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, grasshoper 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.

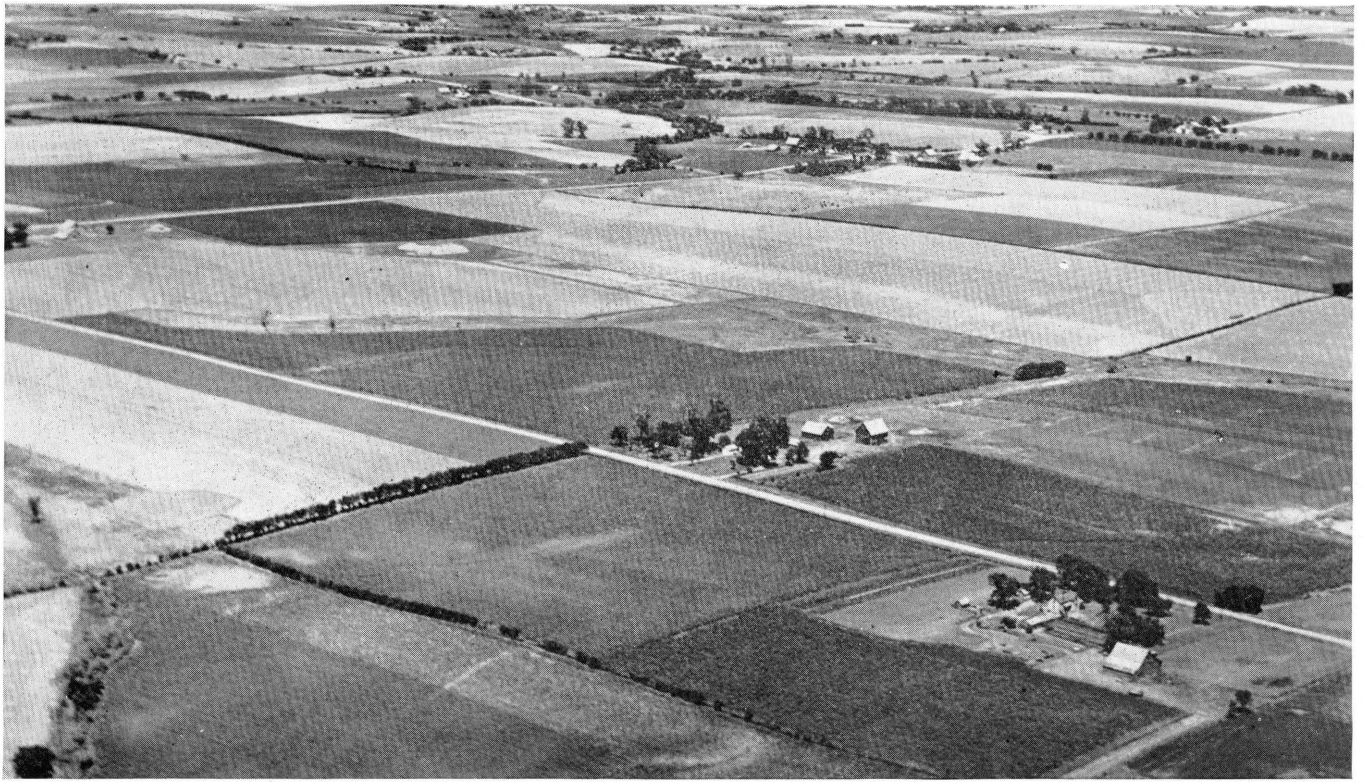
Poison baits now used consist of two components—a carrier and a poison—and are more attractive to the young 'hoppers and fledged adults than their normal green food plants. The most widely used carrier consists of a three to one mixture of sawdust and mill run bran. Sodium arsenite solution is one of 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.

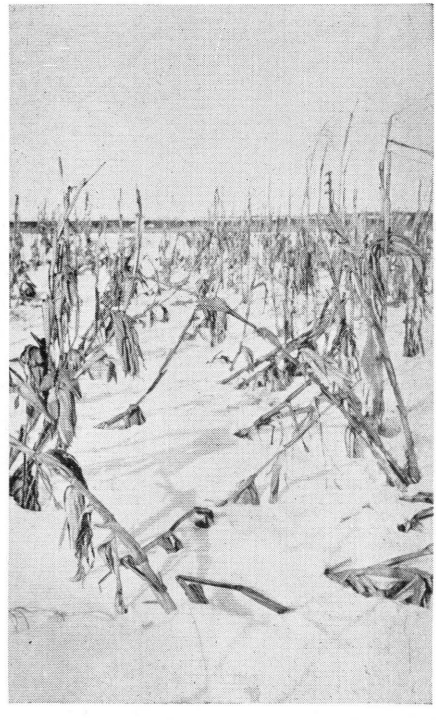


Those who have seen present-day Iowa from the air are impressed by the regular patterned areas of productive farm land. They sense the strength and independence of Iowa as they see the individual farmsteads which dot this landscape as far as the eye can reach. The Iowa prairie has been made into 213,000 farms enclosing 95 per cent of the state's area into productive fields, pastures, and farmsteads.—CHAPTER 1, STRUGGLE FOR FARM OWNERSHIP.

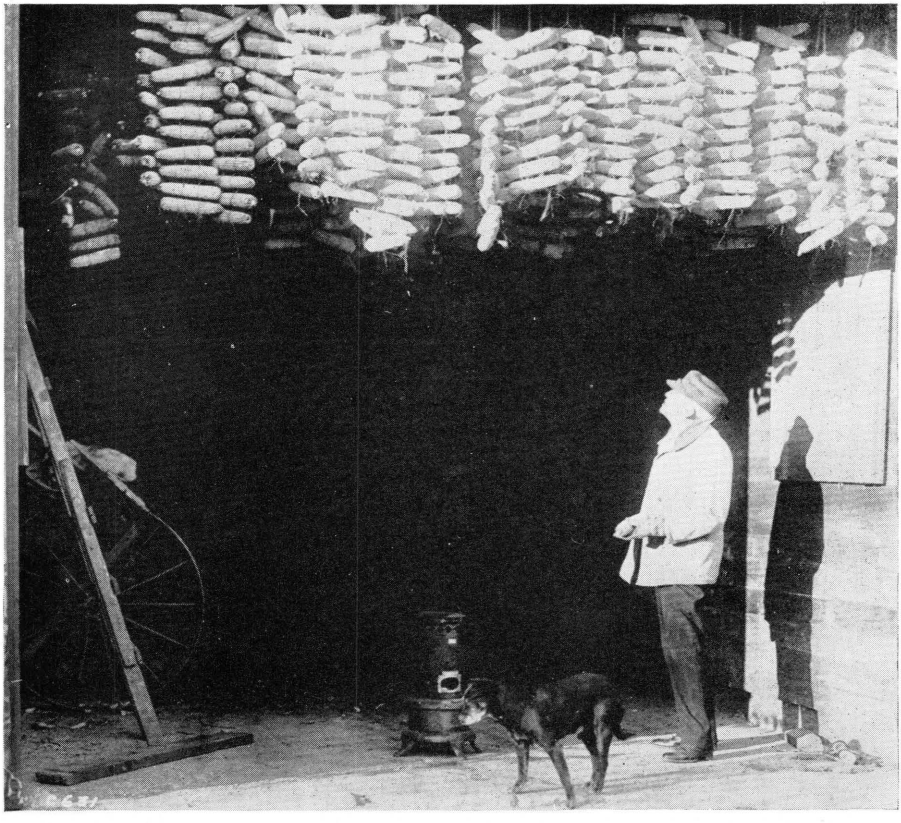
Iowa soils are productive. That fact is proved by the value of farm produce—a higher value than that of any other state in the Union. One-fourth of all Grade A land in the country is contained within the state's borders.—CHAPTER 2, THE SOIL THAT GROWS THE CROPS.

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.



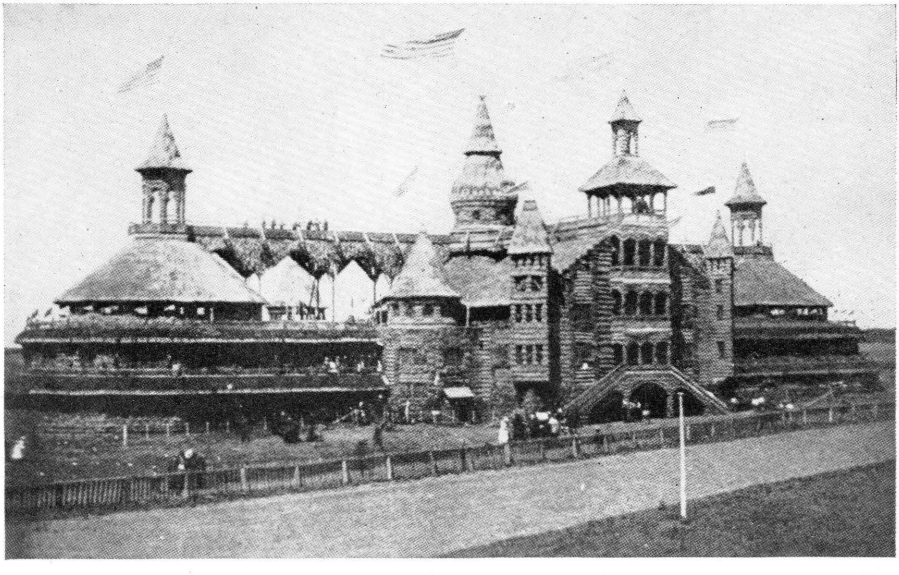
Different hybrids differ as much in their characteristics as do different people. These pictures of two hybrids in the same field were taken on the same day. Notice the difference in strength of stalks and roots.—CHAPTER 3, PRODUCING THE BUMPER CORN CROPS.



"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.

Bromegrass 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 hay or pasture year. Show above is Ida Fischer in 1943 in the field of bromegrass 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 attenion. 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 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. Exvery 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.