureau with an average of two hundred members. In that year delegates from a large majority of the counties met in conference at Marshalltown and organized the Iowa Farm Bureau Federation. Its first president was James R. Howard, who also became the first president of the national federation. Membership rose to 109,543 in 1920. Thereafter it gradually declined to the low figure of 18,041 in 1933, then it increased year by year to 54,122 in 1942 and 103,699 in 1946, nearly reaching the figure for 1920.

The work of the Iowa Farm Bureau Federation has been departmentalized by the establishment of standing committees through which it has developed its action programs. The scope of its activities since 1933 is indicated in part by the committees on organization, service, legislation, marketing, transportation, rural electrification, soil conservation and production adjustment, taxation, auditing and budget, education, insurance, rural credit and banking, and constitutional amendments. The Iowa Federation has continuously extended its fields of interest until there is hardly a phase of American life affecting the farmer directly or indirectly that has not enlisted its attention.

The farmer works to develop the highest profit combination of crop and livestock enterprises. While the typical Iowa farm has conformed to a fairly definite pattern of operation, this pattern has shifted as one enterprise and then another drew more emphasis from time to time.

27. The Pattern of Farm Management

JOHN HOPKINS, *Agricultural Economics*

FARMING HISTORY IS THE STORY OF WHAT FARMERS HAVE done. What they have done is largely influenced by prices and costs. And prices and costs depend upon wars, depressions, improved technology.

From an economic point of view the first hundred years of Iowa as a state can be divided into two periods of about equal length. The first fifty years saw the settlement of the state and the process of settling down into a more or less stable and systematic farming system like that which already prevailed in the older, eastern parts of the country. This required the years from the first settlements in the 1830's until sometime in the 1890's.

The second fifty years saw three great economic upheavals that forced Iowa farmers to revise their farm organization and many of their practices during World Wars I and II, and during the great depression of the thirties. It witnessed also two other powerful influences of a longer lasting type. One of these was the more general application of scientific methods, under the leadership of Iowa State College. The other was the development of government intervention, with the growth of such institutions as the Agricultural Adjustment Administration, Farm Credit Administration, Soil Conservation Service, Farm Security Administration, and the Rural Electrification Administration.

These influences have made the Iowa farmer much less self-dependent and the farm less self-contained decade by decade. To make the largest possible income a farmer now has to think about many things outside his own line fences. His seed corn comes from a

specialized hybrid seed corn farm. His sources of power are manufactured in a tractor factory and oil refinery rather than being raised from colts in his own pasture. If he wants to obtain funds for some farm improvement he may find the cheapest source of credit in a government credit agency. When he decides on his crop rotation, he has to think about government subsidies or penalties that are intended to keep all farmers in line with a planned and balanced economy. There is no question but that the farmer gets more out of life and lives more comfortably than his great grandfather did in 1846. But he does a job that takes greater skill than his great grandfather needed, too. Managing a farm has certainly become a lot more complicated than it was when Iowa became a state.

THE PERIOD OF SETTLEMENT

Settlement of Iowa began in the thirties and continued until about 1890. For about fifty years the frontier advanced across the state from its southeastern to its northwestern corner. The dominant economic characteristics in this period were the great areas of excellent land that were virtually free, the scarcity of labor, scarcity of capital, and a lack of transportation facilities to connect the settlements with the consuming regions of the East. These determined the nature of the farm organization and methods of management. Since there was abundant pasture on and beyond the frontier, the dominant enterprise was, naturally, the raising of cattle. Throughout the half-century we are discussing an extensive cattle enterprise drifted across the state ahead of the plow. In fact, the grazing enterprise had been characteristic of the frontier ever since the settlement of the eastern seaboard. It was reported from each new area taken up by the earlier settlers, from Massachusetts, from Pennsylvania, Virginia, and the Carolinas before the Revolutionary War, and from Ohio, Indiana, and Illinois. After the Civil War the same enterprise of grazing the unfenced prairies advanced rapidly westward until there was no longer free range in Iowa after 1890.

The grazing of cattle provided a solution to the special conditions of the frontier. The cattle could utilize a relatively large area of land without any necessity of preparing or cultivating it. They required but little labor or capital per acre of land or per dollar of product. And finally, when ready for sale they could walk to market. In the earlier years, therefore, the story of Iowa farm management is largely a history of beef cattle production. But by 1890 there was only an occasional section or quarter-section available for extensive pasturing

in the extreme northwestern corner of the state. Iowa had become a settled agricultural area.

The rapid development of Iowa as a land of prosperous and well-organized farms cannot be attributed either to any peculiar characteristics of the people who settled the area, nor to capital and equipment that they brought with them. They were of the same racial stocks as the settlers of the older states. The early settler was ordinarily a poor man, who had to improvise both his methods and his equipment until he could accumulate a little capital. Usually the settler brought with him only one or two pairs of horses, or yokes of oxen, a couple of cows (chiefly to produce milk for the family), a wagon, a plow, and enough capital to see him through until he could raise a crop. The first few years were hard ones. Yet these people were lucky. Railroads were following not far behind them and the markets of the East were prepared, during most of the years of Iowa's settlement, to take their crops and livestock at prices that would enable them to get ahead. The land, the climate, and the location relative to markets were all favorable, and the general attitude of early Iowa farmers, as shown by the newspapers and periodicals of the time, was generally optimistic. In spite of the intermittent hard times, these farmers and their children were among the most fortunate of all settlers in all the favored areas of the United States.

Nevertheless, there were good and bad years. Some of the variation came from fluctuations in the seasons and some from shifts in prices. The Civil War upset the existing price relationships and caused a great wartime inflation followed by the usual collapse. During the war the process of settlement was largely stopped. At the beginning of the war the prices of cattle and hogs dropped because of the loss of the markets for salted beef and pork that had developed in the South. Prices of wool, on the other hand, rose sharply because of the loss of the cotton supply. By the end of the war, wool was a dollar a pound. For a while the interest of Iowa farmers shifted from cattle to sheep. The number of sheep which was 259,000 in 1860, was estimated at 900,000 at shearing time in 1864 and nearly 2,000,000 in 1867. But with the end of the war wool dropped to between 20 and 30 cents per pound and farmers got out of this enterprise and turned again to cattle and hogs.

The war over, settlement made up with a rush for the time lost. Post-war prosperity was supported by a great wave of railroad building, which not only kept business operating full blast in the eastern parts of the country, but also opened new regions and made it cheaper for farmers in settled areas to get their produce to market.

After 1870 there was a period of depression. Newly-built railroads failed to yield the expected profits and there were financial scandals to shake business confidence. Fat cattle in Chicago dropped from \$7 to about \$4.50 per hundred pounds in 1873, and \$4 in 1876. After this there was a recovery and cattle rose steadily until 1884. Hogs, however, recovered more rapidly than cattle and since they offered an outlet for the increasing production of corn, farmers began turning more and more toward the corn and hog combination that was to characterize Iowa agriculture up to the present time.

FARM PRACTICES

The organization and management of Iowa farms in this early period was relatively simple in some ways, and yet was complicated by the fact that farm families needed to be much more self-sufficient than now. Methods of farming and management were brought by the settlers from their old homes farther east. There were no leguminous forages, except that clover began to be planted in a small way a few years after settlement. Buildings were mostly small and cheap. "Straw sheds" were the common shelter for cattle. There were no county agents to whom a farmer could go for aid or advice and Iowa State College was just getting well started, under its old name.

Since most of the settlers had only a few head of cattle, they often were forced to forego the opportunity to utilize the full acreage of prairie pasture on their land for a few years until they could accumulate a herd. In the meantime they turned to raising a small acreage of crops, though this was more laborious and less profitable. The raw prairie soil did not produce a good crop of corn for two or three years after it was first plowed. Consequently, wheat and flax were often the first crops. Many of the first waves of settlers located in rough, timbered land rather than on good prairie nearby. This was at least partly in order to have access to springs of good water and to timber for buildings and fences. Also, many settlers came from similar rough land farther east in Ohio or Pennsylvania, and were suspicious of the level land where there was no natural stand of trees. With only small teams of horses or oxen and no large mechanical equipment, hilly land did not possess the disadvantages that it does today.

Even in the earliest settlements, however, the farm operator seems to have responded about as readily to the price system and to price changes as he does today. The rapid shift into sheep during the Civil War is an illustration of this. So is the shift to hogs a few years later when the ratio of corn to hog prices became favorable. So is the change from selling cattle directly off grass to fattening them on corn. This

latter method improved the market grade of the steers and saved corn by converting it to a smaller volume of beef.

In the southeastern part of the state, where feeding began in Iowa, cattle were commonly fed on corn in the fodder after it had been cut and shocked. These settlers had come from eastern regions where cutting and shocking had long been common practice. Later on it was found that labor could be saved by snapping the corn and feeding it in this form or as husked and broken ears.

A letter in the *Prairie Farmer* in 1866 gives the approved practice for handling feeding steers:

There should be 60 bushels or more of corn put up in the shock for one steer, or one acre and a half of common corn. The cattle should be smooth, thrifty, 3 or 4 years old, to be taken up before they begin to fall off and furnished with good lots to change in, running water, timber or broken ground to the west or north. If possible salt once a week, and after the first week give them as much corn and fodder as they can eat. In case of ailment split the tail and give them soot and salt.

The recommended cure for ailments may seem a bit heroic, not to say bizarre. It is not so strange, after all, in a prescientific era when some farmers discussed, seriously, such diseases of cattle as "hollow-horn" and "wolf in the tail." The rest of the procedure, however, makes sense. Even the advanced age of the feeders was based on good reasoning. In the first place the cattle were not well bred and they matured slowly. Second, with relatively more pasture than cattle, it did not cost much to let the steer grow for another year. And third, since there was no alfalfa and very little clover, corn fodder was about as good a roughage as any available.

Superstitious beliefs in animal diseases and in planting crops according to the phases of the moon, soon began to give way to more scientific methods. A large proportion of the farmers even in early Iowa were hungry for learning and for scientific methods. After the first agricultural society was organized in Dubuque in 1842, the number grew rapidly in the fifties and sixties until virtually every county had one, in addition to various other farmers' clubs organized for the purpose of discussing improved methods. Sixty county fairs were held by county agricultural societies in 1859. Agitation by farmers led to the passage in 1858 of the law which provided for the establishment of Iowa State College. In 1870 President Welch held the first farmers' institute and these educational meetings continued for many years thereafter. In 1868 the first Iowa Grange was organized in Newton partly for educational purposes. In five or six years there was a grange in nearly every village of the state. The number of Granges declined

in the late seventies but these were followed by the Farmers' Alliance in the eighties. Throughout the entire history of the state, Iowa farmers have actively sought for more knowledge and better methods both of technology and of management.

In the latter part of the century, Iowa agriculture was settling down into the pattern which it was to keep to the present day (Table 15). From 1870 to 1890 the corn acreage grew from twenty-two to forty-four acres per farm, replacing wheat. Wheat which had reached an acreage of over three million in 1875, declined to less than one million in 1890, while oats increased from six to twenty acres per farm and tame hay acreage rose from eight hundred thousand to three and one-half million. The tame hay was largely timothy. In fact, President Welch in discussing the improvement of Iowa cattle at the first farmers' institute in Cedar Falls, in December, 1870, maintained that the improved Durham stock could not be raised profitably on prairie hay, but required timothy.

CORN-HOG PATTERN APPEARS

Livestock, as well as crops, were falling into something like the present pattern (Table 16). From 1870 to 1890 cattle increased from ten to twenty-two per farm. The number of these that were reported as milk cows trebled. Hogs increased from twenty-four to thirty head per farm while sheep declined. Horses increased as the growing crop acreage required more and more power.

In 1880 there were still many farms that utilized chiefly a grass economy. Both the gross and the net value of the corn crop, however, was well above that of pasture and prairie or timothy hay. Likewise the opportunity to convert grain and hay into hogs or fat cattle was too obvious to be passed by for long. Each census year up to 1930 found larger acreages of corn and oats, and a larger number of hogs.

In the late eighties and early nineties Iowa farm management was complicated by relatively wide price fluctuations and by intermittent years of drouth. Drouths and short corn crops occurred in 1886, 1887, 1890, and 1894. Fluctuating prices of corn, cattle, and hogs, kept the farmer in uncertainty when he wanted to plan for maximum returns. In addition, the boom in cattle came to an end in 1885. Up to this time the ranges had been stocking up and had not reached their full output of slaughter cattle. In 1885 cattle receipts at Chicago numbered one million nine hundred thousand. During the next four years receipts climbed above three million. Average monthly prices of heavy

steers in Chicago declined from over seven dollars in 1882 to less than four dollars in 1887. There was not much recovery until 1892 and 1893. In the fall of 1893, however, a severe depression hit the country, and in 1894 there was a wide-spread drouth. The decade from 1885 to 1895 was one of long, drawn-out and grinding depression. Thus, Iowa's first half century ended with a general air of discouragement.

TWENTY YEARS OF PROSPERITY

Recovery began in 1896, and except for a brief but sharp panic in 1907, orderly expansion continued until the outbreak of World War I in 1914. The period of settlement was over and there were no more large areas of good land to open up. On the other hand, population and the demand for farm products continued to grow. Prices were slowly rising. Improved farming methods were gradually being adopted. Interest rates were declining. Farm loans had cost 15 per cent in the seventies and early eighties. In the nineties there was some decline, but the cost of capital fell more rapidly around the turn of the century, reaching 8 per cent in 1902 and 1903. Under these circumstances farmers could afford to obtain equipment and make improvements that had been denied in earlier years. Many of the makeshift houses and barns were replaced between 1900 and 1914 with new ones that were better built and more comfortable.

The cattle-feeding enterprise expanded and feeding was practiced by more farmers in this period than before. By 1907 or 1908 it was said that the common cattle of the state were as heavy and as well finished at slightly over two years of age as they had been at three years or over in the early nineties. Replacement of the older, scrub types of cattle with the better-bred Shorthorns, some Herefords, and Angus played an important part in this improvement. So did the growing of more clover hay and the planting of some alfalfa, particularly in the western part of the state.

From 1890 to 1915 the acreage of corn and oats in Iowa increased. Hog numbers fluctuated from year to year but were generally rising while cattle numbers had not changed greatly during the twenty-five years, though they were undoubtedly better animals at the end of the period.

During the first years of the Twentieth Century, Iowa State College began its Extension program and made great strides in carrying the college to the people of the state. A two-weeks' short course was organized at Ames in 1901 by Dean C. F. Curtiss. In 1903, P. G. Holden held the first Iowa farm demonstration work near Orange City, and in

1905 the first local short course at Red Oak. A boys' club was organized in Keokuk County in 1904. The Iowa Legislature in 1906 passed a bill which provided an appropriation for Extension work. In 1912 the employment of county agricultural agents was started, and by 1918 there was an agent in every county.

Agriculture was maturing in Iowa in this period. An organization was being developed to convert scientific discoveries into farm practices and carry these to farmers as rapidly as economic and other conditions justified. The same process was going on in other states at the same time. No longer was the farmer condemned to struggle alone and depend on the erratic rules of thumb that he had been forced to use through all preceding decades.

THE PERIOD OF WORLD WAR I

During World War I, Iowa farm organization and practice was affected chiefly by two sets of influences. The first was the wide and relatively free fluctuation of prices. The second was the wartime shortage of labor, as manpower was drafted for the army or else attracted to munitions factories by high wages.

When the war broke out in 1914 many people expected that prices of farm products would surge upwards at once. They were disappointed for nearly eighteen months. The first reaction was a decline caused by the breaking off of normal trade relationships with Europe. This lasted until March, 1916, when food shortages started the upward spiral to the highest levels yet reached in this state. From 1914 to 1919 hog prices in Iowa rose from \$7.66 per hundred pounds to \$16.87. Cattle rose from \$7.33 to \$12.45, and corn from 61 cents per bushel to \$1.41. Farming costs and the valuation of farm property rose along with prices of products. Land values per acre, which averaged \$124 in 1914, rose to \$255 in 1920 and the total mortgage debt nearly trebled.

As soon as the United States entered the war in 1917, a concerted governmental drive was made to produce food to the maximum. Additional support was given to the Extension Service which undertook an intensive educational campaign through county agents. These years marked the beginning of Extension Service leadership in rural adult education.

Intensive propaganda for greater wheat production to relieve the shortage of bread grains caused a shift of about a million acres in Iowa from corn to wheat in 1918 and 1919. In 1920, however, wheat dropped back to 600,000 acres and corn recovered to ten million two

hundred thousand acres, or a half million above 1914. The number of hogs, which had been running around 9 million head on January 1, in the years before the war, increased to 10.8 in 1919 and then dropped back to 8.3 million in 1920. Cattle increased from 4 to 4.5 million.

The principal new crop appearing in this period was alfalfa. For this crop 23,000 acres was reported for 1909, but by 1920 the figure was up to 180,000.

These figures indicate that, even during the war, the proportionate shifts away from the basic pattern of Iowa agriculture were not very great. Changes in farm practices also were rather gradual, if we view the state as a whole, although some individual farmers were making long strides towards new methods. More important than the net changes accomplished during the war was the beginning of the use of mechanical power in Iowa farm operations.

The end of war saw Iowa farms operating at full capacity. But the reconversion to peacetime conditions required a couple of years, and the demand for food for Europe was filled sooner than many people expected. Decline of prices set in sharply in late 1919 and lasted through 1920. Iowa's gross farm income was nearly eight hundred million dollars in 1920. In 1921 it was less than five hundred million. *Wallaces' Farmer* of November 5, 1920, stated:

The farmers of the nation are thoroughly stirred up over the tremendous drop in the prices of their crops. Meetings are being held; conferences are called; committees are sent here and there; protests are being made in the papers; farmers are urged to hold their crops off the market. Everybody who has a real interest in Agriculture is casting about to find some way to stop the ruinous decline in prices, but no one seems to know just how to do it.

READJUSTMENT IN THE NINETEEN-TWENTIES

Recovery of prices started in 1922. Nevertheless, farmers were at a disadvantage, especially until 1925. Prices of the things they had to buy stayed more than 50 per cent above the 1910-14 level, while prices of Iowa farm products varied from 7 per cent above prewar in 1921 to 19 per cent above in 1924.

Tenant farmers were able to get along and to make moderately satisfactory incomes by 1925. Owners who had no heavy indebtedness against their farms were not doing too badly. But owners who had bought their land during the wartime land boom, and had heavy mortgages against it, fought a losing battle. Many of them were forced to give up their land while others, despite their hardest efforts, were merely able to meet interest charges and taxes. The heavy Iowa

farm mortgage debt declined only from \$100 per acre mortgaged in 1921, to \$80 in 1929, while average land values fell from \$235 per acre to \$139. Changes in farm management and organization were limited largely to those improvements that did not require new investments.

In spite of the discouraging financial situation there was progress and improvement in farming methods. This is largely attributable to the growing influence of the experiment stations and extension services. These agencies, under guidance from the United States Department of Agriculture, were educating farmers on improved methods in Iowa as well as in other states. Improved crop varieties, better-bred cattle and hogs, more efficient and economical feeding methods, and labor-saving machinery were being adopted by more farmers every year. In addition, increasing stress was placed on farm accounting and on other means of controlling the business side of the farm unit.

In 1920 the Iowa Agricultural Experiment Station and the Iowa Farm Bureau Federation started a farm accounting route in Marshall County. A second was started in Shelby County the following year. These continued through 1924. Then the work was moved to Iowa County, and later to Webster County. The first results from these studies were published in the *Iowa Farm Bureau Messenger* in November, 1921.

It had been hoped by some of the supporters of the cost studies that the results could be used to obtain government price control favorable to farmers. But after recovery from the depression of 1920-21, interest in price control diminished. Consequently the accounting routes were modified to yield other types of detailed information on Iowa farm organization and management. Instead of a figure representing cost per bushel of corn or per hundred pounds of hogs, the studies shifted to the influences that determine net income of the farm as a whole.

Aside from the loss of interest, it soon became apparent that the so-called "cost of production" figures would be of little use in governmental price control. Even if full information on costs were available, they alone would furnish no basis for such control, because prices are governed as much by demand conditions as they are by costs. Second, there are several crops in the typical Iowa rotation, and labor, power, and other resources applied on one crop or livestock enterprise are of benefit to others. Consequently, the distribution of these costs between enterprises is largely a matter of arbitrary choice. One method of computation might make corn appear costly and oats

cheap. Another method could reverse the relative costs so that oats would appear expensive and the corn cheap. Unfortunately, there is no sure and unimpeachable method for allocation of costs under these conditions.

A further reason for loss of interest in "cost of production" figures was that prices soon turned upward again, in 1922. With rising prices it would be disadvantageous to producers to have prices held back at "cost of production" levels.

In 1929 a different type of farm accounting work was begun. A co-operative accounting route was started for the benefit of farmers in the region around Cedar Rapids. Since that year four other co-operative farm management associations have been organized, each with about 150 members. Each association employs a trained farm management worker who visits each farm three or four times a year. During this visit he checks over the farmer's accounts and other records, discusses his management problems, and points out opportunities for strengthening the farm business and increasing his income. Part of the expense connected with these associations is borne by Iowa State College. In exchange for this support the college obtains the use of summary data from the records for use in the Experiment Station, the Extension Service, and the classroom.

The most outstanding change in Iowa farm pattern of operation after 1920 was the rapid advance in mechanization. Continuous mechanical improvement was made in the tractor, and it was adapted better to farm conditions. Ignition equipment, fuel, lubrication, and cooling systems were all improved, making the tractor more economical and more dependable. Tractors were developed with less weight and greater power, and operating speed was materially increased.

The most important improvement, from the viewpoint of farm adaptability, came with the development of the row-crop type of chassis. This type began to appear in 1924 and within few years Iowa farmers were demanding the row-crop rather than the older four-wheel type. With this change in design it became possible to use tractor power in cultivating as well as for such operations as plowing and discing.

As tractors increased, the number of horses in Iowa declined. Large amounts of pasturage and feed, formerly consumed by horses, were shifted to hogs and cattle. The greater power of the tractors, and its increased speed over that of horses reduced the amount of labor required to produce crops. It was estimated by the National Research Project that an average of 20.6 hours per acre was spent in the Corn

Belt in raising corn in the years 1917-21. This declined to 17.9 hours in 1927-31, and to 16.9 hours in 1932-36. In production of oats, average labor requirements per acre in the same periods were 8.7, 7.3, and 6.7 hours, respectively. A large part of the change is to be attributed to application of the tractor, though there were some changes in practices, and the use of larger horse-drawn equipment also played a part.

DEPRESSION AND GOVERNMENT INTERVENTION

The decade 1930-40 was a hard one for the Iowa farmer, and yet it saw some important farm management changes. Iowa gross farm income dropped from \$830,000,000 in 1929 to \$317,000,000 in 1932.

Iowa farm land prices dropped from \$139 per acre in 1929 to \$65 by 1933. More than three thousand Iowa farms were sold under foreclosure each year from 1931 through 1934. In 1932, the number was 6,400. In addition many thousands of other farmers saw their equities shrink to the vanishing point. Under these conditions low prices had a perverse effect, and instead of restricting production, farmers tried to produce to the maximum in order to stave off ruin.

In 1933 various new governmental agencies, including the Agricultural Adjustment Administration, were set up for farm relief. These were designed to reduce output until it was more nearly in line with demand. But the farmers' troubles were not over. In 1934 and again in 1936 there were disastrous drouths, especially in the southern and western parts of the state.

Pushed both by the government programs and by the drouths, prices recovered by 1935 to levels which were not far below those of the twenties. By 1939, however, corn had declined again to 39 cents per bushel, hogs to \$6.17, and cattle \$8.43 per hundred pounds.

Under the guidance of the A.A.A., acreages of row crops were held down and efforts were made to expand the use of soil-conserving crops, especially of hay and pasture (Table 15). It was apparent that much Iowa land had been cropped too intensively. Damage by erosion was becoming serious in southern Iowa and in parts of northeastern Iowa. This fact was emphasized repeatedly in educational campaigns under the Soil Conservation Service and the Extension Service. In a period of five or six years after the initiation of the soil conservation, such practices as contour cropping, strip cropping, and terracing were spreading rapidly. Application of lime to permit the production of legume crops was becoming more widespread and many farmers were using commercial fertilizers, especially phosphates.

The organization of such governmental agencies as the Agricultural Adjustment Administration, Soil Conservation Service, Farm Security Administration, and Rural Electrification Service, marked a turning point in farm operation. Business fluctuations had become increasingly

TABLE 15
AVERAGE PRINCIPAL CROPS AND LAND USE PER FARM

Year	Acres				
	Corn	Small Grain	Tame Hay	Other Land	Total Land
1870.....	22.0 (16%)*	24.8 (19%)*	6.9 (5%)*	79.9 (60%)*	133.6 (100%)*
1880.....	37.6	25.1	12.4	58.4	133.5
1890.....	43.5	27.6	17.1	62.8	151.0
1900.....	39.7	29.1	14.2	68.2	151.2
1910.....	43.9	28.3	17.8	66.3	156.3
1920.....	48.4	31.9	15.5	61.3	156.8
1930.....	52.7	33.8	14.5	57.3	158.3
1940.....	42.4 (26%)*	27.8 (18%)*	19.4 (12%)*	70.5 (44%)*	160.1 (100%)*

* Percentage of the total farm land.

destructive and social unrest and economic fear were widespread by 1933. Not only farmers but also laborers and business men were becoming more concerned about economic security than about traditional freedom to carry on unrestricted economic activity.

The organization of these action agencies changed farm management in a fundamental sense. The individual farmer was still following the economic objective of maximum net income. But from this time on his income was to be modified in various ways by action programs intended to co-ordinate agricultural activity in the various regions of the country, and to keep agriculture in balance with other industries. The prices received for farm products became only a part of his income. To make the maximum net income the farmer now has to take into account benefit payments for compliance with such programs as that of the A.A.A., as well as payments for soil conservation, forward price assurances, nonrecourse government loans, and so on.

Under the guidance of the government programs corn and oats

acreage declined. Soybeans were increasing in popularity. Their price per bushel during 1933-40 ran nearly twice as high as corn, or just about enough to offset the lower yield of the soybeans; and since peak labor requirements of the beans occur at slightly different dates from those of corn, it was found convenient to include small acreages of this crop on many Iowa farms.

Numbers of livestock did not change greatly during the decade, with three exceptions. There was a temporary liquidation, especially of hogs, during the drouth years 1934 and 1936. Second, with the increase of soil-conserving forage crops and pasture, there was an increase in total number of cattle. Third, as more and more tractors were adopted, the number of horses continued to decline.

As soon as farmers had sufficient money to buy more equipment, following the worst years of the depression, the process of mechanization proceeded with redoubled speed. Further improvements were made in the tractor, and by January, 1940, the number in Iowa had reached 118,000.

Other large capacity, labor-saving machines also were being adopted. A small number of two-row corn pickers were in use by 1929. In fact during World War I a few had been used by Iowa farmers. They were not highly satisfactory, however, and were used only while labor was scarce and high priced. By January, 1940, there were 20,000 corn pickers and 6,500 combines reported on Iowa farms.

Other technological improvements also were under way. Probably the most outstanding of these was the adoption of hybrid seed corn. This development has made the farm manager dependent on commercial producers for his seed corn. More important is the effect on volume of production. With an added 15 to 20 per cent of grain from the same acreage, the farmer has either had more corn to sell, or has been able to increase the number of such corn-consuming livestock as hogs and fattening cattle.

WORLD WAR II

We are still too close to the events of the war to be able to appraise the effects of World War II on Iowa farm operation and management. During the war the pattern previously established continued without very many changes. In general the wartime shifts were similar to those that occurred during World War I. The demand for food increased rather quickly. Prices rose sharply. Labor became scarce as men were drafted for the armed forces or attracted to munitions plants. The demand for farm implements expanded as farmers tried to accomplish

CAUSES OF FARM PROFITS...

HIGH PROFIT 160 ACRE FARMS

LOW PROFITS 160 ACRE FARMS

LIVESTOCK
PRODUCED PER
\$1.00 FEED FED



PIGS WEANED
PER LITTER



DAIRY INCOME
PER COW *



* ONE UNIT EQUALS TEN DOLLARS

GROSS VALUE OF
CROPS PER C.A.*



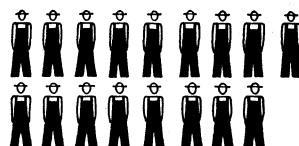
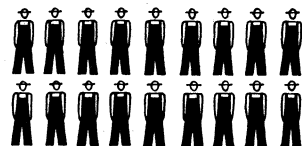
* ONE UNIT EQUALS TEN DOLLARS

BUSHEL OF *
CORN PER ACRE



* ONE UNIT EQUALS TEN BUSHELS

MONTHS
OF LABOR



18 MAN MONTHS

17 MAN MONTHS

TURNOVER
OF CAPITAL

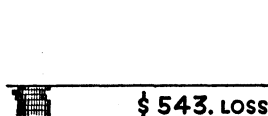


GROSS PROFITS
PER MAN *



* ONE UNIT EQUALS ONE HUNDRED DOLLARS

MANAGEMENT
RETURN *



* ONE UNIT EQUALS ONE HUNDRED DOLLARS

FIG. 10.—Records for 1944 of typical operators of 160-acre farms in Iowa were analyzed to see why some farmers made more money than others. The factors that entered in showed up in this fashion.

more work with fewer men. Government programs were organized to stimulate fullest possible farm production.

Farm prices doubled between 1939 and 1945, and gross farm income in Iowa climbed from \$684 million in 1939 to \$1.6 billion in 1943.

The labor surplus that had developed on many Iowa farms during the depression years quickly melted away, and labor shortage became a universal topic of conversation. To offset the lack of hired men, farmers attempted to turn as rapidly as they could to more tractors and larger implements. These, however, were limited by shortages of materials and labor in implement factories, particularly after the United States entered the war. Nevertheless, farm implements were given a relatively high priority.

In spite of a pronounced shrinkage in the number of farm workers, Iowa farmers were able to handle materially larger crop acreages and livestock numbers, by use of the added equipment and by cutting corners in maintenance of buildings and equipment.

There was an interesting development in small grain production. This was the dissemination of improved and higher-yielding varieties of oats. Iowa barley had been running around a half million acres per year. But with availability of oats which definitely outyielded barley, the latter crop dropped almost to nothing within a period of three years. In 1945 only three thousand acres of barley were reported for the whole state.

It was obvious almost from the beginning of the war in 1939 that the United States would have to provide supplies, and particularly food, for the support of the allied nations. By early 1941 the keynote of our agricultural programs had changed from conservation and output restriction, to greater production for national defense and for aid to Britain. After the attack on Pearl Harbor efforts were redoubled to increase production. Secretary of Agriculture Wickard announced in December, 1940, the intention of the Government to support prices of hogs at a level around \$9 per hundred pounds, and similar support prices were soon announced for other products. The administrative machinery of the United States Department of Agriculture, including the Extension Service and the A.A.A., was quickly turned to wartime objectives of stimulating production. "Goals" higher than previous production levels were set to stimulate farmers to greater effort, and these were raised from time to time during the war.

The feed surpluses that had accumulated in the "ever normal" granary during the depression years were converted into livestock

products, especially into hogs (Table 16). By early 1943 these surpluses had largely been consumed. It was anticipated that large shipments of foodstuffs would be necessary at the end of war to avoid famine and to aid in reconstruction of war-devastated areas, especially in Europe. The demand on the United States, however, was greatly increased by short crops in other regions. In 1944 and 1945 there were widespread drouths in the southern hemisphere which cut exportable supplies of grains and livestock products in Argentina and Australia,

TABLE 16
AVERAGE NUMBER OF HORSES, COWS, AND HOGS PER IOWA FARM

Year	Horses, Mules	All Cattle	Dairy Cattle	Hogs
1870.....	4.6	10.4	3.7	23.7
1880.....	4.9	13.0	4.4	23.8
1890.....	6.7	22.1	6.1	29.5
1900.....	6.1	21.2	6.0	30.1
1910.....	7.2	20.5	5.8	28.9
1920.....	6.9	21.4	5.3	38.1
1930.....	5.3	18.5	6.5	47.4
1940.....	3.7	22.2	6.8	48.8

and reduced the Cuban sugar crop. In 1945 the shortages caused by war were further increased by drouth in large areas of Europe. Consequently, at the end of 1945 and the early months of 1946, farmers were being urged to furnish all possible supplies and to liquidate stocks of grains and numbers of excess livestock in order to minimize the suffering in other parts of the world. It was again being demonstrated to them that their productive activity was of vital importance not only to the rest of the country but to other parts of the world.

TODAY'S VIEW

From 1900 to the present time the typical Iowa farm has conformed to a fairly definite crop and livestock pattern. The pattern, however, was not a static one but was being modified continually in detail. The shift toward mechanization brought a continuous reduction in the number of horses per farm, and a corresponding increase in cash expenses for purchase of equipment and of tractor fuel after 1910. The trend toward soil conservation and greater acreages of legumes increased the feed supply for forage-consuming livestock, especially for dairy and beef cattle after 1935. The development of hybrid seed

corn increased feed available for hogs and for fattening steers. The development of higher-yielding varieties of oats increased the feed supply, particularly for dairy cows after 1940, and the increase in soybean acreages during the thirties and early forties provided a greater supply of protein supplements. Consequently, internal organization of the Iowa farm has shifted so that first one enterprise and then another has been enlarged in comparison to others. Nevertheless, the general pattern has remained very much the same since 1900.

In 1846 the Iowa farmer was an isolated settler on the frontier. In 1946 he was, in a very real sense, a citizen of the world, and a member of a society that was becoming more closely integrated each decade. As a farm manager he was still striving for highest net income as an immediate objective. Such an income, however, is now obtained by keeping in touch with both technological and economic developments through the facilities of the Department of Agriculture, the Extension Service, and other governmental agencies. This was never demonstrated more forcibly than during the years from 1939 to 1946, when the correct managerial decision might turn on news of a war in Europe or Asia, a food shortage in Europe, or a drouth in Argentina or Australia.

Index

- Alfalfa, 62
- Amana Colony, 8
- Anderson, Arthur L., 97
- Animals, diseases of, 167
- Anthrax, 171
- Anti-Monopoly party, 321
- Apples, 186

- Bakke, A. L., 89
- Bang's disease, 181
- Barley, 52
- Beef cattle, 112
- Beekeepers, 208
- Bees, 206
- Beetle, Colorado potato, 86
- Bluegrass, 56
- Bromegrass, 59
- Buildings, farm, 250
- Butter
 - Iowa, quality of, 225
 - Iowa State brand, 225
- Buttermaking, 221

- Caine, A. B., 141
- Cannon, C. Y., 120
- Cattle, beef, 112
 - fattening of, 117
 - feeding practices, 116
 - purebred, introduction of, 114
 - stock-improvement of, 118
- Cattle, dairy, 120
 - breeder associations, 122
 - herd-improvement associations, 126
 - preferences in, 122
 - shows, 126
- Chinch bug, 82
- Cholera, hog, 179
- Concentration yards, 232
- Corn, 32
 - annual production of, 33
 - crop, handling of, 245
 - diseases of, 72
 - experiment stations, work in, 35
 - hybrid, 39
 - inbreeding and crossbreeding, 37
 - pioneers in development of, 34
 - types, in olden days, 33
 - uses of, 43
 - yields, 42
- Corn borer, European, 88
- Craft, W. A., 97
- Creameries
 - centralized, 220
 - co-operative, 218
 - early, 216
- Crops
 - forage, 54
 - rotation of, 29
- Cultivators, 245
- Cunningham, J. C., 32
- Cushman, M. L., 303

- Dairy Cattle, 120
- Dairy products, 214
- Davidson, J. B., 241
- Diseases, animal, 167
- Diseases, plant, 66
- Dourine, 174
- Drainage, 22
- Drake, Carl J., 76

- Education, 303
- Eggs, 163
 - marketing of, 236
- Electric service, rural, 238
- Englehorn, A. J., 18
- Erwin, A. T., 185

- Fairs, early agricultural, 319
- Farm Bureau, 333
- Farmers' Alliance, 325
- Farmers' Union, 332
- Farm management, 336
 - corn-hog pattern in, 341
 - practices in, 339
- Farms, size of, 6
- Fencing, 256
- Flax, 53
 - diseases of, 74
- Flowers, 185, 194
- Foot-and-mouth disease, 178
- Forage crops, 54
- Forestry, 200
- Fruits, 185

- Giese, Henry, 250
- Gilman, J. C., 66

- Glanders, 170
- Grain, 45
 - harvesting of, 247
 - marketing of, 228
- Grange movement, 321
- Grange, revival of, 331
- Grasshopper, 76
- Greenback party, 324
- Haber, E. S., 185
- Hay and pasture, 54
- Haymaking, 246
- Heath, Maurice E., 54
- Hemmingsen, Mildred, 66
- Hessian fly, 85
- Hogs, 97
 - breeding of, 100
 - practices in, 105
 - clean-ground systems for, 107
 - early development of, 98
 - experiments with, 110
 - feeding of, 107
 - improved breeds of, 100
 - type of, 103
- Hopkins, John, 336
- Horse breeders' associations, 150
- Horses, 141
 - draft, 142
 - influence of, 152
 - light, 147
- Horticulture, 185
- Hoyt, Elizabeth E., 287
- Hughes, H. D., 45, 54
- Ice cream industry, 221
- Implements, early, 241
- Insects, 76
- Insurance, mutual fire, 237
- Journalism, agricultural, 262
 - education for, 277
- Journals
 - dairy, 267
 - early farm, 264
- LaGrange, W. F., 128
- Land
 - disposal by gift, 5
 - mortgaged ownership of, 13
 - private sales and auctions of, 4
 - rectangular survey of, 3
- Land ownership, struggle for, 1
 - settlement without legal sanction, 2
- Lantz, H. L., 185
- Livestock, marketing of, 230
- Living, farm standard of, 287
 - broadened interests in, 295
 - clothing, 289
 - diet changes in, 294
 - educational developments in, 300
 - food, 288
 - furnishings, 289
 - new pattern in, 297
 - prosperity, increases in, 292
 - recreation, 290
- Locusts, 76
- MacDonald, Gilmour B., 200
- Machinery, 241
- Marketing, 228
- Marvin, K. R., 262
- Melons, diseases of, 75
- Milk, 221
- Milking, by machine, 247
- Mules, 152
- Mortensen, M., 214
- Murray, Charles, 167
- Murray, W. G., 1
- Newspapers
 - early, 263
 - farm news, 274
- Nichols, H. E., 185
- Nurseries, 192
- Oats, 45
 - Clinton, appearance of, 48
 - diseases of, 69
 - farm comparisons of, 47
- Organizations, farmers', 319
 - sheep-growers', 140
- Packing houses, 231
- Paddock, F. B., 206
- Pasture, 54
- Pella Colony, 8
- Peterson, J. B., 18
- Pickett, B. S., 185
- Plants, diseases of, 66
- Pleuropneumonia, 173
- Plows, 242
- Populist party, 328
- Porter, R. H., 89
- Potato beetle, 86
- Potatoes, 189
 - diseases of, 73
- Poultry, 154
 - marketing of, 236
- Prosperity, 342

Publications, *see* Journalism
Publishing centers, 269

Rabies, 173

Red clover, 61

Redtop, 61

Reed canarygrass, 60

Ross, Earle D., v

Rye, 52

Schmidt, Louis Bernard, 319

Schools, 303

Seed laws, 91

Shearer, P. S., 112

Sheep, 128

diseases of, 139

mutton, shift to, 132

present-day practices, 138

purebred, appearance of, 133

Sleeping sickness, 183

Societies

agricultural, early, 319

horticultural, 195

Soil, 18

characteristics of, 20

composition of, 24

cropping pattern of, 20

drainage of, 22

tillage of, 29

Soybeans, 65

Sprague, G. F., 32

Stewart, George F., 154

Storage, 259

Structures, farm, 250

building problems of, 258

clay products in, 253

Supplies, farm, 236

Sweetclover, 63

Sylwester, E. P., 89

Telephones, mutual, 238

Tenancy, rise in, 12

Texas fever, 171

Thompson, Sam H., 228

Tillage, 29

Timothy, 59

Trees, 200

Turkeys, 165

Vegetables, 185

Volz, E. C., 185

Weeds, 89

Wheat, 51

diseases of, 68, 71

Wool

marketing of, 236