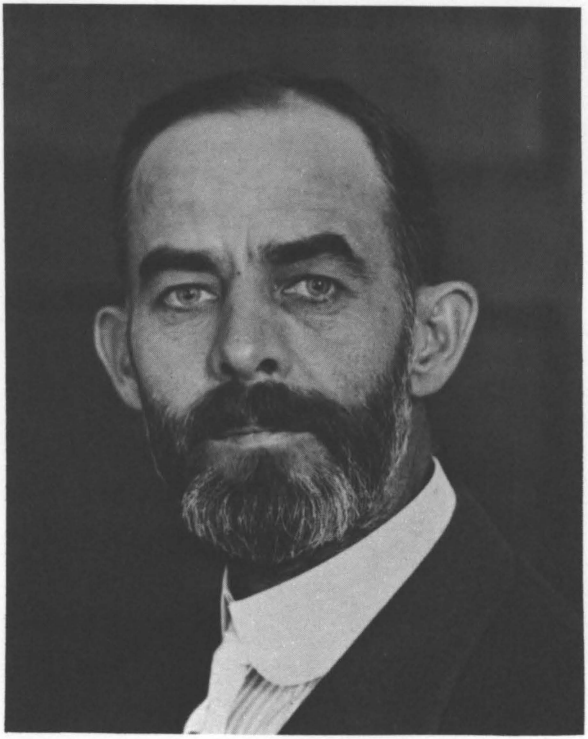
Early Iowa Corn Yield Tests and Related Later Programs



Perry G. Holden in about 1903, when he initiated the corn demonstration tests in Iowa counties as reported here. Credited with being among the first to inbreed corn, the first to be given the title Professor of Agronomy, and the first to organize a State Extension Service in Agriculture and Home Economics, Professor Holden was one of the most magnetic and inspirational leaders in promoting better methods in agricultural production and in community betterment.

Early Iowa Corn Yield Tests and Related Later Programs

Martin L. Mosher

Iowa State University Press, *Ames*, Iowa

The Author

Martin L. Mosher has received numerous awards and citations for his leadership in farm management and agricultural extension work. Notable among these were the USDA Superior Service Award in 1949 for "Especially meritorious service to agriculture through pioneering leadership in farm management extension work . . ." and the 1950 annual award from the Illinois Society of Farm Managers and Rural Appraisers for "Keen understanding of farm people and leadership in farm management extension and research work."

Mr. Mosher is author and joint author of many bulletins and magazine articles on seed corn selection and related topics in agriculture. Following his work with early seed corn testing he was selected to serve as the first "county agricultural adviser" (later called "county agent") in Iowa. He served Clinton County in this capacity from 1912 to 1916 when he moved to Woodford County, Illinois, to continue in the same service. Mosher later joined the staff of the University of Illinois where for 25 years he did research and extension work in the farm management department until his retirement.

Library of Congress Catalog Card Number: 62-13164

Introduction by Henry A. Wallace

IN THE FALL of 1906 I was rooming in the same house at Ames, Iowa, with M. L. Mosher, who was running County Corn Yield Tests at the various County Farms for P. G. Holden, the famous corn evangelist and probably the first person in the world to cross inbred strains of corn. Holden had gotten me interested in corn in 1904, when I had an ear-row corn yield test.

When Mosher asked me to help him weigh up the Story County Yield Test at the County Farm near Nevada, Iowa, I was naturally much interested. I was amazed to find how differently the seed corn furnished by different farmers produced. So were the farmers. When Holden inspired Mosher to test in the field the yielding power of seed from hundreds of different farmers, county by county, he set in motion forces which have changed the yielding power of corn in at least 30 nations.

Mosher went on to become the first Iowa County Agent, in Clinton County in 1912. There he applied the technique he had first learned on the County Farms of Iowa. But not he did the work more carefully and continued it until he found which farmers had the corn with the greatest inborn potentiality to serve Clinton County farmers. Then he went to Woodford County, Illinois, and discovered after three years of trials the world-famous Krug corn. Out of the mental climate which Holden and Mosher developed, grew the Iowa Corn Yield Test, which has now continued for 40 years, and which

perhaps did as much as any single force to demonstrate to Iowa farmers the worthwhileness of hybrid corn.

This unique corn book by M. L. Mosher is vital history. For me it lives in a very personal way because it calls up memories of the wisdom absorbed from M. L. Mosher in the cornfield, as we worked together harvesting and weighing in the field some 50 years ago.

Farvue Farm,
South Salem, New York

Author's Introduction

THIS SUMMARY REPORT of the early corn demonstration work in Iowa initiated by Professor Perry G. Holden – and the later work that grew from it – is offered as a tribute to Professor Holden, in recognition of the great influence he had on all who were privileged to be associated with him.

The first urgent request that I prepare this summary came from M. L. Wilson, formerly Director of the United States Agricultural Extension Service. He and I each made about 180 of the more than 600 talks on the "Seed Corn Specials" run on Iowa railroads in 1905.

Professor Holden was delighted when he learned that the old corn demonstration records were being summarized for publication. All chapters were submitted to him as they were written and several very helpful suggestions came from him. (Professor Holden died in 1959, at the age of 94.)

Others who encouraged me were Henry A. Wallace, Dean Emeritus Ernest Anthony and others of the Michigan State University Corn Foundation, and R. K. Bliss, Murl McDonald, Paul C. Taff and others of my old-time colleagues of the Iowa State University Extension Service.

I was asked to do the job because I had worked more closely with Professor Holden on the seed corn program than had anyone else. Also, I had kept carbon copies of summaries of the County Farm Demonstrations, which I

had prepared in 1912. They were not published, and the originals and all data obtained before 1909 have disappeared.

I am greatly indebted to Professor H. D. Hughes who wrote Chapter 9 of this book, "The Iowa State Corn Yield Test," and who has been otherwise most helpful in the preparation and publication of the manuscript, as well as to R. K. Bliss, Murl McDonald, and Paul C. Taff who also read the manuscript and provided helpful suggestions. I appreciate also the cooperation of the Iowa State University Press in effecting publication.

I realize that work similar to that reported here was being done in several other corn growing states. I have purposely limited this report to the work which P. G. Holden initiated, and to projects that grew directly from this work, with which I am familiar.

Finally, I would acknowledge the help of my wife and children, especially for their patience with me during those years when, as they might well have said, I "worked with, and thought, and dreamed about nothing much but corn."

Martin L. Mosher

Table of Contents

Part II

COUNTY AND STATE CORN YIELD TESTS

The development of more useful
corn score cards;
the Seed Corn Specials of 1905;
world-wide influence
of the County Farm demonstrations

Special Note: Copies of the detailed tables on which the graphs and charts presented here are based are on file in the libraries of Iowa State University, Michigan State University Corn Foundation, and University of Illinois. Also, carbon copies of four manuscripts prepared in 1912, which are referred to in Chapter 1, are on file in the library of Iowa State University. Copies of a diary of the Seed Corn Special Train described in Chapter 11 are also on file in the three libraries.

Illustrations

PART I

History and Summary of Data

Data from County Demonstrations during the 12 years 1904 to 1915, involving about 75,000 field plots

1. History, Purpose, and Plans of Demonstrations

WHEN PERRY G. HOLDEN came from Illinois in 1902, to become Head of the Department of Agronomy at Iowa State College, he brought with him a keen appreciation of the poor quality of the seed corn that was being planted by Corn Belt farmers.

While at the University of Illinois, Professor Holden had obtained from many farmers samples of seed which he planted side by side and had observed "tremendous differences in apparent yield and quality of corn grown from them."

He began at once to impress Iowa people with the notoriously poor seed corn that was being planted in Iowa. He did this in the classroom, at the Winter Short Course School, at Farmers' Institutes, and at every other opportunity.

Early in 1903 Professor Holden went to Hull, Iowa, to speak at the Sioux County Farmer's Institute. There a discussion developed as to whether crop experiments conducted at the State Agricultural Experiment Station, 200 miles distant, would be expected to apply equally well to the conditions of Sioux County. It was then that Professor Holden suggested the idea of locally conducted experiments and demonstrations, the local community to provide the land and labor and certain other local costs. (See Fig. 1.1.) As a result, a plan was developed, with the help and cooperation of the County Supervisors, for extensive

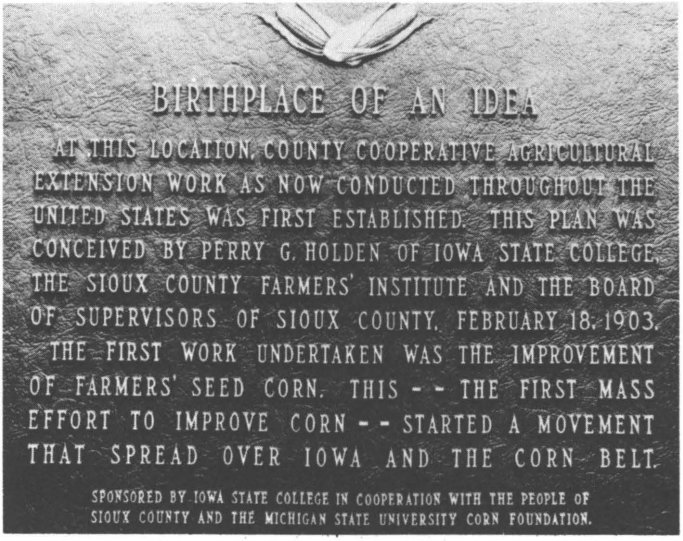


Fig. 1.1. Plaque commemorating the establishment of cooperative agricultural extension work. Dedicated at Hull, Iowa, August 22, 1957.

demonstrational plantings with corn on the Sioux County Farm in the spring of 1903.[1]

THE FARMERS' VARIETY TESTS WERE THE FIRST DEMONSTRATIONS

The first demonstration undertaken in Sioux County was what came later to be known as the "Farmers' Variety Test." This and other tests were planned as demonstrations rather than experiments. However, the results came to have great value in college and extension teaching.

Other demonstrations were included in later years, and as the work spread to other counties four tests became standard practice. They were:

[1]R. K. Bliss, *History of Agricultural and Home Economics Extension in Iowa*, Iowa State University, 1960, pp. 24 – 37.

Farmers' Variety Tests
Introduced Variety Tests
Thickness of Planting Tests
Single Ear Tests

Other tests were included during the later years, namely:

Depth of Planting Tests
Butt, Middle, and Tip Kernel Tests
Individual Ear Germination Tests

The extent to which the different demonstrations were conducted is shown in Figure 1.2. Statistics for these demonstrations are as follows:

Name of Demonstration	Number of Demonstrations	Number of Counties	Number of Years
Farmers' Varieties	97	43	13
Introduced Varieties	73	35	8
Thickness of Planting	143	32	8
Single Ears	151	33	7
Depth of Planting	21	14	2
Butt, Middle, and Tip Kernels	17	11	2
Individual Ear Germination	12	10	4

The number of counties in which demonstrations were conducted each year were:

Year	Number of Counties	Year	Number of Counties
1903	1	1910	9
1904	5	1911	16
1905	8	1912	10
1906	10	1913	6
1907	7	1914	1
1908	12	1915	15
1909	8		
		Total	108

WHO DID THE WORK?

The first work was under the immediate direction of Professor Holden, ably assisted by L. C. Burnett and J. W. Jones, assistants in the Department of Agronomy.

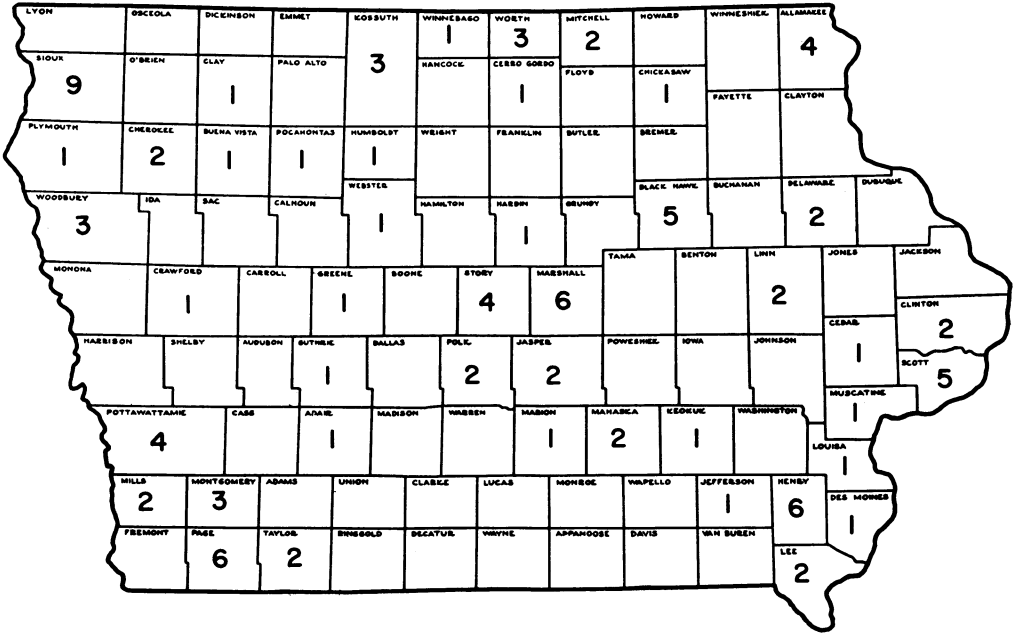


Fig. 1.2. Counties and numbers of years in which demonstrations were conducted.

Students, interested alumni, and local farmers were employed to help with the planting and harvesting. As a senior student I helped harvest the plots on the Story County Farm in 1904. Professor Holden's name appears as senior author of all reports published prior to 1911.

The Farm Crops Specialist was given the responsibility of directing the work of the demonstrations when the Iowa State College Extension Department was organized as of August 1, 1906. As the crops specialist, I had charge under Professor Holden's supervision from the summer of 1906 until the summer of 1912, except during the fall of 1908 and the year 1909. A. H. Snyder, Soils Specialist, directed the work during that time.[2]

Professor Snyder deserves much credit for having prepared reports of the demonstrations in eight counties in 1909 and having them published as Demonstration Reports Numbers 1 to 8. The publication of such reports was continued until 1915, which was the last year that the demonstrations were conducted. Copies of Demonstration Farm Reports, Numbers 1 to 62, are to be found in the Iowa State University Library.

The names of J. A. King in 1908, A. E. Nelson in 1909, and Murl McDonald in 1911 appear as co-authors of the published reports. P. C. Taff was in charge of the project from the fall of 1912 until 1915, which was the last year for which reports were published. After County Extension Services were organized, the county agricultural agents assisted the crops specialist in conducting the demonstrations in their respective counties. The following names of county agents appear on the reports published from 1913 to 1915: Clinton in 1913 and 1915, M. L. Mosher; Scott in 1914 and 1915, G. R. Bliss; Muscatine in 1915, J. W. Merrill; Black Hawk in 1915 (A. A. Burger was county agent but his name does not appear on the report); Des Moines in 1915, A. L. Higgins; Henry in 1915, Don E. Fish; Marion in 1915, Ben Walker. Murl McDonald's

[2]During 1908 and 1909 I was employed by two large hacienda owners in Mexico on a corn improvement project. (See Chapter 12.)

name appears as joint author of reports for Adair, Hardin, and Webster Counties in 1915.

PLAN OF CONDUCTING THE COUNTY FARM DEMONSTRATIONS

The Iowa Legislature enacted legislation in 1906 authorizing the County Boards of Supervisors to appropriate not more than $300 annually to pay the expenses of conducting demonstrations on the County Farms, under the supervision of the Extension Department of the College. (County Boards took care of such expenses without special authorization previous to 1906.) The County Boards appropriated funds for such demonstrations on the request of interested groups of local people, such as Farmers' Institutes and Short Course Schools.

Detailed plans for the demonstrations are given with the results in succeeding chapters.

Field meetings were held on the County Farms in the early fall of each year, to which thousands of farmers came to observe the lessons taught by the demonstrations. In reporting the work of the Farm Crops Division of the Department of Agricultural Extension for the year ending June 30, 1907, the dates of holding these meetings in 1906 and the approximate attendance are listed as follows:

County	Near what Town	Date	Attendance	Notes
Sioux	Orange City	Sept. 27	2,000	
Kossuth	Algona	Sept. 5	200	Afternoon only
Chickasaw	New Hampton	Sept. 22	1,000	
Greene	Farlin	Sept. 14	800	
Story	Nevada	Sept. 25	800	
Polk	Saylor	Sept. 11	600	Rainy day
Montgomery	Red Oak	Sept. 20	800	Rainy day
Page	Clarinda	Sept. 19	300	Rainy day
Taylor	Conway	Sept. 18	600	Rainy day
Total attendance in nine counties			7,100	

The plan at these meetings was to visit the plots in the forenoon, with an explanation of the work and results presented by some member of the Extension Service. Basket dinners were then enjoyed under the trees, after which there was a program of a general agricultural nature, in which local people and one or two from the college took part.

The results of the demonstrations were used in giving instruction at the college, on educational trains, at Farmers' Institutes, at Short Course Schools, in Chautauqua lectures by Professor Holden, and in general publicity. Local newspapers published reports of work in their respective counties.

THE BASIS FOR THIS REPORT

I summarized the data that had accumulated during the years of 1904 to 1911 and prepared manuscripts for four extension bulletins during the spring of 1912 as follows:

Comparative Value of Seed Corn Planted by Different Men

Imported and Seed House Seed Corn Compared With Home Grown Seed

A Study of Single Ears of Seed Corn

Thickness of Planting Corn

I was transferred from the Extension Department staff at Ames September 1, 1912, to become the County Agricultural Agent in Clinton County, Iowa. The bulletins were not published and the original manuscripts and all other records previous to 1909 have disappeared. However, I had kept carbon copies of the four manuscripts. These manuscripts and the published reports for the years of 1909 to 1915 provide the data summarized in this report.

THE FARMERS' VARIETY TESTS WERE THE MOST IMPORTANT DEMONSTRATIONS

The Farmers' Variety Tests were the first demonstrations conducted on the County Farms and were probably the most important. However, in this report the Thickness of Planting Tests will be considered first, because of their importance in interpreting the results of the Farmers' Variety Tests, and all other tests.[3]

[3]Only summaries of the results of demonstrations are shown in this report. Detailed tables of all data for all demonstrations are filed in the libraries at the Iowa State University, the University of Illinois, and Michigan State University to serve as a supplement to this book. Carbon copies of the lost manuscripts are included in the supplement filed in the Iowa State University Library.

2. Thickness of Planting Tests

THE PURPOSE of these tests was to determine and demonstrate the relation of planting seed at different thicknesses to the yield and quality of the crop produced.

PLAN OF THE TESTS

The seed was planted in plots of seven by ten hills during the first three years and replicated four times in different parts of the field to minimize yield differences due to differences in soil, drainage, and other factors. Four plots, eight hills square, were used during the four years 1908 to 1911. Six or eight plots of four by eight hills were used in 1912 and 1913. All seed was dropped by hand so as to insure accuracy in the number of kernels planted. The hills were spaced three-and-a-half by three-and-a-half feet.

Nine thicknesses of planting were compared — from one to five kernels (or stalks) per hill. Thus the planting was done at rates of from 3,556 to 17,780 kernels (or stalks) per acre.

SOURCE OF SEED

The seed used in each county was obtained from farmers living in the respective counties. It usually was

obtained from a farmer known to have good seed. However, for some tests the seed was a composite of seed planted in the Farmers' Variety Test.

Records are not available for the individual tests conducted from 1905 to 1908. However, for 88 tests conducted in 25 counties from 1909 to 1913 the following methods were used:

Mixed seed was planted with one to five kernels in 23 tests.
Mixed seed was thinned to one to five stalks in two tests.
One farmer's seed was planted with one to five kernels in 41 tests.
One farmer's seed was thinned to one to five stalks in 22 tests.

RECORDS

This summary reports on only the bushels per acre, percent stand, stalks per acre at harvest, percent barren stalks, and percent of marketable ears. The percent of marketable ears as reported here includes both the "seed ears" and the "marketable ears" of the original data. Records obtained on the percent of suckers, and the percent of nubbins and worthless ears are not here reported because of their apparent less worth.

Bushels Per Acre

In estimating the yield in bushels per acre, the total number of pounds produced was divided by 70, 75, 80, or 85, according to the estimated dryness of the corn when harvested.

Percent Stand

This refers to the percentage of stalks found at harvest time to the number of kernels planted, or the number

of stalks to which the corn was thinned at the time of the first cultivation.

Percent Barren Stalks

Barren stalks were recorded as those stalks other than suckers which bore no harvestable ears.

As the corn was harvested the ears were divided into four grades by numbers of ears as: Seed ears, market ears, nubbins, and worthless ears.

RESULTS AND CONCLUSIONS

The average results of 143 thickness of planting tests in 32 counties during the eight years of 1905 to 1913, except 1907, are shown in Figures 2.1, 2.2, and 2.3.

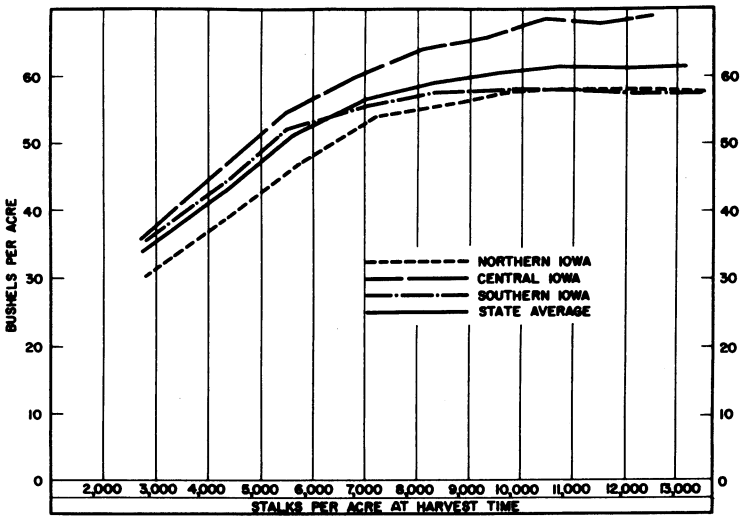


Fig. 2.1. Bushels per acre in relation to stalks per acre: 143 tests in 32 counties during the eight years, 1905 to 1913, except for 1907.

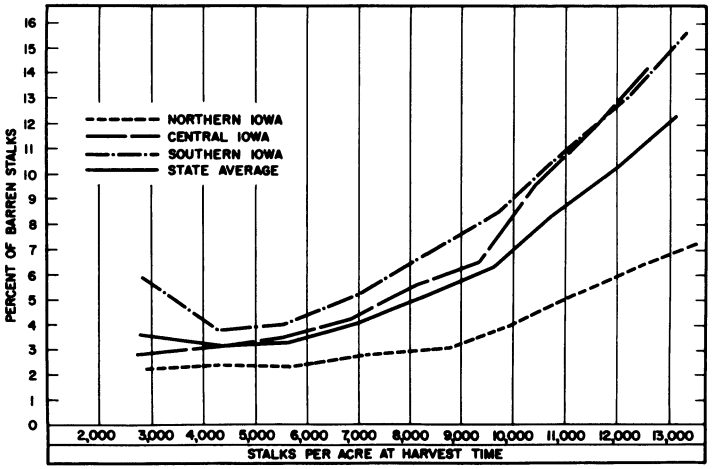


Fig. 2.2. Percent of barren stalks in relation to the stalks per acre.

It is evident from the results here reported that there was more danger of loss from planting too little than too much seed. It would appear that the general practice of planting three kernels per hill (10,668 per acre) was about right for the conditions as they prevailed at the time, but when the planter missed three it was better to drop four rather than two.

The yield increased rapidly with the increase from one to three kernels or stalks per hill (3,556 to 10,668 per acre), increased slightly more for four per hill (14,224 per acre), and leveled off about the same for four-and-one-half and five per hill (16,002 and 17,780 per acre). The highest eight-year average yield was in northern Iowa with four kernels or stalks per hill, in central Iowa with five per hill, and in southern Iowa with three-and-one-half per hill.

There were only 75 to 80 percent as many stalks left at harvest as there were kernels planted, or stalks left at the time of the first cultivation.

The proportion of suckers decreased rapidly with an increase in the thickness of planting. Consequently, it

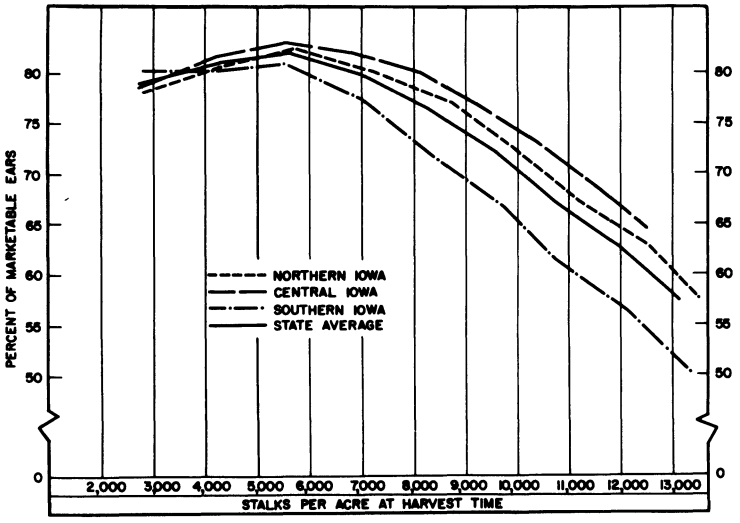


Fig. 2.3. Percent of marketable ears in relation to stalks per acre.

was recommended that a person should plant plenty of seed, especially on rich land, for it is better to have stalks than suckers, because those ears which are produced on suckers are usually small, late, and of poor quality.

The proportion of barren stalks increased with the increase in thickness of planting. This was much more pronounced in central and southern Iowa than in northern Iowa.

The proportion of marketable ears decreased with the increase of thickness of planting. This also was more apparent in southern than in central or northern Iowa.

These two facts — namely, the increase in the percentage of barren stalks and the decrease in marketable ears as the thickness of planting increased — are the two facts that had so important a bearing on the location of the causes of the great differences in yield of corn from different farmers and of different ears of the same man's seed (other than for germination and low stand). It is for that reason that the Thickness of Planting Tests are being discussed before the Farmers' Variety Tests.

The fact that "On rich land the thicker planting gave better results than on soil lacking in fertility" was recognized in the original manuscript prepared in 1912. Of course, it is now recognized that the old-time, blanket recommendation that "The general practice of dropping three kernels per hill is about right under average conditions" needs to be very much broadened. Present recommendations vary the thickness according to the fertility level of the soil, the available moisture, and the decrease in size of stalks and ears as one goes north from the middle of the Corn Belt.

3. The Farmers' Variety Test

A COMPARISON of the seed corn planted by different farmers was the first of the demonstrations conducted in Sioux County in 1903, and continued to be the center of interest among the demonstrations during the next twelve years.

PURPOSE AND PLAN OF DEMONSTRATIONS

The purpose of the demonstrations was to show the quality of seed corn planted in Iowa and to determine, if possible, the cause for the low yields produced by many lots of seed.

The demonstrations were conducted on the County Farms by the Extension Department of the Iowa State College, cooperating with the County Boards of Supervisors.

At corn planting time, men from the College, transported by interested farmers in each county in which demonstrations were being conducted, obtained samples of seed corn from different farmers "as they came down the road." Most samples were from planter boxes or from sacks in the field, thus insuring that the seed accurately represented the seed that the farmers were planting.

The different samples of seed were numbered and planted side by side in a field on the County Farm. During most years a careful germination test of several

kernels from each sample was made. As uniform a field as it was possible to find on the County Farm was selected for the demonstrations. The general plan of the field tests, including method of planting, numbers of plots, and records kept, was much the same as described in Chapter 2. Three kernels were planted by hand in each hill.

DIFFERENCES IN YIELD

The ten-year average yield of 5,245 farmers' samples was 55.4 bushels per acre. The best tenth of the samples yielded 66.0 bushels, or 10.6 bushels more than the average of all. The poorest producing tenth yielded only 41.3 bushels, or 14.1 bushels less than the average and 24.7 bushels less than the best tenth.

The spread in yield between the average of the best tenth and of the poorest tenth varied from 9.2 bushels in Pottawattamie County in 1908 to 46.7 bushels in Polk County in 1905.

Thus one farmer in ten was planting seed which yielded an average of 11.7 bushels per acre more than the average of the other nine. The facts that about 12 bushels per acre average annual loss was realized by nine of ten farmers, and that a 25 bushel loss was realized by one in ten only because they were planting less productive seed than some of their neighbors, were the first and probably the most important lessons taught by the County Farm demonstrations.

It is not surprising that farmers flocked to the Special Seed Corn Trains, Farmers' Institutes, and Fairs to learn how to select seed that would produce better yields of corn of better quality. They wanted to know "Why" and "How." They were told that differences in yield were due largely to differences in stand and that differences in stand were due to differences in germination. Barren stalks and stalks producing only nubbins were given as other important causes of low yields.

RELATIONSHIP OF STAND TO YIELD

A summary which shows the relationship of stand to yield of farmers' samples as found in the average of 83 demonstrations in 36 counties during ten years is shown in Figure 3.1.

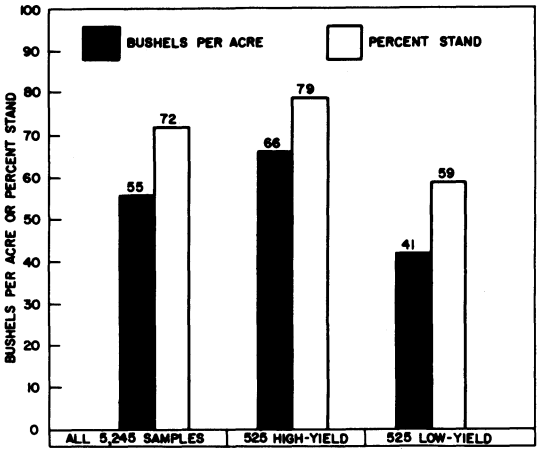


Fig. 3.1. Relation of stand to yield of farmers' samples. Summary of 5,245 samples in 83 demonstrations in 36 counties during the ten years 1904 to 1913, inclusive.

Records of about 25,000 field plots are involved in this study of farmers' varieties. The large number of plots and the consistency of results from demonstration to demonstration and from year to year lend confidence to the accuracy with which the data show the condition of seed that was being planted.

The ten percent best yielding samples had stands of 78.8 percent as compared with 71.6 percent for the average of all and only 58.9 percent for the average of the ten percent with the lowest yields.

The relationship of yield to stand for the average of all demonstrations is shown in Figure 3.2. All farmers' samples in all demonstrations were divided into ten groups according to the percent of stand. The first group

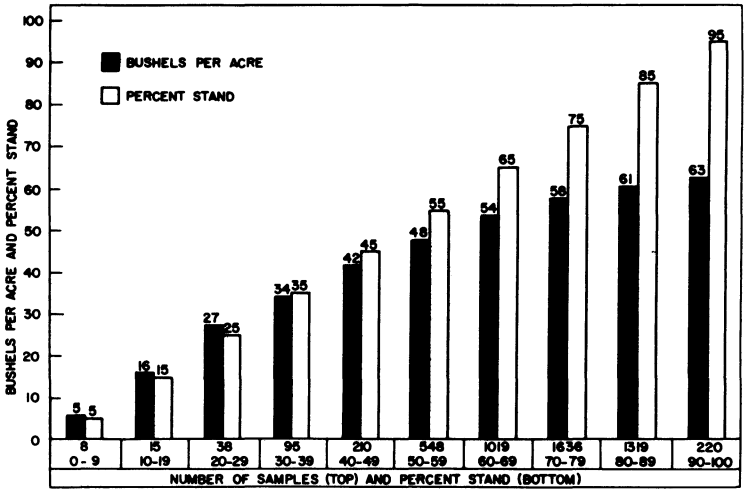


Fig. 3.2. Relation of yield to stand of farmers' samples.

had less than 10 percent and the tenth group had from 90 to 100 percent stand.

The regularity with which the average yield increased with the increase in stand, as shown in Figure 3.2, lends confidence to the statement that difference in stand was a major cause of the wide differences in yield. However, it must be remembered that difference in stand was only one cause of differences in yield. Barren stalks and stalks having only nubbins also were important causes of low yield.

RELATION OF GERMINATION OF SEED AND STAND TO YIELD

Farmers were told that if they would make a germination test of six kernels taken from each ear and plant only those ears that showed six strong stem and root sprouts, they could insure good stands and relatively high yields. A study of data from the demonstrations shows the validity of the recommendation (see Figure 3.3).

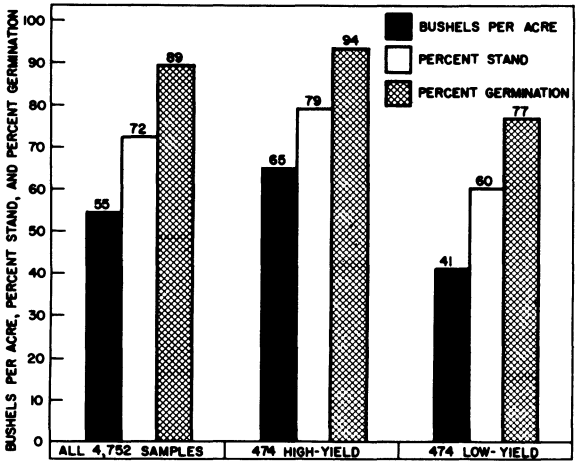


Fig. 3.3. Relation of germination and stand to yield of farmers' samples. Summary of 4,752 samples in 73 demonstrations in 35 counties during the eight years, 1905 to 1913, except 1907.

The germination of the 10 percent high-yielding samples showed 93.6 percent of live kernels, including those with both strong and weak sprouts. Of the 93.6 percent live kernels, 84.5 percent produced stalks that survived until harvest, producing 79.1 percent stand and 64.8 bushels of corn per acre.

In sharp contrast, germination tests of the 10 percent lowest yielding samples showed only 77 percent of live kernels, of which only 78.1 percent survived, to produce only 60.1 percent stand and 41.1 bushels per acre.

The records of all samples of which germination tests were available were divided into groups according to the percentage germination (see Figure 3.4). Yields increased with as great regularity as could be expected in view of the small number of samples in some groups, and the varying conditions from county to county and from year to year. Yields varied from 15.1 bushels per acre for the average of the samples which showed only 10 percent or less germination to 59.7 bushels for the samples that showed 100 percent germination.

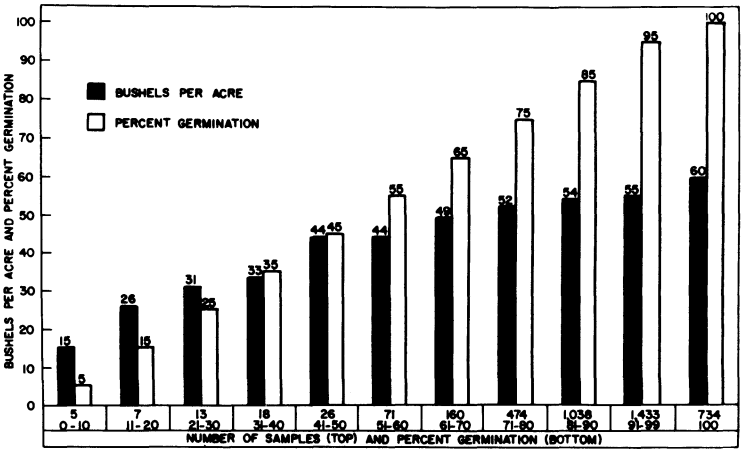


Fig. 3.4. Relation of yield to germination of farmers' samples.

THE DEMONSTRATIONS WERE EFFECTIVE

The results of the demonstrations were published widely. Within a few years the testing of each ear of seed corn had become a common practice among progressive farmers.

BARREN STALKS AND STALKS PRODUCING ONLY NUBBINS

The fact was recognized that the low yields of many farmers' samples were caused by large numbers of barren stalks and by stalks producing only nubbins, as well as by poor stands. However, it was assumed by many that barrenness and the ability to produce only nubbins was largely a matter of vitality, which could be observed in the germinated seedlings. In the first published reports, those for the year of 1909, the cause of low yields is stated as follows: "This means that low yields were caused principally by corn which failed to grow, and that the difference in vitality was the greatest difference between the several samples of seed."

The "barren stalk" and "nubbin" factors were recognized in the 1909 reports of the single ear tests, which are discussed in Chapter 5. The 1909 reports state: "There are a few instances in which ears of corn that gave the same percentage of stand differed widely in yield, and ears that gave approximately the same yield differed widely in percentage of stand. This may be explained by a difference in vitality. The ear which gave a low yield but produced a correspondingly high stand was undoubtedly a weak ear and produced stalks many of which produced only nubbins or worthless ears. A careful test of each ear and the discarding of those which are weak or dead would greatly increase the yield."

The importance of barren stalks and nubbins in relation to yield of farmers' samples was recognized in some Demonstration Farm Reports for the year 1911 in the following statements: "Low yields are usually caused by poor stands.... The low yields produced by many samples were caused by barren stalks and nubbins." However no cause is given for barren stalks and nubbins other than from weak seed which could be detected in the germination test.

A different idea appears in the reports for the year of 1912: "Poor stands are the greatest causes of low yields. ... However, differences in yields may sometimes be due to other causes. For example, sample 48 (in the Winnebago County Report) produced 58 bushels per acre with 87 percent stand, while No. 44 produced only 43 bushels with exactly the same stand. This can be accounted for only by differences in the producing power of the corn." This appears to mean that barrenness and nubbin production were considered to be inherited qualities.

The percentage of barren stalks and marketable ears in relation to yield of farmers' samples was studied in the preparation of this report. The close relation of barren stalks and of marketable ears to thickness of planting was discussed in Chapter 2. The differences in yield, barren stalks, and marketable ears in that study were due only to differences in thickness of planting and not to

inherited differences in the seed, because the seed for the different thicknesses of planting was always the same.

In this study of the relation of barren stalks and marketable ears to yield of farmers' samples, the yield, percent of barren stalks, and of marketable ears found in the thickness of planting tests with the same number of stalks per acre as produced by the farmers' samples were used as checks, as a measure of causes of high or low yield other than the stand of stalks.

An eight-year summary of the loss or gain in yield of farmers' samples from other causes than stand is shown in Figure 3.5. The eight-year average yield of all farmers' samples was 54.6 bushels per acre, produced with an average of 7,700 stalks per acre. This was 94.1 percent of the 58 bushel average yield produced with the same number of stalks in the thickness of planting tests.

The ten percent best farmers' samples produced 64.8 bushels per acre with 8,400 stalks per acre. They would

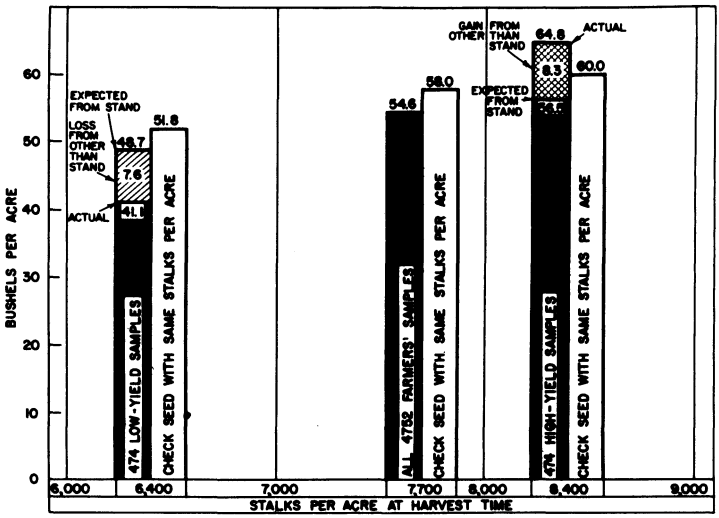


Fig. 3.5. Loss or gain in yield of farmers' samples from causes other than stand differences.

have produced only 56.5 bushels if they had produced only the 94.1 percent of the 60 bushels from the same number of stalks per acre in the thickness of planting tests. It appears, therefore, that only 1.9 bushels of the 10.2 bushels greater-than-average yield was due to the better stand and 8.3 bushels was due to other causes.

Again, the ten percent poorest farmers' samples produced 41.1 bushels per acre with 6,400 stalks per acre. They would have produced 48.7 bushels if they had produced 94.1 percent of the 51.8 bushels produced from the same number of stalks per acre in the thickness of planting tests. So it appears that only 5.9 bushels of the 13.5 bushels less-than-average yield was due to the poorer stand and 7.6 bushels to other causes.

Eighty-one percent of the 10.2 bushels higher-than-average yield of the ten percent best samples was evidently due to other causes than stand differences. Fifty-six percent of the 13.5 bushels lower-than-average yield of the ten percent poorest samples appeared due to such other causes.

Higher yields than expected from the stand of the ten percent best farmers' samples and lower yields than expected from the poorest samples were obtained in each of the 45 county demonstrations from which data needed to make the study were available.

Thus it appears that there was some factor, or factors, other than germination of the seed, or survival of the stand, that caused a few farmers' samples to produce much more and a few others much less than the average of the seed that was planted in any county.

RELATION OF BARREN STALKS TO YIELD

Differences in yield can be due only to differences in the number of ears per acre or the average weight of the ears, or to both. The average farmers' sample produced 7,700 stalks per acre, 6.1 percent of which were barren as shown in Figure 3.6. This was 15.1 percent more than

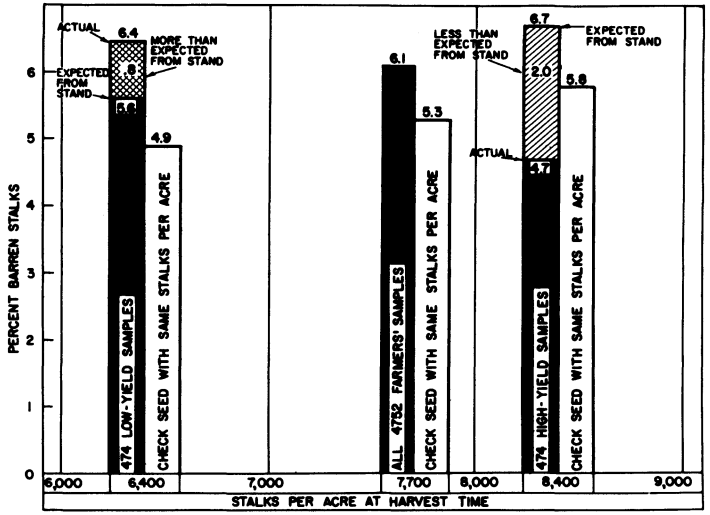


Fig. 3.6. Higher or lower percents of barren stalks from causes other than the thickness of stand.

the 5.3 percent barren stalks produced by 7,700 stalks per acre in the thickness of planting tests.

The 10 percent high-yielding samples produced 8,400 stalks per acre, only 4.7 percent of which were barren. They would have produced 6.7 percent barren stalks if they had produced 15.1 percent more than the 5.8 percent barren of the 8,400 stalks in the thickness of planting tests. A study of the data from all tests shows that the high-yielding samples produced fewer barren stalks than expected from the stand obtained in 35 of the 45 county demonstrations for which the study was made, produced the same in seven, and more in only three cases.

The 10 percent low yielding samples produced 6,400 stalks per acre, 6.4 percent of which were barren. They would have produced only 5.6 percent barren stalks if they had produced 15.1 percent more than the 4.9 percent barren of the 6,400 stalks in the thickness of planting demonstrations. The low-yielding samples produced more barren stalks than expected from the stand in 35 of

the 45 demonstrations, produced the same in three, and less in seven cases.

Thus, it appears that a considerable part of the high-yielding quality of the best farmers' samples was due to an inherited relative freedom from barrenness.

THE RELATION OF MARKETABLE EARS TO YIELD

As the thickness of planting increased in the thickness of planting tests (Chapter 2) the percent of marketable ears decreased. However, in the farmers' variety tests the high-yielding samples with their thicker stands produced more marketable ears than the average, and the low-yielding samples with their thinner stands produced less marketable ears than the average.

The 10 percent high-yielding samples produced 4.5 percent more and the 10 percent low-yielding samples 2.6 percent less marketable ears than was expected from the stands of stalks produced by them (see Figure 3.7).

High-yielding farmers' samples produced more marketable ears than expected from the stand in 43 and less in only two of the 45 county demonstrations. On the other hand, low-yielding samples produced fewer marketable ears than expected in 39 and more in only six of the 45 demonstrations.

The ability to produce more or less than average marketable ears was, therefore, an important factor in the production of high or low yields of corn. The best farmers' samples owed more of their higher yielding ability to the production of high percentages of marketable ears than the poorest samples owed their low yields to low percentages of marketable ears.

Thus we see now that the making of germination tests of each ear was a very valuable means of discarding low-yielding seed but that it fell far short of selecting the high-yielding seed that had been selected and prepared for planting by a few farmers. Good germination was an

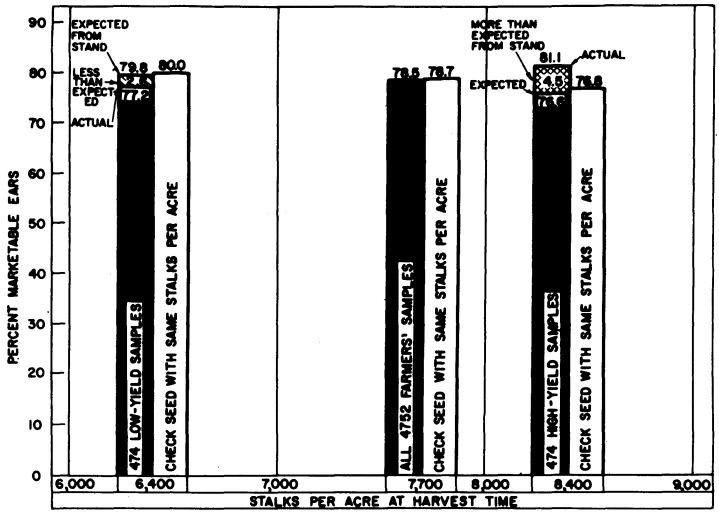


Fig. 3.7. Higher or lower percent of marketable ears from causes other than thickness of stand. Summary of tests of farmers' varieties in 35 counties during the eight years, 1905 to 1913, except 1907.

important factor in the selection of high-yielding samples but some hidden factors that caused them to produce few barren stalks and uniformly good ears were even more important. It was the elimination of the germination and stand factors that led to the finding of consistently high-yielding strains of seed corn in both Clinton County, Iowa, and Woodford County, Illinois. (See Chapters 7 and 8.)

SECOND AND THIRD YEAR FARMERS' VARIETY TESTS

After several years of the County Farm demonstrations it became apparent that there were a few men in each county who had especially good strains of corn. Tests were conducted in 1911 and 1912 to learn if such apparently superior strains would produce high yields consistently from year to year. In 1911 a few men whose seed had done particularly well in 1910 were asked to

provide seed for a second year's test. This was done in eight counties in 1911 and repeated in eight counties in 1912. Also in 1912, in four counties those men whose seed had yielded well both in 1910 and 1911 brought in seed for a third year's test. Such seed was planted beside samples obtained for the first time from planter boxes.

About half of the second-year samples repeated their performance, by outyielding the average of all first-year farmers' samples. There was only one case in which none of the second-year samples outyielded the average of the first-year farmers' samples. There was also one case where none of the third-year samples yielded better than the average of the first-year farmers' samples. An average of four two-year samples per county outyielded the average of 59 first-year farmers' samples both years. The average two-year advantage was 6.1 bushels per acre. The average three-year advantage of the three-year samples was 5.5 bushels per acre. Only one to two bushels of the six bushel advantage of the two-year and

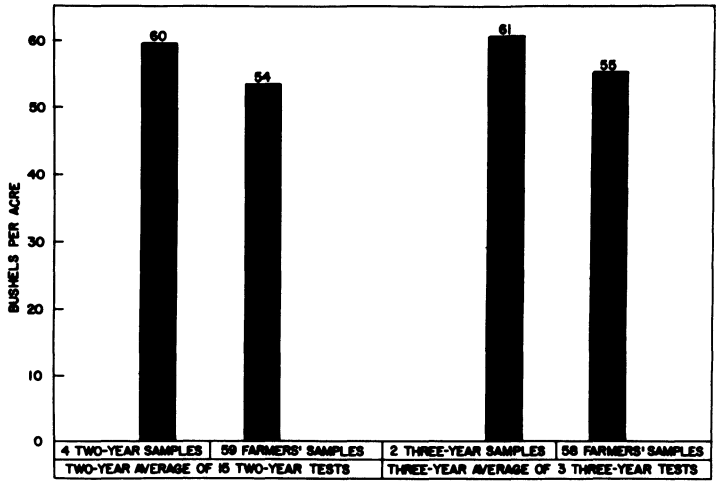


Fig. 3.8. Yield of second- and third-year farmers' varieties compared with all first-year farmers' samples.

three-year samples could be attributed to better-than-average stands, as shown by comparing the variety tests with the thickness of planting tests. The two-year and three-year samples produced fewer barren stalks and more marketable ears than the average of all first-year farmers' samples. These two-year and three-year tests verified the conclusion that there were a few men who had strains of corn that were superior for their area (see Figure 3.8). This led to the Clinton County, Iowa, and the Woodford County, Illinois, Corn Yield Tests. Still further, it led to the Iowa State Corn Yield Test, in which several strains of corn were found that came into widespread use as open pollinated varieties.

4. Introduced Seed Compared With Home-grown Seed

SEED BROUGHT into the county was compared with local farmers' seed obtained from planter boxes in most counties in which demonstrations with corn were conducted.

Such introduced seed was of two classes. One, known as *imported seed,* was obtained from prominent and successful corn growers living in different parts of the state —usually prize winners at corn shows. The report for the year 1911 says, "The seed classed as imported was secured from first-prize winners at the State Corn Show in December, 1910."

Seed purchased from large seed companies and referred to as *seed house seed* was the second class of introduced seed. The seed house samples were obtained by farmers who had ordered as if for planting on their own farms.

PLAN OF DEMONSTRATIONS

The imported and seed house samples were planted beside and in the same manner as the farmers' samples. The same data were obtained. Samples of imported seed from prize-winning farmers were planted in 66 of the 83 county demonstrations where the farmers' samples were planted. Seed house samples were planted in 55 of the 83 county demonstrations.

FARMERS' SAMPLES OUTYIELDED IMPORTED SEED

The average yield of all samples imported from prize-winning farmers was four bushels less than the average of all farmers samples (see Figure 4.1). The average yield of the imported seed fell below the average of all farmers' seed in 40 of 66 demonstrations.

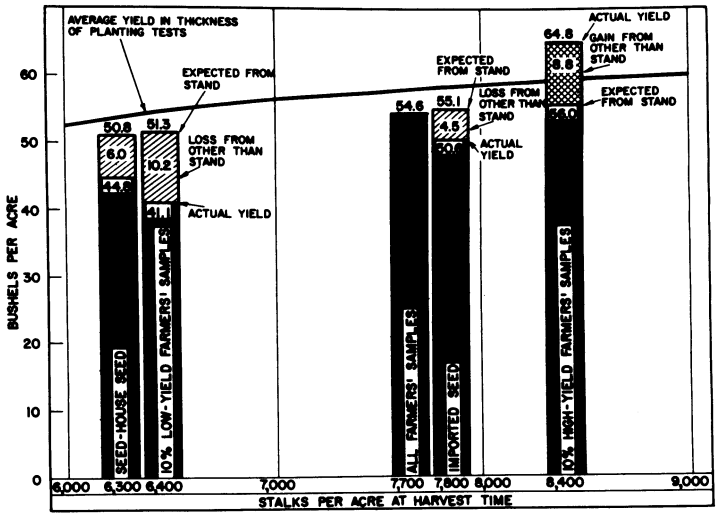


Fig. 4.1. Yield of imported and seed house seed compared with all, 10 percent best, and 10 percent poorest farmers' samples: 61 field tests in 35 counties during the eight years, 1905 to 1913, except 1907.

The 10 percent best farmers' samples outyielded the average of all imported seed in every demonstration, and by an average of 14.2 bushels per acre. The 10 percent poorest farmers' samples outyielded the imported seed in five demonstrations and were outyielded 3.7 bushels per acre as an average for all tests. The one best farmers' sample outyielded the best imported sample in 33 demonstrations, and by an average of 5.5 bushels per acre in all 41 demonstrations for which the data were available.

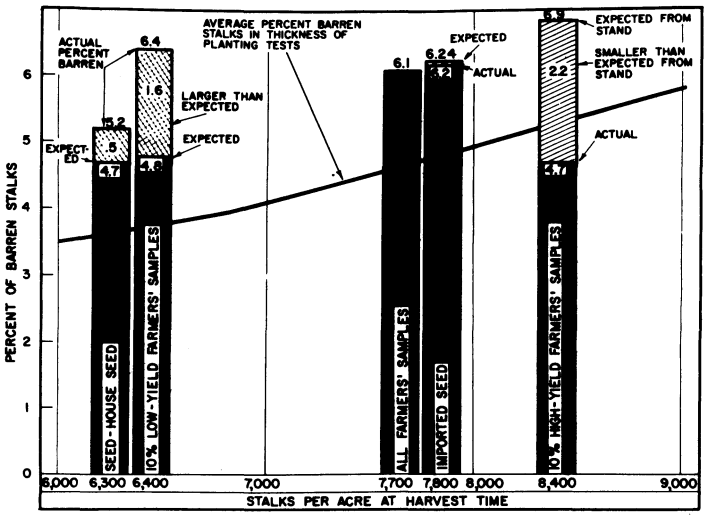


Fig. 4.2. Percent of barren stalks of imported, seed house, 10 percent best, and 10 percent poorest farmers' samples compared with all farmers' samples.

The imported seed produced slightly better stands than the average of the farmers' samples and about the same percentage of barren stalks (see Figure 4.2).

The quality of the average crop produced from imported seed was not as good as the average of that from local farmers. Only 72.7 percent of the ears produced from imported seed were classed as marketable, as compared with 78.5 percent, as the average for all local farmers' samples (see Figure 4.3).

The late maturity of much of the imported prize-winning seed was one of its greatest faults. The prize-winning samples from the State Corn Shows were usually relatively late in maturing.

MOST SEED HOUSE SEED WAS POOR

The seed house seed used in the demonstrations produced 9.8 bushels less than the average of all farmers'

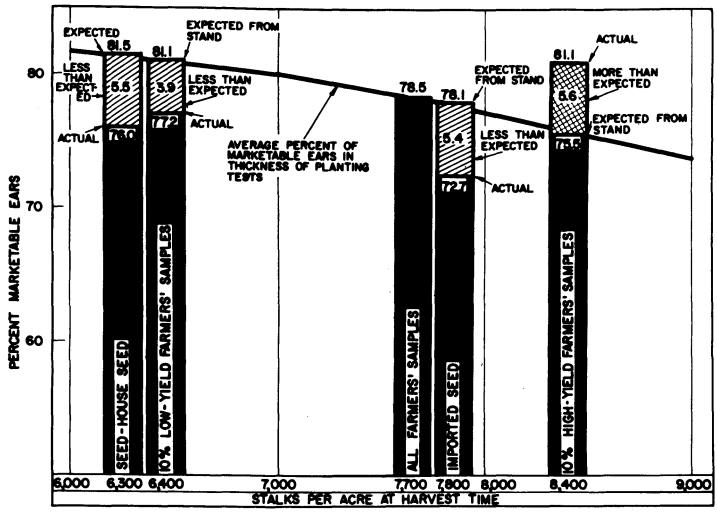


Fig. 4.3. Percent of marketable ears of imported, seed house, 10 percent best, and 10 percent poorest farmers' samples compared with the average of all farmers' samples.

samples and 20.0 bushels less than the 10 percent best (see Figure 4.1).

The average yield of all seed house seed fell below that of all farmers' samples in 50 of 54 demonstrations, and below the 10 percent poorest farmers' samples in 12 trials.

The average stand produced by the seed house seed was only 59.5 percent of the kernels planted, which was almost exactly the same as the average percent for the one-tenth poorest farmers' samples and 19.6 percent less than the best tenth of farmers' samples.

FALLACIES IN RECOMMENDATIONS BASED ON IMPORTED SEED DEMONSTRATIONS

Two fallacies in recommendations based on the Imported Seed Demonstrations were not recognized at that time. *First,* it had been assumed that the relative low

yield from the imported prize-winning samples was due to the fact that they were not acclimated and not to the fact that they, as a rule, lacked some hidden yield quality which the judges had been unable to observe but which some of the farmers' samples possessed.

The *second* fallacy was expressed when telling of a safe place for a farmer to buy good seed; namely, "He can go to some neighbor who is known to raise good corn and has more seed than he will need on his farm." This assumed that the neighbor had good seed because he had won a prize at a corn show.

One illustration of how these fallacies were discovered is given in the latter part of Chapter 10, Some Contributions of Corn Yield Tests to Seed Selection and Corn Shows.

5. Individual Ear Tests

A LARGE NUMBER of ears of carefully selected seed were obtained from each of one to three men in each county and planted in ear-to-row tests on the County Farm. Usually two men each brought in forty ears. A total of 6,387 single ears were tested in 168 demonstrations in 35 counties during eight years.

The purposes of these tests were: (1) to demonstrate the difference in yielding power of different ears of one strain of seed that appeared equally good and (2) to determine if possible the causes for such difference.

Each ear was numbered and a germination test of each made. The usual procedure was to plant each ear in four rows in different parts of the demonstration field to overcome differences in soil and drainage. The same information was recorded regarding stand at harvest time and the yield and quality of corn produced as for the other demonstrations.

DIFFERENCES IN YIELD

The one-fourth best ears averaged 11.3 bushels per acre more than the average of all ears and 24.8 bushels more than the one-fourth poorest ears in the 168 tests. See Figure 5.3.

The value of making a careful germination test of a few kernels from each ear was again well demonstrated. Ears showing from none to 50 percent germination

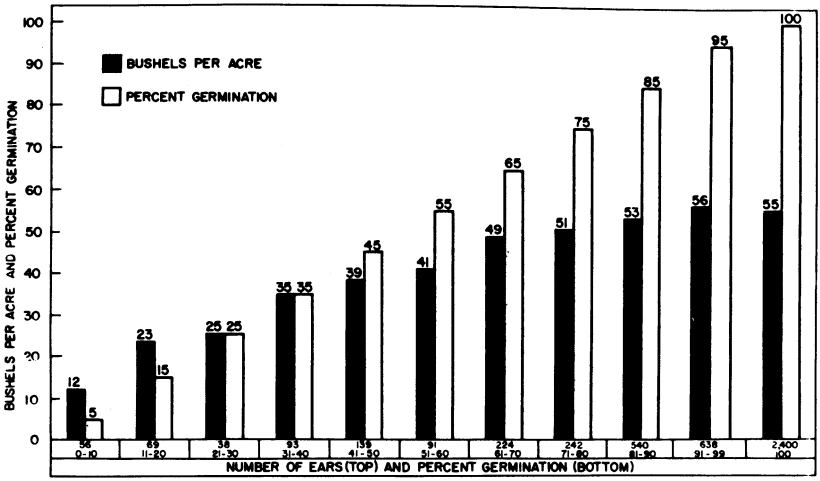


Fig. 5.1. Relation of yield to germination of single ears. Summary of 4,532 ears during five years of 1908 and 1910 to 1913.

averaged only 12 to 39 bushels per acre, with 4,532 ears from 100 men included in the comparisons. Ears showing 51 to 90 percent germination yielded 41 to 53 bushels and those testing better than 90 percent yielded an average of 55 or more bushels per acre (see Figure 5.1).

The individual ear tests, as did the farmers' variety tests, demonstrated the poor condition of the seed corn being planted by Iowa farmers. The seed used in the individual ear tests was obtained from the more progressive farmers of the counties in which the tests were made. Even so, only five of 80 lots of ears for which data were available had all ears with more than 90 percent germination. It is no wonder that the idea of testing a few kernels from each ear as a means of seed selection spread rapidly.

Average yields of individual ears increased at the rate of seven to 10 bushels per acre for each 10 percent increase in stand, up to 50 percent stand. The increase was from three to four bushels for each 10 percent increase above 50 percent (see Figure 5.2).

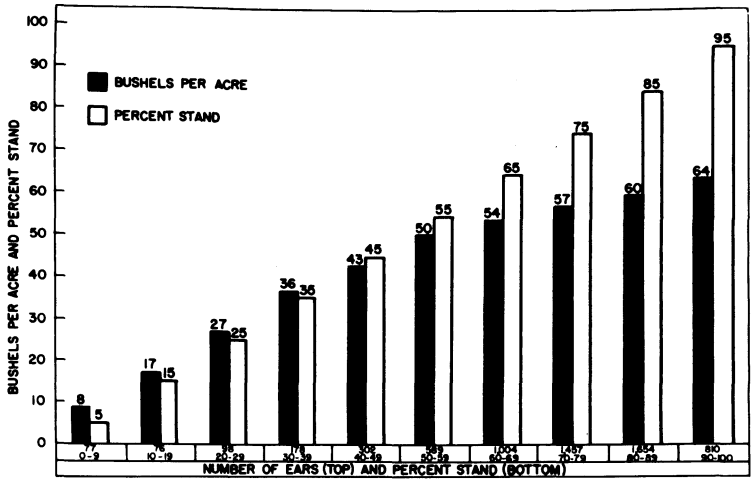


Fig. 5.2. Relation of yield to stand of single ears. Summary of tests of 6,245 ears during nine years of 1906 to 1914, except 1907.

BARREN STALKS AND POOR QUALITY OF GRAIN CAUSED LOW YIELDS

Yield and quality of corn from high- and low-yielding ears were compared with yield and quality of corn grown with the same stands in the thickness of planting tests conducted the same years in the same counties, as a means of determining the extent to which difference in yield was caused by factors other than differences in the stands.

As much as 9.8 bushels of the 11.3 bushels higher-than-average yields obtained from the one-fourth high-yielding ears was evidently due to other causes than better stands of stalks (see Figure 5.3).

This same condition was found in the study of the yields of corn from different farmers, as reported in Chapter 3. However, the effects of other factors than stand appear greater among the individual ears of one lot of seed than among samples of seed from different farmers.

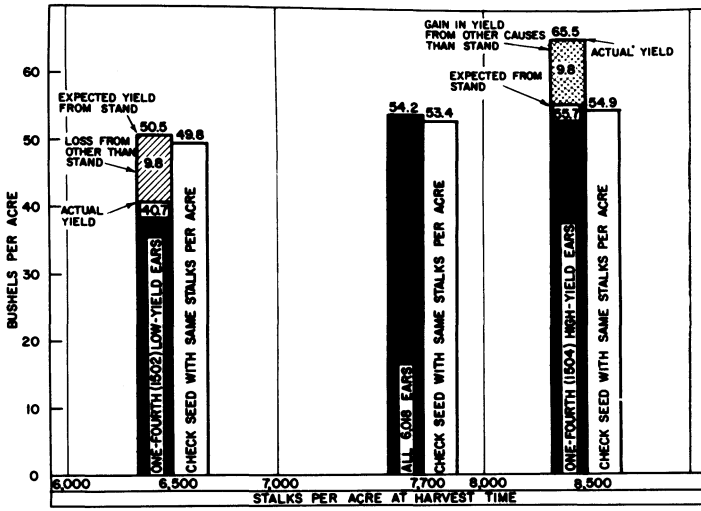


Fig. 5.3. Loss or gain in yield of single ears from causes other than thickness of stand. Summary of 6,018 ears in 151 tests in 33 counties during the seven years 1906 to 1913, except 1907.

All ears produced an average of 6.8 percent of barren stalks, as shown in Figure 5.4. The one-fourth highest yielding ears produced 5 percent barren stalks. They had considerably better stands than the average and would have been expected to have about 7.9 percent barren stalks when compared with corn with the same stands in the thickness of planting tests. This relation of barrenness to yield was shown in each of the many demonstrations.

The one-fourth low-yielding ears produced 8.9 percent barren stalks on relatively thin stands. They would have been expected to produce only 5.8 percent barren stalks when compared with corn with the same stands in the thickness of planting tests.

The thickness of planting tests showed that the thicker the stands, the smaller the proportion of marketable ears. However, in the single ear tests the high-yielding ears

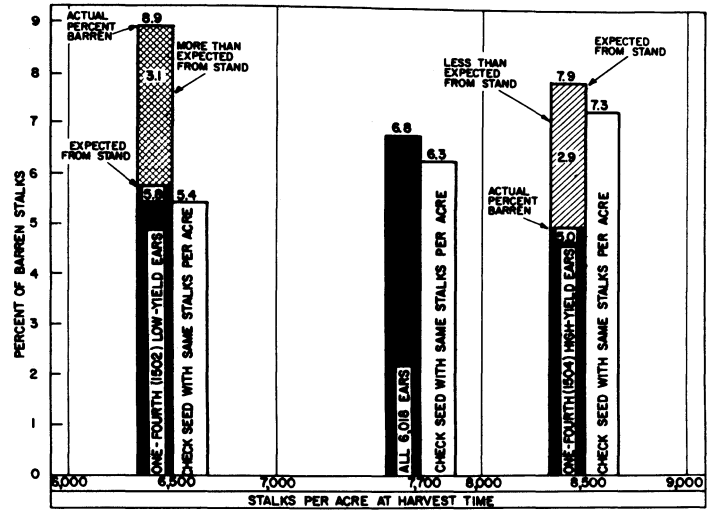


Fig. 5.4. Higher or lower percentage of barren stalks from causes other than the thickness of stand.

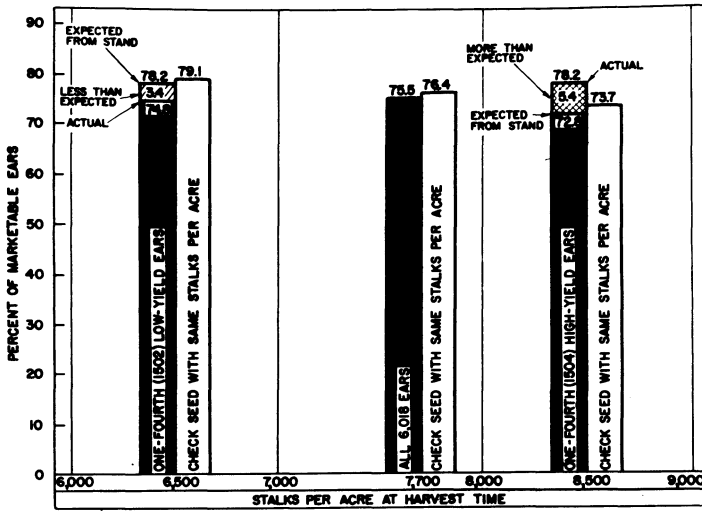


Fig. 5.5. Higher or lower percentage of marketable ears from causes other than thickness of stand.

with their thicker stands produced a larger percentage of marketable ears. Also, the low-yielding ears with their thin stands produced less marketable corn (see Figure 5.5).

Two facts were established by these Individual Ear Demonstrations: (1) many low-yielding ears could be eliminated by making careful germination tests of a few kernels from each ear. (2) low percentages of barren stalks and high percentages of marketable ears were closely associated with high yields.

6. Miscellaneous Demonstrations

DEPTH OF PLANTING

TWENTY-ONE depth of planting tests were conducted in nine counties in 1912 and 1913. Seed was planted at 1, 2, 3, 4, 5, and 6-inch depths. From six to eight plots in different parts of each field were planted at each depth.

There was no appreciable difference in yield between the 1, 2, and 3-inch depths of planting. Yields obtained from 4, 5, and 6-inch depths dropped only one to two bushels for each inch of increased depth (see Figure 6.1).

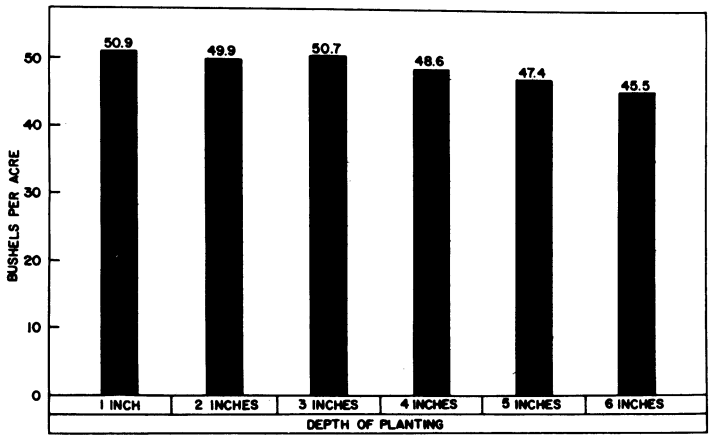


Fig. 6.1. Depth of planting demonstrations. Average of 21 tests in 14 counties during 1912 and 1913.

The decrease in yield was in proportion to the decrease in stand obtained.

Many farmers were surprised to learn that the main feeding roots branched out from the stem sprout near the surface of the ground, regardless of the depth of planting.

The Clinton County Farm Report for 1913 gives, "The squirrels took the shallow planted corn much worse than they did the deeper" as the reason for low yields of plots planted less than four inches deep. The general conclusion and recommendation based on these depth of planting tests were: "There seems to be more danger of getting the corn planted too deep than too shallow. For best results, corn should be planted only deep enough to have the seed well covered with moist soil."

BUTTS, MIDDLES, AND TIPS

Farmers usually shelled off one to two inches of tip kernels and half an inch to an inch of butt kernels when preparing their seed for planting. They did this in order to get a more even stand and because of a widespread belief that butt and tip kernels would produce low yields of poor quality corn even if they grew.

The comparative value of butt, tip, and middle kernels was demonstrated in 17 tests in 11 counties during 1912 and 1913.

Middle kernels yielded more than butt kernels in 12 of 17 trials, more than tip kernels in 13 trials, and more than either in nine of the 17 trials. Middle kernels outyielded butt kernels by an average of 1.7 bushels and the tip kernels by an average of 3.3 bushels as an average for all trials (see Figure 6.2).

Most of the differences in yield are believed to be due to differences in stand of stalks obtained. Middle kernels produced 2.4 percent better stands than butt kernels and 6.3 percent better than tip kernels.

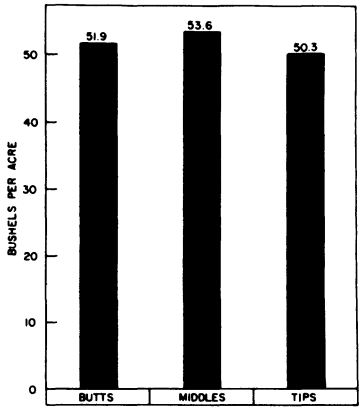


Fig. 6.2. Butt, middle, and tip kernels compared. Averages of 17 tests in 11 counties during 1912 and 1913.

There was some evidence that the stalks that grew from middle kernels were more productive than those from butt or tip kernels.

The conclusion from these demonstrations was: "The chief reason for shelling off butts and tips before planting is to allow the planter to drop a uniform number of kernels."

VALUE OF TESTING EACH EAR

The fundamental relation of the percentage germination of seed corn, stand, and yield was fully demonstrated by the Farmers' Variety and Individual Ear Tests, Chapters 2 and 3.

It was only in 1912 and 1913 that separate demonstrations to show the value of testing a few kernels from each ear were included in the County Farm tests. A considerable number of ears were obtained from each of one or two men in each county. Six kernels from each ear were carefully germinated.

Six lots of seed were prepared: (1) ears showing all *strong* sprouts from the six tested kernels; (2) ears

showing one or more *weak sprouts;* (3) ears showing one or more *dead sprouts;* (4) the corn used in plots one and two was mixed, to give a sample of seed with both *strong and weak* sprouts; (5) the seed used in plots two and three was mixed, to give a sample of *weak and dead* kernels; (6) the seed used in plots one, two, and three was mixed, to give a sample of *strong, weak, and dead* kernels. (See Figure 11.4.)

The value of testing six kernels of each ear and discarding all except ears which showed six strong sprouts was again clearly demonstrated. As an average of all tests the six-strong-kernel ears outyielded the one-or-more-weak-kernel ears by 4.9 bushels per acre and the one-or-more-dead-kernel ears by 19.9 bushels per acre. The strong-and-weak-mixed seed outyielded the one-or-more-dead-kernel seed by 16.8 bushels (see Figure 6.3).

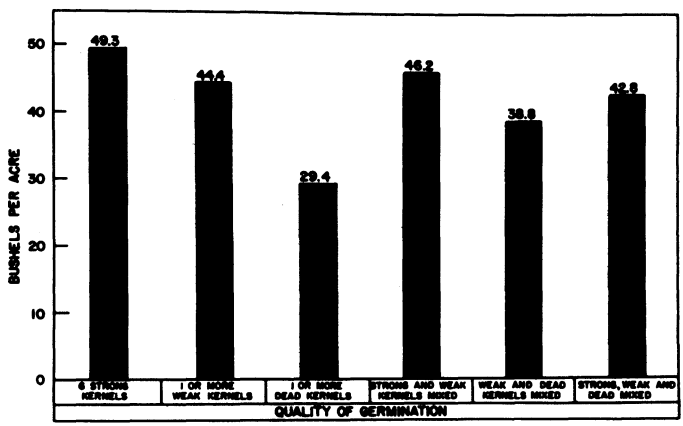


Fig. 6.3. The value of testing each ear of seed corn. Summary of 9 tests in 7 counties during 1912 and 1913.

SINGLE-EAR TESTING SPREAD RAPIDLY

The idea of testing each seed ear for germination and disease symptoms spread rapidly. Many commercial testers were on the market. Commercial and co-operative

seed testing laboratories were established in many counties. The sawdust box tester, illustrated in Figure 11.4, and the rag-doll testers continued to be favorites.

The rag-doll tester was very simple. A piece of good muslin about one foot wide and four feet long was ruled down the middle with two rows of 10 sections each. The cloth was soaked in water so the kernels would stay in place and six kernels from each of 20 ears were placed in the 20 sections of the cloth, with germ sides up and the tips of kernels pointing to one edge of the cloth. A half page of newspaper was crumpled into a tight roll, soaked in water and, beginning at one end, the cloth with kernels in place was rolled around the soaked paper. Three rubber bands were put around the rolled-up cloth, one at each end and one in the middle. The "dolls" were then stood on end in a bucket with the tips of the kernels pointed down. The buckets were filled with warm water and the dolls soaked for one or two hours. Then the surplus water was poured out of the bucket and the bucket with the dolls still on end was placed in a warm room. The dolls were sprinkled every day or two to keep them moist. The rag-doll tester was a very good tester.

PART II

County and State Corn Yield Tests

The development of more useful corn score cards; the Seed Corn Specials of 1905; world-wide influence of the County Farm demonstrations

7. The Clinton County, Iowa, Corn Yield Test

THE FIRST corn yield test in Iowa deliberately planned to find a superior strain of corn adapted to a county and to provide for its distribution was conducted in Clinton County, Iowa, during the years of 1913, 1914, and 1915. The project was successful.

A strain of Reid's Yellow Dent corn which had been grown for the 10 preceding years by A. H. and F. A. Studeman (father and son) was found to be superior and was distributed in 1915 and 1916. Within the next 10 years this corn came to be used by an estimated 75 to 80 percent of the farmers of Clinton County.

It happened in this way. Clinton County was the first county in Iowa organized for the employment of a county agricultural adviser. When I was appointed to that post on September 1, 1912, I immediately began a series of care-of-seed-corn demonstrations in the rural schools.

Ninety-five meetings, five per day in each of 19 townships, were held during September and early October. Four meetings in the corner schools of each township were held during the day, with a night meeting in a central school of the township. The night meetings were attended by adults, with a few children; the day meetings by school children, with a few adults. The meetings were attended by a total of 85 teachers, 1,169 children, and 1,926 adults.

At each night meeting, the care-of-seed-corn demonstration as given during the day meetings was repeated.

This was followed by a discussion of what the county agricultural adviser planned to do. Three lines of work were outlined: increased crop production; increased animal production; and soil conservation.

During the discussion of the first topic the County Farm corn demonstrations, then in their tenth year, were explained. A plan for finding and distributing a superior strain of corn for Clinton County was suggested. Later that fall a corn improvement plan was developed by the Clinton Commercial Club, the local organization cooperating with the Iowa State College and the Bureau of Plant Industry, USDA, in the conduct of the County Extension project.

PLAN OF THE CLINTON COUNTY CORN YIELD TEST

The plan of the corn yield test was based on the following conclusions, reached after nine years of the County Farm demonstrations:

1. There are in every county a few men who are growing strains of corn superior to most seed used in that area.
2. Seed from a large number of men who have not been exhibiting seed corn, as well as those who have, must be field tested for yield, through several years if the few really superior strains are to be found.
3. Differences in yield due to differences in the germination of the seed must be eliminated insofar as possible.

THE PLAN IS PUT INTO ACTION

During the fall of 1912 an outline of the plan for the project was given wide distribution throughout the county.

Early in 1913 meetings were held in nearly every town in Clinton County, to which farmers were requested to

bring 70 ears of their seed corn. From the 153 samples brought in to the different meetings, 97 were selected for planting in a field test at the County Farm.

SELECTING FORTY OF THE SEVENTY EARS IN EACH SAMPLE FOR THE FIELD TEST

From each of the 97 samples of 70 ears the 60 "best" were selected and numbered from 1 to 60. From each of these ears three rows of kernels were shelled, after which the ear remnants were taken home by the owner. During March and April, six kernels from each ear-sample were tested. If any of the six failed to grow strong such ears were discarded. From the remaining, the 40 showing the "best" shapes and general appearance of kernels were then selected. The seed from these 40 ears was then thoroughly mixed and labeled with the name of the man who had furnished the seed.

This plan, as carried out in 1913, shows that I was still of the opinion that I *knew* which were the "60 best ears" and which "40 lots of kernels showed the best shape and general appearance." This error was corrected when planning the Woodford County test. (See Chapter 8, page 75.)

As soon as the 40 ears from each lot of seed had been selected, the owner was advised of the ear numbers, with the suggestion that he plant the remnants of these ears on one side of a field, and save seed from that part of the field the following fall. Reports received later showed that this was done in most cases.

MANNER OF CONDUCTING THE FIELD TESTS

The field tests were conducted in much the same way that the County Farm demonstrations had been conducted during the preceding 10 years and the same kind of records kept.

In the fall, as the corn was harvested, two representative ears were saved from each plot and marked with the

sample number. After all plots had been harvested, the ears from all plots of the same strain of corn were put together, a 10-ear sample selected, and the weight recorded. The 10-ear samples and their yield records were exhibited throughout the county and later, when well dried, each was weighed and shelled, and the shrinkage and proportion of shelled corn calculated.

The following items of information were recorded, as a basis for selecting the "best samples" for further testing in 1914 and 1915:

1. The yield of ear corn at harvest, at 75 pounds per bushel
2. The yield of dry shelled corn, at 56 pounds per bushel
3. The percent shrinkage from harvest until air dry
4. The percent of shelled to ear corn
5. The percent stand at harvest
6. The percent of barren stalks
7. The percent of seed ears
8. The percent of nubbins and worthless ears
9. The time of ripening

SOME OBSERVATIONS ON HIGH- AND LOW-YIELDING SAMPLES

The 20 high-yielding samples produced an average of 12 bushels per acre more dry shelled corn than the 20 low-yielding samples. The reader is reminded that differences in yield due to differences in stand had been almost eliminated by the use of only the ears having strong, mold-free germination.

Little or none of the 12-bushel difference in yield between the 20 high-yielding and the 20 low-yielding samples could be attributed to the four percent difference in stand. The highest yield, 83.5 bushels per acre, was

obtained from a medium to late sample of Reid's Yellow Dent. A sample of medium-maturing Reid's Yellow Dent yielded only 60.5 bushels per acre, 23 bushels less than the high-yielding sample of the same variety. Ironically enough, this low-yielding sample was from the man who had shown "the most perfect ear of corn ever exhibited," and which had been bought back at auction by the owner for $150. This was the highest price ever paid for seed corn. A photograph of the ear has been published far and wide as an example of a perfect seed ear.[1]

This prize-winning farmer was in the seed business and because of his reputation was allowed to enter samples of each of three strains which he grew commercially. It was a severe blow to him to learn that his three samples yielded from 10 to 20 bushels per acre less than samples contributed by others who were growing the same varieties. We did not publish his name with the record.

AVERAGE YIELD OF DIFFERENT VARIETIES

The average yield of different varieties contributed for the test is not important but may be of some interest.

	Number of Samples	Yield, Dry Shelled
Reid's Yellow Dent	43	72.7
Unnamed yellow	39	71.2
Leaming	9	68.9
White varieties	4	65.0
Calico varieties	2	64.7
Average of all varieties	97	71.2

YIELD OF DRY SHELLED CORN INCREASED WITH LATENESS OF MATURITY

The average yields of samples classified as to time of maturity follow:

[1]See such a photograph in the book, *Corn*, by Bowman and Crossley, published in 1908.

	Number of Samples	Yield, Dry Shelled
Early	5	65.1
Early to medium	9	68.7
Medium	41	71.2
Medium to late	12	72.2
Late	30	72.8

I believe that if the early, small-eared varieties had been planted thicker, perhaps four kernels per hill rather than three, some of them might have yielded as well or even better than the later varieties. However, in those days of hand husking, farmers preferred large rather than small ears, even though they did not mature as well.

Apparently some inherent quality that caused some seed to produce many nubbins reduced the yields of some samples. Fourteen samples having less than 6 percent nubbins by weight produced an average of 73.2 bushels per acre. Eighteen other samples that produced 11 percent or more nubbins averaged only 66.9 bushels of dry shelled corn. The 20 high-yielding samples had 6.7 percent nubbins while the 20 low-yielding samples, with slightly thinner stands, had 10.3 percent.

THE SECOND YEAR'S TEST

Fourteen of the higher-yielding samples from the 97 compared in 1913 were selected for a second year's test in 1914. Samples which showed more than the average yield of dry shelled corn were selected. From these, those showing more than average shrinkage were discarded. Then from the high-yielding, early-to-medium-maturing samples, 12 were selected which had more than the average proportion of "good ears" and more than the average proportion of shelled corn. Another sample was selected because of high yield, large proportion of shelled corn, and attractive appearance, although it was later than average. The fourteenth sample was included because of its very low proportion of nubbins, although it was rather late in maturing. Five other selections were made for further trial because of their early maturity. In selecting

these five, earliness of ripening was considered first and yield second.

Each man whose seed had been selected for the second year test was asked to furnish a peck of tested, shelled seed which he had selected from a field of the same seed as that furnished the first year. This is recognized to have been a mistake. The second-year samples should have been brought in the ear and ear-tested and prepared for planting in a uniform manner. Most, if not all, of the 19 samples were selected from the seed plots in which the 40 selected ears of the first year had been planted.

Each lot of seed was planted on six farms in 1914, representing three soil types: black loam, sandy loam, and yellow clay loam.

At harvest, as soon as the corn was in condition to crib, two samples were selected from each lot of corn on each of the six farms, from which the shrinkage and shelling percentages were calculated. The final acre yield was based on the weight of dry shelled corn.

Results of the Second Year's Test

Seven of the 19 samples planted on the six farms in 1914 were selected for further tests in 1915. In making the selections the yield of dry shelled corn and the shrinkage were considered first. Some attention was given to the uniformity with which the selected samples produced on the different farms. No consideration was given at any time to variety, type, color, or the men who furnished the seed.

Much emphasis was placed on maturity. The two samples that had the highest yield during the first two years were dropped because of late maturity. Two of the six early-maturing samples selected in 1913 proved to be relatively high yielding in 1914 and so were selected for further tests. One of them, the A. H. Studeman corn, was the one finally accepted by the farmers of Clinton County and this came into general use within a few years.

ANOTHER FIRST-YEAR TEST IN 1914

From eighty 30-ear samples exhibited in township corn shows, the "best" 43 were selected for trial in 1914 and were field tested in much the same way as the 97 samples had been in 1913.

Six of the samples which were in the test for the first time in 1914 were selected for the county-wide trials in 1915. Two of the samples planted in the 1914 tests and which were also in the 1913 tests but had not been chosen for retrial in 1914 were again selected for the final trials in 1915.

THE FIELD TESTS IN 1915

The six samples from the 1913-14 tests and the eight from the 1914 test were machine planted on 21 farms in 16 townships in 1915.

The owner of each farm on which the test was being made planted his own seed in plots of two rows across the field, alternating with two-row plots of each of the 14 lots of seed being tested.

Fourteen of the 21 fields lay along the public highway. Neat signs were placed at the ends of each pair of rows, giving the name of the man from whom the seed had been obtained and the statement that it was one of 14 strains of seed which had been selected from 140 which had been tested in 1913 or 1914.

The season of 1915 was wet and very cold in Clinton County. People were generally agreed that the crop raised was of the poorest quality ever produced in the county. This may have been fortunate for the purpose of the tests, as it helped to weed out some of the late-maturing strains.

During the winter of 1914-15 I obtained seed for the 1915 trials from those farmers whose seed had been selected after two years' tests. From 3 to 14 bushels of

seed were selected from that picked early in the fall and stored by the owner. The soundest ears of the type preferred by the owner were selected. My ideas of what was best were disregarded as much as possible, although this seed was all carefully ear tested, shelled, and graded under my supervision. One bushel of each man's seed was then reserved for the county-wide tests, with the rest of it furnished to 4-H Club boys or sold to farmers in the county.

Records of yield, shrinkage, and shelling percentage were obtained on 11 of the 21 farms. The corn was of such poor quality and down so badly on the other farms that no harvest records were obtained.

Table 7.1 gives the average of results, showing the yield and quality of the 14 samples of corn as grown on the 11 farms in 1915.

The C. H. Joehnk corn, which gave the highest yield, was of the Leaming variety and had been kept fairly pure in a small locality near Elvira for 30 or 40 years. This corn had been shown to be high yielding during a good corn year as well as during a poor corn year. It was rather sharp in indentation making it a little disagreeable to handle. It broke harder and had more nubbins than the Reid's corn. This was a splendid, high-yielding,

Table 7.1. Records of the Third Year Clinton County Test, 1915

Rank in Yield	Name	Variety	Yield, Dry Shelled	Percent Shrinkage	Percent Shelled	Percent Cribable
1	C. H. Joehnk	Leaming	48.5	27.0	82.0	69.0
2	Detlef Schnack	Unnamed yellow	46.0	29.0	81.5	67.5
3	C. W. Greve	Reid's yellow dent	45.5	28.5	81.5	69.5
4	A. H. Studeman	Reid's yellow dent	45.0	28.5	81.5	61.5
5	P. E. Eggers	Reid's yellow dent	45.0	31.0	81.0	63.0
6	J. N. Homrighausen	Unnamed yellow	43.5	30.5	79.5	62.5
7	H. J. Schneider	Unnamed yellow	43.0	35.0	80.0	47.5
8	Frank Coverdale	Reid's yellow dent	42.5	26.5	82.5	66.5
9	T. H. Dann and Son	Reid's yellow dent	41.5	36.5	82.0	48.5
10	Charles Smith	Unnamed yellow	41.0	37.5	78.5	47.5
11	Henry Cornish	Reid's yellow dent	40.5	36.5	80.5	53.0
12	John Olson	Reid's yellow dent	40.5	36.5	81.5	53.0
13	William Rice	Reid's yellow dent	39.5	34.0	79.5	58.0
14	J. C. Palmer	Reid's yellow dent	39.5	37.0	81.0	45.0
Average of 14 samples			43.0	32.5	81.0	58.0

early-maturing type of corn and was well worth consideration by anyone who wanted an early type. This corn might have been selected for distribution if mechanical corn pickers had been in use.

The Detlef Schnack corn, which gave second highest yield was in the test for only two years.

The C. W. Greve corn, third in yield, was a very good, early-maturing type of Reid's Yellow Dent.

The A. H. Studeman corn, which produced only one-half bushel less per acre than the Greve corn, was of practically the same type. In fact, Mr. Studeman and Mr. Greve both had developed their seed from small samples distributed by *Wallaces Farmer* of Des Moines in 1903 or 1904. Figure 7.1 shows a sample of Studeman corn.

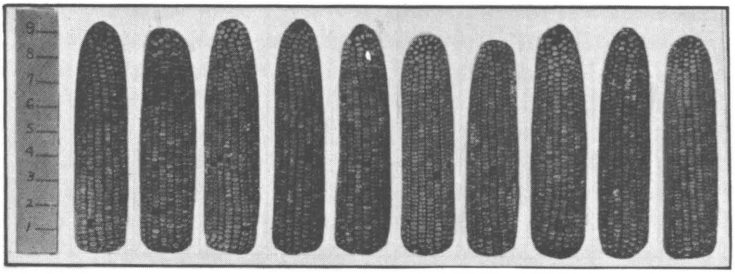


Fig. 7.1. Typical sample of the Studeman corn, which came to be grown by 75 to 80 percent of the Clinton County farmers during the 20 years before hybrid corn came into general use.

Considering the fact that seed from these two men had given such good results consistently during the three years that the Clinton County tests had been in progress, we did not hesitate to recommend this type of corn for general use in Clinton County.

The P. E. Eggers corn — which gave practically the same yield as the Schnack, Greve, and Studeman corns — was a few days later in maturing than those three.

THE STUDEMAN AND GREVE CORN, WALLACES FARMER AND P. G. HOLDEN

There is an interesting story that involves the Reid's Yellow Dent seed distributed to boys by *Wallaces Farmer* in 1904.

In 1958 Professor Holden was recalling an incident that happened during the winter of 1903-04 when he was conducting a short course in corn judging for the Iowa Grain Dealers Association. As a result, this Association financed the purchase of a carload of Reid's Yellow Dent seed corn and authorized Professor Holden to go to Illinois and obtain the seed of a type that he thought best suited to Iowa conditions.

Professor Holden had remembered an especially productive-appearing strain of Reid's corn that had been exhibited a few years before by a boy from Taylorville at the first Illinois Short Course.

So he went immediately to Taylorville, looked up the boy, and purchased the seed from him and others who were growing the same strain.

When Professor Holden told the story in 1958 all he could remember was that the boy lived at Taylorville and that he had a German name something like Schram (but not Schram, he added) and that the type of corn was smoother and a little sounder appearing than most Reid's Yellow Dent as it was selected at that time.

From there the story moves ahead over half a century. On June 25, 1959, I went to Taylorville, Illinois, called at the office of *The Daily Breeze and Courier*, and spent a full half day thumbing through the old bound volumes of *The Daily Breeze*, as it was then named, for the years of 1903 and 1904. I finally found the following item down in the corner of the front page.

The Daily Breeze — Taylorville, Illinois — March 21, 1904

Found it in Christian

"Professor Holden of the Agricultural College at Ames, Iowa, who has been in the state looking for seed

corn for his state, has at last found what he wanted in Christian County. Saturday he closed a deal with C. A. Peabody, Ross Peabody and Sylvester Schrantz for 350 bushels of their celebrated Reid's corn. This corn tested 95 percent. The Iowa college is getting this to donate to elevator men in the state, who in turn select three of the best farmers in their section and donate the corn to them."

The similarity of the name Schrantz to the name "Schram" that Professor Holden remembered is easily noted.

On inquiry, it was learned that of the three men from whom the seed was purchased, only Ross Peabody was living. A visit with Mr. Peabody, a kindly gentleman of 80 years, on his farm six miles south of Stonington, Christian County, who had retired from its active management only three years before, was most interesting.

Mr. Peabody remembered the details of the incident very clearly. In fact he began to tell about it as soon as I asked if he remembered Professor Holden and before I had indicated the reason for my visit.

Mr. C. A. Peabody was the man who had developed the productive-appearing strain of Reid's Yellow Dent. He had sold considerable seed in Christian County for several years and had built up a local reputation as the newspaper item indicates. Ross Peabody was his son and Sylvester Schrantz was a young neighbor.

The carload of seed was selected from the cribs of the three men. They selected about ten percent of the ears for seed.

Now to go back to Professor Holden's story. He told how he shelled each ear of the seed separately, hand picked the shelled corn, and put it up in small sacks for distribution at 25 cents per sack by the grain dealers all over Iowa. Holden said that *Wallaces Farmer* distributed some of the same seed.

Professor Holden told that a few years after the distribution of the Illinois Reid's Yellow Dent seed, representatives of the Corn Products Millers came to him and wanted to know what had happened to the corn being planted in Iowa, reporting that there had been a very great improvement in quality and uniformity in much of the corn which was coming to the mills. There can be little doubt that the carload of "productive-appearing" Reid's Yellow Dent seed purchased in Christian County, Illinois, and distributed by the Iowa Grain Dealers Association and *Wallaces Farmer* was largely responsible for much of the improvement.

A corrollary to this story is the following: *Wallaces Farmer* required each boy entered in the corn growing contest to select 12 ears grown from the distributed seed and send them to Des Moines to be judged by Professor Holden and his assistants.

Wallaces Farmer of December 25, 1903, indicates that among the several hundred contestants, Ben Studeman of Clinton County won 7th prize in the Central Iowa District and C. W. Greve, Jr., of Clinton County the 11th prize.

Wallaces Farmer of December 23, 1904, states that the 3rd prize in the Central District was awarded to Ben N. Studeman of Clinton County. Thus the two samples, Studeman and Greve, which proved most satisfactory in the three years of the Clinton County Yield Test also were of such appearance that Professor Holden and his assistants recognized their worth in the samples of seed selected for the corn show.

FINAL RESULTS OF THE CLINTON COUNTY CORN YIELD TEST

Final results of the tests are well indicated by excerpts from a letter written by John Coverdale in 1921 which was six years after the tests were closed. Mr. Coverdale had grown up in Clinton County and was farming there when the tests were begun. He was the first

State Leader of County Agricultural Agents in Iowa, 1915 to 1918, and was Secretary of the American Farm Bureau Federation when he wrote the letter.

I have your announcement of the Woodford County Corn Test which will be given to the public on January 5 and 6, 1922.... Wish to state that the corn test that you conducted in Clinton County, Iowa,... is today resulting in the adoption all over the county of the variety of corn that stood first in your county test. (He referred to the Studeman corn.) This corn is proving very practical, is always safe from the standpoint of maturity and is a good yielder.

Some estimated that about three-fourths of the corn in Clinton County preceding the introduction of hybrid corn was of the Studeman strain of Reid's Yellow Dent.

TYPE OF CORN RECOMMENDED FOR CLINTON COUNTY

The type of seed corn to be selected was very important in those days when farmers selected their own seed. The following description of the type of corn suggested for Clinton County conditions is from one of my reports published at the close of the three-years' test:

The ear is rather long for its circumference having the appearance of being a little slender. It tapers for a third of its length toward the tip rather than being cylindrical. The kernels are wide but of medium length, being neither long nor short. The dent is smooth to medium.

8. The Woodford County, Illinois, Corn Yield Test

KRUG CORN came to be the most commonly grown strain of open-pollinated corn in an area from 50 to 100 miles wide, reaching across the Corn Belt from Ohio to Nebraska, during the ten years just preceding the general introduction of hybrid corn. It also became a valuable source of inbreds for the production of commercial hybrids.

It happened in this way. I began work in Woodford County, Illinois, as farm adviser (county agricultural agent in most states) January 1, 1916. The Clinton County, Iowa, Corn Yield Test as described in the preceding chapter had just been completed.

The agricultural leaders in Woodford County, which is in the edge of the great grain-farming area of east central Illinois, knowing of the work in Clinton County asked that a similar project be undertaken in their county. World War I was on and the project was not undertaken until the close of the war. The Armistice on November 11, 1918, left the way open to proceed.

THE PLAN OF THE WOODFORD COUNTY CORN YIELD TEST

The Woodford County Corn Yield Test was based almost entirely on the observations and results of the County Farm demonstrations in Iowa and the Clinton

County Corn Yield Test. The more important ideas on which the plans were based follow:

1. The belief that in every Corn Belt county there was some farmer who had developed a strain of corn which was better for that county than the strains that most farmers were growing, or that they could bring in from outside the county.
2. A field test for yield and quality continued over several years was the only way of finding superior strains.
3. The field testing of seed *from a large number of farmers,* each of whom had selected his seed for several years according to his idea of what was best.
4. Acceptance for the test of seed from all farmers who submitted samples. (Failure to do this in Clinton County, Iowa, may have caused us to miss a superior strain.)
5. Continued planting during all three years of the test of all samples submitted in order to test all samples under varying conditions.
6. Each farmer submitting seed to bring in a relatively large number of ears in order to insure that the sample was representative of the strain.
7. Each ear of each sample to be ear tested for germination and disease under carefully controlled and uniform conditions so as to eliminate insofar as possible differences in yield and quality due to differences in germination and disease.
8. The director of the project to avoid any selection of ears or kernels of any sample submitted for the test based on his idea of desirable type.
9. The elimination as much as possible of accidental differences in yield due to environmental differences.
10. A comparison in the fourth year of a few of the high-yielding strains by farmers of Woodford and surrounding counties, with plantings beside their own seed.

11. Definite plans for the commercial production and distribution of the strain or strains finally selected as most superior.

DESCRIPTION OF THE WOODFORD COUNTY CORN YIELD TEST

During January, 1919, 118 men each brought to local meetings 100 ears of his seed corn. All but three or four samples had been grown in the county by the owner for five or more years.

Each sample was examined with the help of the owner and the 20 ears which appeared to be in the poorest condition for seed were discarded. An earnest attempt was made not to meddle with the type as selected by the owner.

Ten representative ears were then selected from the 80 and numbered with the owner's number. The 10-ear samples were kept to use in exhibits showing the results of the tests.

Three rows of kernels were shelled from each of the remaining 70 ears, to represent the farmer's strain in planted yield comparisons, and placed in envelopes. The owner of the corn then took the 70 ears home with him.

A careful germination test of 10 grains from each envelope was made, and the corn from ears which did not have perfect germination or which showed badly shrunken kernels or were apparently diseased, was discarded. The kernels from the ears which showed perfect germination, apparent freedom from disease, and good kernel development were then mixed to provide the sample for field planting. As an average, about 50 ears of each man's seed qualified for the test.

Each of the 118 samples was planted in four places, twice in each of two widely separated fields. The corn was planted by hand so as to get the same stand. In 1919 three kernels were planted in each hill. The plots were four rows wide and 15 hills long. Test samples were

separated by plots planted with one lot of seed, so that each test sample was planted between two plots of the same kind of corn, these to serve as check plots.

As the corn from each plot was harvested in the latter part of October the ears were divided into two grades, one of sound corn and one of nubbins, moldy, and smutted ears. The corn in each grade was weighed separately.

In 1920 each of the same 118 men who had had seed in the 1919 test brought in another sample of 80 ears of the same kind of corn as that furnished in 1919. In most cases the 1920 bushel was selected from the plot where the remnants of the selected ears of the 1919 sample had been planted. Two additional samples were included in 1920, making a total of 120 lots.

In 1921, 117 samples were brought in by the same men who had had seed in the test during the first two years. All three of the men whose seed was not entered the third year had quit farming or had moved away.

The test was conducted in almost the same way in 1920 and 1921 as in 1919. In 1920 and 1921 the seed was planted with four kernels per hill and the corn thinned to two stalks per hill in the first and third rows and to three stalks in the second and fourth rows of each plot. The thinning was done when the stalks were about a foot tall. It was thought that the thick planting thinned to a uniform stand would give a yield determined more nearly by the inherent ability of the seed to produce, and less influenced by any diseased or accidental condition that would have lowered the vitality or vigor of the seed. Final exhibit of the Woodford County tests is shown in Figure 8.1.

RESULTS OF THE THREE-YEAR TEST

The seed furnished by George Krug produced an adjusted three-year average yield of 78.1 bushels per acre of dry shelled corn. This was 1.8 bushels more than the next highest yielding sample, 6.6 bushels more than the

Fig. 8.1. Final exhibit of the Woodford County Corn Yield Test. The six high-yielding samples are on the left-hand table with others arranged in order of yields down the left-hand row of tables and back to the six low-yielding samples on the right-hand table in the foreground.

average, and 17.1 bushels more than the lowest yielding sample.

A brief summary of Krug and other samples is shown in Table 8.1.

Table 8.1. A Brief Three-year Summary of Krug and Other Samples

Item	Bushels Per Acre	Percent Moisture	Percent Good Corn	Percent Shelled Corn
The George Krug sample	78.1	20.3	89.7	86.3
Average of 120 samples	71.5	21.4	89.7	85.7
The lowest yielding sample	61.0	23.6	86.1	85.3
Average of 12 high-yielding	75.5	20.7	89.7	86.1
Average of 12 low-yielding	67.4	21.9	86.1	85.5
12 with least moisture	72.2	19.1	89.5	85.8
12 with most moisture	69.9	23.6	88.7	85.4
12 with most shelled corn	72.6	21.1	89.6	86.8
12 with least shelled corn	69.8	21.5	89.8	84.8

The Krug corn was more consistently high yielding in the 12 field trials, four per year for three years, than any other sample. When the 120 samples were divided into 10 groups according to yield, the Krug sample was in the high decile group eight of the 12 times and once in each of the second, third, fourth, and sixth decile groups. A sample of the high-yielding Krug corn is shown in Figure 8.2.

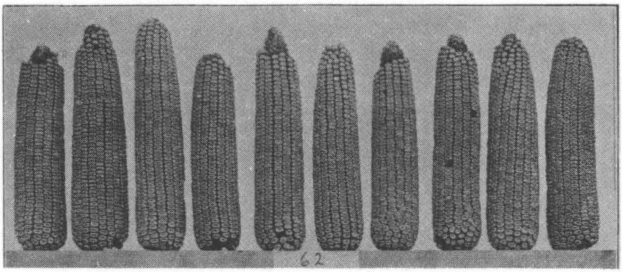


Fig. 8.2. Typical ears of Krug corn as selected by George Krug.

COUNTY-WIDE TEST IN 1922

Eleven of the 12 samples producing the highest yields during the three years of 1919, 1920, and 1921 were planted in comparative tests on one farm in each township of Woodford County in 1922. The samples were planted with corn planters. Every alternate two rows were planted with the farmer's seed, used as check plots when the yields were calculated.

Two of the most popular strains of seed sold by commercial seedsmen, whose seed production farms were in adjoining counties, were included in the trials in 1922. One strain was carefully ear tested and sold as "disease-free" seed. The other was a consistent winner in the newly established Illinois Utility Corn Show. Also, a composite sample of seed obtained at early planting time from the planter boxes of 45 farmers in Woodford County was included in the field trials.

The Krug corn was again the consistent high-yielding sample in this county-wide test. It outyielded the average of the other 10 high-yielding Woodford County samples by 2.7 bushels per acre. It had outyielded the same 10 samples during the preceding three years by 2.8 bushels.

The Krug corn outyielded the widely advertized and very good "disease-free" corn by 0.6 bushels and the prize-winning "utility corn" by 1.6 bushels. It was consistently high yielding on each of three different types of soil on which the tests were planted.

The Krug corn outyielded the composite sample of seed from 45 planter boxes by 5.1 bushels per acre. It had outyielded the average of the other 119 farmers' samples during the three years by 5.8 bushels. It outyielded the average of the farmers' seed on the ten farms on which the tests were made in 1922 by 2.8 bushels per acre.

FOUR-YEAR SUMMARY

The performance of the Krug corn compared with other seed during the four years 1919 to 1922 is shown in Table 8.2.

Table 8.2. Results of the Woodford County Corn Yield Test Averages of Four Years of 1919 to 1922, Inclusive

Grower of Seed	Bushels per Acre: All Corn	Bushels per Acre: Good Corn	Percent Moisture	Percent Good Corn	Percent Shelled Corn
George Krug	75.8	68.5	21.5	90.5	86.1
William Shuck	73.7	66.4	22.3	90.1	86.8
Edwin R. Schertz	73.5	67.1	20.7	91.3	87.1
J. D. Smith	73.5	66.9	22.3	91.0	86.6
Herman Lampe	73.4	66.1	20.1	90.0	85.4
E. D. McChesney	73.3	66.5	21.7	90.7	85.6
C. H. Kamm	73.3	67.0	23.0	91.4	86.5
John Martin	72.7	65.7	22.3	90.4	86.4
Yordy Brothers	72.3	65.7	23.3	90.0	85.9
Peter R. Schertz	72.2	65.4	22.0	90.6	86.0
L. J. Wadsworth	71.7	65.0	21.6	90.7	85.6
Average of 120 samples*	69.5	62.9	22.9	90.5	85.6
Tests on 10 fields in 1922					
Krug corn	68.8	64.1	25.3	93.1	85.7
Disease-free corn	68.2	62.8	29.4	92.1	84.7
Utility prize corn	67.2	62.2	27.7	92.6	85.8
45 farmers' seed	63.7	56.2	27.6	93.0	85.5

*The composite sample of seed from 45 men used in 1922 was averaged in with the 120 lots used during 1919, 1920, and 1921.

COMMERCIAL DISTRIBUTION OF HIGH-YIELDING STRAINS

A farmers' cooperative seed company, the Woodford County Agricultural Association, later named the Woodford County Seed Company, was organized in 1919. One object in organizing the company was to provide a means of commercial production and distribution of the high-yielding seed corn as soon as such was found.

From about 10 to 100 bushels of seed was selected in 1921 by each of the 15 men whose seed had produced the highest yields during the first two years of the 3-year test. Among the 15 samples were 11 of the 12 that

produced the highest three-year average yields. This seed was purchased and distributed by the seed company.

RAPID INTRODUCTION OF KRUG CORN

Favorable publicity was given to the Woodford County Corn Yield Test. This, combined with publicity telling of the rapid distribution of the Studeman corn in Clinton County, Iowa, following the similar program in that county, led to many requests for Krug seed.

Wallaces' Farmer said editorially in the issue of January 12, 1923: "Over in Woodford County in central Illinois, they seem to have discovered an extraordinarily productive strain of corn....Everything considered, it now has behind it the best verified yield record of any corn grown in the central part of the corn belt."

The Krug corn immediately won such favor in an area 50 to 100 miles wide across the south central part of the Corn Belt from Ohio to Nebraska that many old, established seed companies obtained foundation seed from the Woodford County Agricultural Association and produced large quantities of seed for sale in their areas.

The greatest impetus to the widespread distribution of Krug corn came in 1926, when entries in the Iowa Corn Yield Test were made by the Woodford County Agricultural Association, and by S. E. Unzicker, and by Lester Pfister of Woodford County. All three samples of Krug corn did well in the Iowa test and the Pfister sample was declared the top-yielding corn in the open pollinated class for the state.

The Krug corn also was the winner in many local yield tests in different states. Quotations from some reports follow:

The report of "A County Corn Improvement Program, 1923 to 1930" by the Jasper County, Iowa, Farm Bureau stated:

For the past seven years (1924 to 1930, inclusive) five or more stations have operated in different sections of the county. An average of 50 or 60 different varieties or strains have been tested each year.... The results of the eight years testing has demonstrated the Krug corn to be the highest yielding variety of the open pollinated strains, with the Wilson a close second.

A four-year summary of tests conducted by the Henry County, Illinois, Farm Bureau during the years of 1922 to 1925 reads:

Variety	1922	1923	1924	1925	Average 4 years
Krug	79.7	61.3	68.8	95.9	76.4
Hulting	79.7	53.0	63.0	94.2	72.5
Ward	79.6	53.3	58.0	96.4	71.8
Funk	76.7	54.2	63.7	92.4	71.7
Washburn	78.4	56.2	61.0	87.3	70.7
Golden King	76.3	53.6	61.7	90.7	70.6

Krug corn was used by the winner of a state-wide contest in Nebraska in 1933. W. W. Motz, the winner, grew 100.7 bushels per acre on the required 10 acres on his farm in Madison County.

A state-wide survey in Iowa by the Iowa State College showed more Krug corn was being grown in Iowa in 1928 than any other one strain. This was only five years after the first general distribution in 1923! This shows the effectiveness of the Iowa Corn Yield Test in getting rapid distribution of strains of seed corn found by means of that program.

The Iowa Corn Yield Test has had such an important place in the finding and distribution of superior strains of open pollinated and hybrid corn that Chapter 9 is devoted to its history and accomplishments.

Distribution of Krug corn in north central Illinois was rapid. Several times as much of it was grown as of any other one strain. This statement is based on corn-growing practice records kept by cooperators in the Farm Bureau Farm Management Service. A brief summary is given in Table 8.3.[1]

[1]See Ill. Exp. Sta. Bul. 444, "Farm Practices and Their Effects on Farm Earnings," by M. L. Mosher and H. C. M. Case, Aug. 1938.

Table 8.3. Summary of Krug Corn Compared to Other Varieties in North Central Illinois

Kind of Seed	Number of Fields	Percent of Fields	Yield Per Acre
Krug	2,923	48.1	52.4
Other good strains[a]	721	11.9	51.6
All other kinds[b]	2,437	40.0	49.0

[a]Other good strains included six or more of the most popular strains being sold in the area.
[b]All other kinds were mostly yellow strains developed from Reid's Yellow Dent and Leaming, with some white strains of Boone County White and Silvermine.

REASONS FOR THE RAPID DISTRIBUTION OF KRUG CORN

The Woodford County Agricultural Association had prepared in advance to produce and sell the high-yielding seed as soon as it was found. A contract was made with George Krug to buy from him all of the seed that he would select annually from his crop. He was very particular and such purchases were limited to only a few hundred bushels each year.

Krug was paid what he considered a satisfactory price. His seed was carefully stored, prepared for planting, and put out to good corn growers under contract. It was the corn grown under contract from the seed grown and selected by George Krug that was sold to farmers. George Krug was paid a royalty of a few cents a bushel for all such commercial seed that was sold.

Another source of Krug corn available soon after its discovery was that grown by Lester Pfister. Pfister had been growing a white variety of corn on his mother's 80-acre farm and selling some seed before the Woodford County Corn Yield Test was started in 1919. He had done some careful selection by the old-time, ear-to-row method and his painstaking work and careful records had attracted my attention. His sample, Number 73, was the second highest yielding of the white samples in the test.

George Krug, Woodford County, Illinois: The man who made Krug corn. Untold thousands of farm people have had more abundant lives because of Krug seed corn, or hybrids for which Krug corn provided one or more of the parent inbreds.

When harvest time came in 1919, Pfister was hired to help weigh and grade the corn as the hundreds of plots (about 1,200 per year) were harvested. His work was so satisfactory that that job was turned over to him. All of the field records for all three years are in Pfister's handwriting. [2]

Pfister obtained some of the Krug seed distributed in 1922 and began at once to grow and sell it. His experience in helping weigh and grade all samples in the test, his natural painstaking ability to select good seed, and his close study of the basis of selection that George Krug

[2] The original field records in Lester Pfister's handwriting and all other original laboratory and office records are filed in the Holden Library of the Michigan State University Corn Foundation.

used enabled him to select a strain of Krug corn that was more true to the original Krug type than was selected by most others. His was the best of the Krug seed that won such favor in the Iowa Corn Yield Test.

Other seed corn producers were soon selling large quantities of Krug corn.

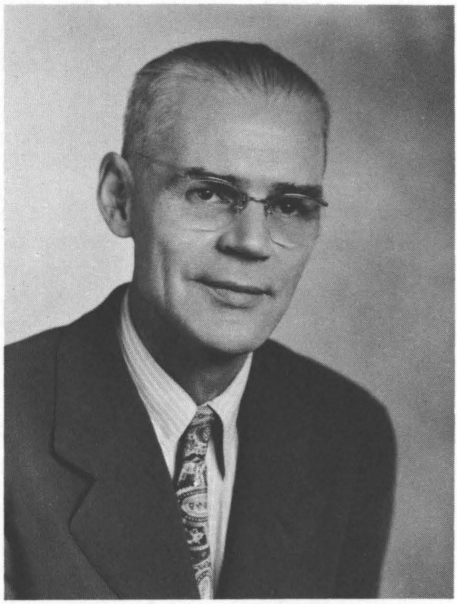
Thus the Krug corn, totally unknown even in Krug's own county as late as 1921, within 10 years came to be the most generally grown of any single strain of open pollinated corn in an area from 50 to 100 miles wide across the south central part of the Corn Belt from Ohio to Nebraska.

DESCRIPTION OF KRUG CORN

The quality of Krug corn was good. It was a little earlier than most of the rougher, deeper grained corn then in common use, and graded well on the market. Its golden color and the lustrous, oily appearance of the shelled corn appealed to farmers. It had been developed by rigid selection from a mixed planting of Reid's Yellow Dent and Iowa Goldmine made about 1910.

Krug's most characteristic method of selecting seed was: first, to heft and twist each ear to see that it was heavy for its size and solid; and, second, to shell a few kernels from the butt of each ear to see that the kernels were fully developed down to the cob.

While there was a wide range in most characters, a majority of ears and kernels were medium in size, shape, and indentation. Before me now as I write is an ear of Krug corn which George Krug picked from his 1921 crop as the most typical ear that he could find. It is a medium-sized ear with medium depth of kernels, cylindrical in shape for about two-thirds of its length, then tapering gradually to the tip. It has 18 rows of kernels which are



Lester Pfister, who assisted with the Woodford County Corn Yield Test and later developed valuable inbreds from Krug Corn, was one of the first large-scale producers of hybrid seed.

distinctly medium rather than smooth or rough in indentation.[3]

KRUG CORN HAS BEEN AN IMPORTANT SOURCE OF INBREDS USED IN HYBRID CORN PRODUCTION

Lester Pfister, the young man who had assisted with the field records kept during the progress of the Woodford County Corn Yield Test, was among the first to develop inbreds from the Krug corn. As has been stated, he began selling open pollinated Krug corn in 1923.

[3] This ear and one ear of each of the next eleven high-yielding samples are now in the Museum of the Michigan State University Corn Foundation, East Lansing, Michigan.

He began inbreeding Krug corn in 1925 with 388 ears. Within a few years he had reduced the number to four inbreds. His single-cross hybrid, Number 58, was the high yielder on the University plots at Urbana in 1934. During the next ten years the Pfister hybrids, all of which included one or more Krug inbreds and were sold by Pfister's own company or by the Pfister Associated Growers (who obtained seed stock from Pfister), were among the popular hybrids in general use.

Henry A. Wallace and William L. Brown in their book, *Corn and Its Early Fathers,* published in 1956 by Michigan State University Press, place Krug corn along with Reid's Yellow Dent, developed by James L. Reid of Illinois, and Lancaster Sure Crop, developed by Isaac Hershey of Pennsylvania, as a most valuable source of inbreds for hybrid seed corn production.

9. The Iowa State Corn Yield Test[1]

SEED CORN obtained from different Iowa farmers and planted in local county yield test comparisons had shown significant yield differences, some of which appeared not to be in any way related to stand, maturity, or variety characteristics.

In 1918 and again in 1919, some 40 farmers in the central part of Iowa, from east to west, who had been entering samples of their Reid Yellow Dent corn in the annual Iowa State Corn Show, were invited to supply Iowa State College samples of their seed, to be planted in yield comparison plots at Ames. These tests showed that different strains of the same variety, all developed in the same area in the state, might vary greatly in productivity and in other agronomic characters when grown side by side under uniform conditions.

With this background information, in addition to that from the county yield test reports previously referred to, the Iowa Corn and Small Grain Growers Association decided in 1919 that it would sponsor a state-wide Corn Yield Test, as well as the State Corn Show, which it had been sponsoring for some 20 years.

[1] Professor H. D. Hughes, author of this chapter, was Head of the Farm Crops Section of the Iowa Station from 1910 until 1948. The Iowa State Corn Yield Test was initiated under his leadership.

THE OBJECTIVE

The object was "To locate the strains and varieties of corn which will produce the larger yields of dry shelled corn per acre in the different sections and districts of the state." The Farm Crops Section of the Experiment Station cooperated with the farmer's Association from the time the state test was first inaugurated in 1920. Beginning in 1922, this cooperation was also shared by the "Office of Cereal Crops and Disease," USDA.

PLAN OF THE IOWA STATE TESTS

The general plan of procedure of the Iowa State Corn Yield Test has varied but little from year to year. The state was divided into four sections: Northern, North Central, South Central, and Southern. Each section was divided into a Western, Central, and Eastern District, making 12 districts in all. A test field was located in each district.

During the period 1920-24, inclusive, each entry was compared in each of the three districts of a section. Beginning in 1924, a strain might be compared in only one or in several districts.

Corn growers and breeders were invited to enter their strains of corn, to be planted under uniform conditions in comparison with other strains and varieties. One of the early Corn Shows is illustrated in Figure 9.1. During the first six years each entrant was limited to not more than three entries of different strains in any one section. This limit was removed in 1926, to be imposed again in a somewhat different manner a number of years later. Each entrant indicated the districts or sections in which his strains were to be entered and compared.

An entry fee of $10 per section was required for Iowa residents and $40 for nonresidents during the years 1920-24, inclusive. Beginning in 1925, the entry fee was $3.00 per district for residents of Iowa and $10 for nonresidents. These fees were estimated to cover about one-half

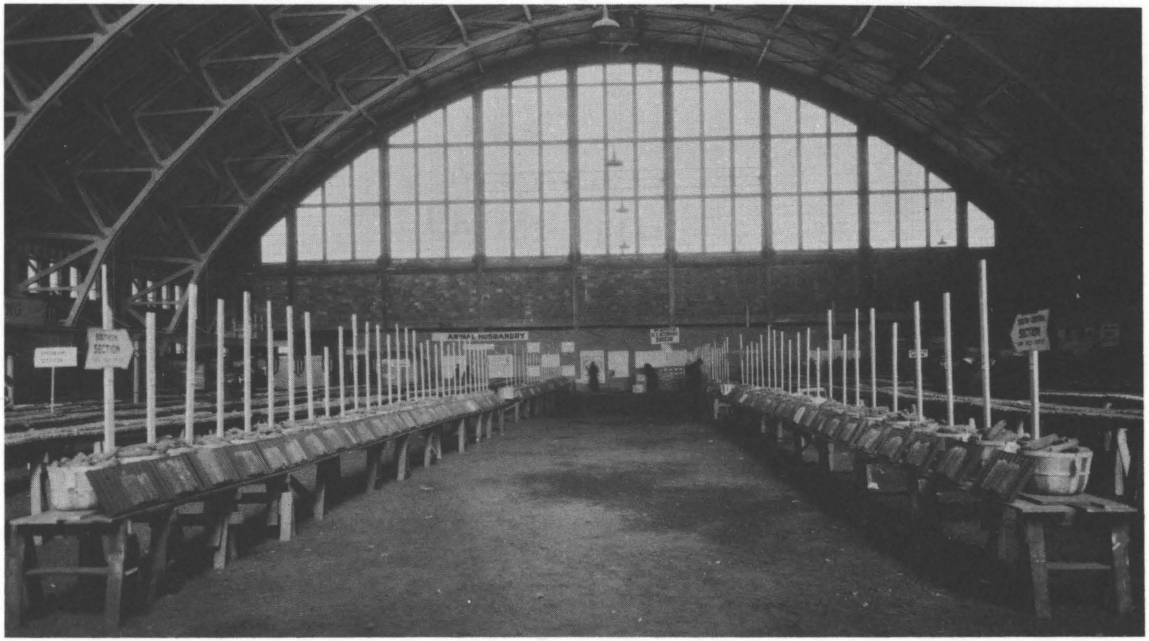


Fig. 9.1. Iowa State Corn Yield Tests — January, 1924. Exhibit of baskets of field-run corn and a few selected ears from each sample entered in the 1923 tests. The heights of the boards indicate the relative yields of the different entries.

the cost of making the tests, the other half coming from State and Federal funds. At the time of making entries each sample was given a number, which was the only means of identification from that time until after all performance records had been calculated and tabulated.

Studies in field plot technique had indicated that 250 hills, distributed in ten 25-hill plots randomized throughout the test field to overcome variations in productivity of the soil, would insure satisfactorily accurate comparisons. The number of plots planted to each entry in each test field was five in 1920, 1921, and 1922, and 10 replications generally planted in each field in later years. Section yields, therefore, were the average of 30 plots, with 10 in each of three parts of the section.

In some cases, three-row plots were used and in others four-row plots, with only the central row, or rows, harvested for the yield determinations. Yields were all calculated to the same stand in the field and to a uniform moisture content of shelled corn, except that for the first four years the yields were reported on an ear-corn basis.

In the earlier years of the program, as an encouragement to corn growers and breeders to enter their strains of corn in the yield test, the names of only those whose corn strains ranked above the average in yield were published. The purpose was to find the high-yielding strains or varieties, not to humiliate those who had less productive strains. It was not until 1935 — 16 years after the state testing program was begun — that the names of all entrants were reported, together with the performance record of their strains.

In the very early years of the yield testing program, entrants sent in their seed samples at the time of making entries. After a few years, however, entrants were required to state the amount of seed of each entry and the location of at least one-half of this amount. Representatives of the Association then took samples of seed from these stocks, in this way ensuring that the seed planted in the yield test was truly representative of the seed of these strains being sold to farmers over the state.

OPEN POLLINATED AND HYBRID STRAINS COMPARED

When the Iowa State Corn Yield Test was organized there were no commercially available hybrids. The first entry of a hybrid was in 1923. In 1924 there were four hybrid entries and in 1925 there were 10. Beginning in 1926 a separate class was provided for hybrid entries. The purpose in making this arrangement was to encourage entrants to continue with the testing of their open pollinated strains. This separation appeared to be necessary in view of the fact that the hybrids were consistently outyielding even the best of the open pollinated varieties. In 1926 there were 133 and in 1927, 206 district hybrid entries, indicating something of the rapidity with which hybrid corn came into the picture. A few years later the open pollinated class was discontinued, as all the entries were hybrids.

"EXTENSIVELY GROWN" HYBRIDS ENTERED BY THE ASSOCIATION

Many of the most extensively grown hybrids were not being entered in the State Corn Yield Test by their producers. This meant that there was no information available to seed corn buyers on the productivity of these hybrids, their maturity, or other characteristics. As a service to Iowa seed corn buyers, beginning in 1944 a survey was made each year to determine which of the hybrids commercially sold were being most extensively grown in the different areas in the state. Those found to be grown on the larger acreages were entered in the name of the Association, representative seed samples being obtained by the Association.

In 1944 the five hybrids reported to be grown on the larger acreages in each of the four sections were so entered in the State Corn Yield Test. In following years 10 of these "most extensively grown hybrids" were entered for each of the four sections of the state, making a total of 40.

In obtaining and testing these extensively grown hybrids in this way, the Iowa Corn Growers Association rendered a very important service to Iowa farmers. For the first time, purchasers of seed corn had readily available to them accurate, unbiased performance records on the hybrids being promoted by the larger hybrid seed corn producers, and which were being planted on a larger and larger percentage of the state corn acreage.

REPORTING OF RESULTS

In the earlier years of the state test, the results were made available annually at the midwinter State Corn Show at Ames, in reports published and distributed by the Association, and especially in the agricultural press.

In 1929 the Iowa Station in its Bulletin 265, "High Yielding Strains and Varieties of Corn for Iowa," authored by H. D. Hughes, Joe L. Robinson, and A. A. Bryan, summed up the results of the first eight years: "Inasmuch as the average of accumulated tests is of special significance in a comparative study of varieties and strains, it is deemed advisable herewith to report certain results not previously available." In the more recent years, the results of the Iowa Corn Yield Test have been published annually by the Iowa Agricultural Experiment Station, the publication being made available at the time of the winter meeting of the Association (more recently known as the Iowa Crop Improvement Association).

In addition to reporting the strain yield comparisons, Bulletin 265 also reported on studies having to do with:

1. The rate of planting as related to yield in the different parts of Iowa
2. Effect of moving seed corn east and west within the state
3. Shelling percentage in relation to acre yield
4. Relation of moisture content at harvest to acre yield
5. Method of testing in relation to the accuracy of yield comparisons.

A MEASURE OF THE IMMEDIATE EFFECT

The number of district entries in the first eight years of the State Yield Test was 3,229, with the same entry usually planted in more than one district and in more than one year. In 1928 several hundred Iowa farmers were asked to estimate the acreage planted to different strains and varieties of corn in their respective localities. Based on these reports — on the average acre yield in the different parts of the state as published by the Iowa Crop Reporting Service, and the increase in acre yield by these newly found strains as shown in the Corn Yield Test — it was calculated that:

The use of Krug corn in the districts where yield comparison data are available has resulted in an estimated increase in annual production of 445,918 bushels; Ioleaming, 228,822; Black yellow dent, 178,906; Golden King 104,426; Osterland yellow dent 109,844; and for other corn yield test strains somewhat smaller amounts — an annual increase in production of 1,255,513 bushels, with no increase in acreage or other material expense. This is not an estimate of what might result at some time in the future if a certain percent of the corn acreage of the state were to be planted with some of the varieties located through the Iowa Corn Yield Test, but by what actually has resulted within nine years after the yield test was inaugurated.

IMPORTANT TO THE HYBRID BREEDING PROGRAM

The Iowa Corn Yield Test made a very important contribution to the hybrid seed breeding program, in that as the hybrid method of breeding got under way, these high-yielding, high-quality strains provided the foundation stocks from which many of the most valuable inbreds were isolated.

State corn yield test programs, similar to the pioneering procedure developed in Iowa, were established and have been continued through the years in practically all — if not all — of the Corn Belt states.

10. Some Contributions of Corn Yield Tests To Seed Selection and Corn Shows

THE UNIVERSAL USE of commercially produced hybrid seed corn has made the selection of seed by the individual farmer obsolete. Thus the need for "corn judging," and interest in the old-time corn shows has vanished. However a record of the contributions that corn yield tests were beginning to make to the type of corn recommended by some experiment stations, and which received prizes at corn shows, should be of value to anyone interested in the development of "maize the wonder crop" which the American Indian gave to the world.

Local, county, state, and national corn shows, in which prizes were offered for the "best seed corn," were very popular the first third of the twentieth century.

The major purpose of such shows was to instruct farmers on how to select seed that would produce the most profitable crops. This was stated in a circular, "A Score Card for Corn and Suggestions for Corn Growers," by the Department of Agricultural Extension of the Iowa State College in about 1910, as follows: *"The judge should give the first prize to the sample that will be of most benefit to the corn grower."*

Professor Holden did much to promote local corn shows. No Farmers Institute, Short Course School, County Fair, or State Fair was complete without its corn show. Local banks and merchants contributed cash and merchandise for prizes and often conducted corn shows for their own patrons. Such shows stimulated interest not

only in the selection of good seed but in the whole program of corn growing, good farming, and good living.

The same standards shown on the score cards used as guides in the judging of such shows were used in the teaching of seed corn selection in colleges, short courses, farmers, institutes, and public schools.

The values assigned in such score cards were based on general observations and theory, rather than on field trials.

Iowa's official guide to such judging and teaching for many years was Iowa Experiment Station Bulletin 77, published in April, 1904, "Selecting and Preparing Seed Corn," by P. G. Holden. It was well illustrated with photographs of supposedly desirable and undesirable stalks, ears, and kernels, and written in such terms that an eighth grader could understand it. It was so popular that it was reprinted several times, and had wide circulation, outside as well as in Iowa.

AN EARLY SCORE CARD, 1904

The score card with explanations of points as published in Bulletin No. 77 and in general use at the time follows:

SCORE CARD

Explanation of points in corn judging

1. Trueness to type or breed characteristics. 10 points. The ten ears in the sample should possess similar or like characteristics and should be true to the variety which they represent.
2. Shape of ear. 10 points. The shape of ear should conform to the variety type. The ear should be full and strong in the central portion and not taper too rapidly towards the tip, indicating strong constitution and good yielding quality.
3. Purity. (a) In Grain. 5 points. Color of grain should be true to variety and free from mixture. For one or two mixed kernels, a cut of one-fourth point should be made; for four or more

mixed kernels a cut of one-half point should be made. Differences in shade of color must be scored according to variety characteristics.

(b) In cob. 5 points. An ear with a white cob in yellow corn or red cob in white corn should be disqualified or marked zero. This mixture reduces the value of the corn for seed purposes, indicates lack of purity, and tends towards too wide a variation in time of maturity, size and shape of kernels, etc.

4. Vitality or seed condition. 10 points. Corn should be in good seed condition, being capable of producing strong, vigorous growth and yield.

5. Tips. 5 points. The form of the tip should be regular; kernels near the tip should be of regular shape and size. The proportion of tip covered, or filled, must be considered. Long pointed tips as well as short flattened or double tips are objectionable.

6. Butts. 5 points. The rows of kernels should extend in regular order over the butt, leaving a deep depression when the shank is removed. Open and swelled butts, depressed and flat butts with flattened glazed kernels are objectionable and must be cut according to the judgment of the scorer.

7. Kernels. (a) uniformity of, 10 points. (b) shape of, 5 points. The kernels should be uniform in shape and size making it possible to secure uniformity in planting with the planter, and consequently a good stand. The kernels should also be not only uniform on individual ears, but uniform in color and true to variety type. The kernels should be so shaped that their edges touch from tip to crown. The tip portion of the kernel is rich in protein and oil, and hence of high feed value. Kernels with large germs insure strong vigorous growth as well as richness in quality of kernel.

8. Length of ear. 10 points. The length of ear varies according to the variety, type, and the characteristics sought for by the individual breeder. Uniformity in length is to be sought for in a sample, and a sample having an even length of ears should score higher than one that varies, even if it be within the limits. Usual lengths of ears for the northern section of the state, 8-1/2 to 9-1/2 inches; central section, 8-3/4 to 9-3/4 inches; southern section 9 to 10 inches. Very long ears are objectionable because they usually have poor butts and tips, broad shallow kernels and hence a low percentage of corn to cob.

9. Circumference of ear. 5 points. The circumference of ear will vary according to the variety and the latitude. The circumference of ear should be in symmetry with its length. An ear too great in circumference for its length is generally slow in maturing, and too frequently results in soft corn. Dimensions for the northern section of the state, 6-1/2 to 7 inches in circumference; central section 6-3/4 to 7-1/4 inches; southern section 7 to 7-1/2 inches. Measure the circumference at one-third the distance from the butt to the tip of the ear.

10. (a) Furrows between rows. 5 points. The furrows between

the rows of kernels should be of sufficient size to permit the corn to dry out readily, but not so large as to lose in proportion of corn to cob.

(b) Space between tips of kernels at cob. 5 points. This is very objectionable as it indicates immaturity, weak constitution and poor feeding value.

11. Proportion of corn to cob. 10 points. The proportion of corn is determined by weight. Depth of kernels, size of cob, maturity, furrows and space at cob, all affect the proportion. In determining the proportion of corn to cob, weigh and shell every alternate ear in the exhibit. Weigh the corn and subtract from the weight of ears, giving weight of cobs; divide the weight of shelled corn by the weight of the ears which will give the percent of shelled corn. Percent of corn should be 86 to 87. For each percent short of standard a cut of 1-1/2 points should be made.

Each sample should consist of ten ears of corn.

EXTENSION DEPARTMENT SCORE CARD — 1908

That early score card as used in 1904 was condensed and simplified as time went on. The score card used for several years, from about 1908, by the Extension Department of the College had four main points. Each point was divided into from seven to eleven parts. Several of the subpoints under one main point were duplicated under other main points. The four main points and the weights given to each follow:

I. Will it yield? . . . . . 25 points
That is, will it yield well; has it constitution; can we depend on it when conditions are unfavorable?

II. Will it ripen? . . . . . 25 points
That is, will it mature; will it ripen every year; is it safe for the locality?

III. Will it grow? . . . . . 25 points
That is, has it vitality; will it germinate; will it grow and grow uniformly, giving strong vigorous sprouts?

IV. Does it show improvement? . . . . . 25 points
That is, has it breeding; has it distinct type; will it reproduce itself; has it several years of careful selection and improvement back of it?

A LATER SCORE CARD FOR CORN (IOWA STATE COLLEGE)

Several years later the following simplified score card was used at the Iowa State College:

I.	Maturity and soundness		45 points
	A. Freedom from disease	10 points	
	B. Plumpness of kernel tips	10 points	
	C. Weight and freedom from starchiness	20 points	
	D. Condition of germ	5 points	
II.	Kernel Characteristics		40 points
	A. Size and shape of kernels	15 points	
	B. Density of kernels	15 points	
	C. Size and shape of germs	5 points	
	D. Uniformity of kernels	5 points	
III.	Type		15 points
	A. Size and shape of ear	5 points	
	B. Uniformity	5 points	
	C. Purity	5 points	

UTILITY CORN SCORE CARD (ILLINOIS COLLEGE OF AGRICULTURE)

The Illinois Utility Corn Score Card resulted from many years of research including many years of field testing by the Illinois station, much of which was in cooperation with the United States Department of Agriculture.

An important part of the research on which the score card was based had to do with the identification of diseases as observed in careful germination tests and the relation of such observed diseases to the yield and quality of the crop produced. The Illinois Utility Score Card follows:

Utility Corn Score Card — Illinois College of Agriculture

I.	General appearance		45 points
	A. Indentation	5 points	
	B. Kernel composition	5 points	
	C. Kernel characteristics	10 points	
	D. Shank attachments	10 points	
	E. Tips of ears	5 points	
	F. Luster or polish	10 points	

II.	Type and uniformity		20 points
	A. Type	5 points	
	B. Length of ear	5 points	
	C. Color	5 points	
	D. General uniformity	5 points	
III.	Germination record		35 points
	A. Vitality and vigor	20 points	
	B. Freedom from disease symptoms	15 points	

SOME CHANGES IN SCORE CARDS

There was less emphasis on the uniformity of ears and kernels in the score cards used during the later years of the "corn show era" than during the early years. Much emphasis on observable characteristics that indicate disease is shown on the later score cards. This is especially true of the Illinois Utility Score Card. The only reference to disease in the score cards used during the early and middle years was, "ears with mouldy cobs should be avoided."

There were important changes made in the emphasis on indentation and depth of kernel. In the early years such expressions as "smoothness of kernels indicates running out" and "with kernels, the deeper the better just so they mature" were common. However during later years smoothness came to be associated with freedom from disease and "deep kernels with rough starchy kernels are late in maturing and subject to disease and of relatively low feed value."

Much more emphasis on uniformity in size and shape of ear, size and shape of kernel, and color of grain and cob is shown on the score cards used during the first few years of the century than on those used from 1908 to 1920. However uniformity continued to be a major factor in the actual selection of samples for the shows and in the judging.

PROFESSOR HOLDEN'S IDEAS ABOUT JUDGING CORN

Professor Holden's ideas about judging corn are well expressed in an article which he wrote, entitled "Judging Corn," for the Iowa Corn Growers Association prior to its Eighth Annual Exhibition in the fall of 1910.

If both the exhibitor and the judge at a corn show will bear in mind a few fundamental facts about corn and corn shows, there will be fewer misunderstandings and mistakes and greater progress.

1. The best ear of corn is that ear which will, when planted, give the greatest profit per acre year after year.

2. The best ear of corn for seed is also the best ear for the show.

3. The judge should place the blue ribbon on that ear or on that sample of corn which he would select to plant year after year on his own farm if he lived in the district from which the exhibits are made.

4. The sole purpose of a corn show is to increase the profit from the corn crop, by improving it through education and developing interest. In just so far as the show helps to increase the profit from the corn crop it is a success. On the other hand, if the premiums are awarded to inferior samples because of some fancy points, samples which will not give the greatest profit per acre in the district, then to just that extent the show is a failure, for it will do damage by setting up wrong standards.

The judge will be successful in proportion to his ability to see in the samples of corn before him just what they will actually produce in profit the next year and the next year and so on, when grown by people of the district from which the entries are made.

Professor Holden has been accused of having overemphasized uniformity at the expense of other characteristics which were thought to be closely associated with ability to produce. He emphasized uniformity only as an indication of careful and continued selection of desirable characteristics. In his corn talks of that day he did emphasize uniformity in size and shape of kernel as a means of getting a uniform stand of corn which, in turn, resulted in higher yields.

YIELD OF CORN AS RELATED TO TYPE

As the County Farm demonstrations were continued and were followed by the Clinton County, Iowa, the Woodford County, Illinois, and the Iowa State Yield Test and similar work in other states, a noticeable difference between high-scoring, prize-winning seed at most corn shows and high-yielding, good-quality corn in the corn yield tests became apparent.

Joe L. Robinson writing in 1961 about the corn shows conducted by the Iowa Crop Improvement Association through many years wrote:

> The samples exhibited in the early years of the show were usually ears with deep kernals and rather deeply dented. These had great eye appeal. Many heated arguments resulted from discussions of the relative merits of smooth types of corn as compared to the rough dented types.
>
> Some smooth types began to show promise with good production records as revealed by yield tests. They became more and more popular until in 1935 a class for smooth ears was included in the show.[1]

The comparative value of the old-time score cards, the Illinois Utility Score Card, and carefully conducted yield tests as a means of selecting good seed is shown in a study of the records of the Woodford County Corn Yield Test.

I had been a long-time judge at county, state, and national corn shows of the "old type" corn and was an official judge at one of the Illinois state shows of the "utility type." This familiarity with both types enabled me to select by means of the three 10-ear samples of each man's seed, which were kept from year to year, the 10 samples which most nearly represented the old "show type" and 10 others of the "utility type." One typical ear of each man's seed was photographed.[2]

---

[1] *Iowa Certified Seed News*, Vol. 15, No. 7, July, 1961, published by the Iowa Crop Improvement Association, Ames, Iowa.

[2] Photographs of all 120 typical ears are shown in the "Report of a Study of the Relations of Certain Physical Characteristics of Seed Corn to Yield, Quality, and Maturity of the Crop Produced," by M. L. Mosher, 1934. Copies are in the libraries of the Iowa State University, the University of Illinois, and the Holden Library of the Michigan State University.

In Figure 10.1, the typical ears of the 10 old-type samples are shown above the typical ears of the 10 lowest yielding samples. Samples numbered 40, 90, 99, and 108 were among the best old-type samples and also among the 10 lowest yielding samples. No. 90, the lowest yielding sample, was the only Illinois sample to win a prize in its class at the 1920 International Grain and Hay Show. This farmer's corn was a winner also in 1921. No. 93 and No. 99 were prize winners in an Illinois show held in connection with the International Livestock Exposition in 1918 or 1919. No. 40 and No. 92 were consistent winners in county shows.

In Figure 10.2, the typical ears of the 10 best utility-type samples are shown above the ears of the 10 highest yielding samples. Samples numbered 30, 57, and 62 were among the 10 highest yielding samples. Samples numbered 55, 54, and 97 were consistent winners in the Illinois utility-type shows. Sample No. 62 was George Krug's corn. It was the last of the 10 samples to be selected as a sample from which good "utility" corn could be selected. A sample of Krug corn won a championship prize in the "Utility Section" of the International Grain and Hay Show a few years later.

The 10 old show-type samples produced a three-year average of 2.4 bushels less than the average of all 120 samples in the test and only 2.0 bushels more than the average of the 10 lowest yielding samples as shown in Figure 10.3. Only one was above average and it was 32nd in yield.

However there were a few high-yielding samples from which good old-type corn could have been selected. One such, No. 109 in Figure 10.2, tied for fifth place among all 120 samples. It was, however, appreciably later in maturing than any others of the high-yielding samples.

The 10 utility-type samples produced a three-year average of 3.3 bushels more per acre than the average of all 120 samples and only .9 bushels less than the average of the 10 high-yielding samples. All 10 were among the 21 highest yielding samples.

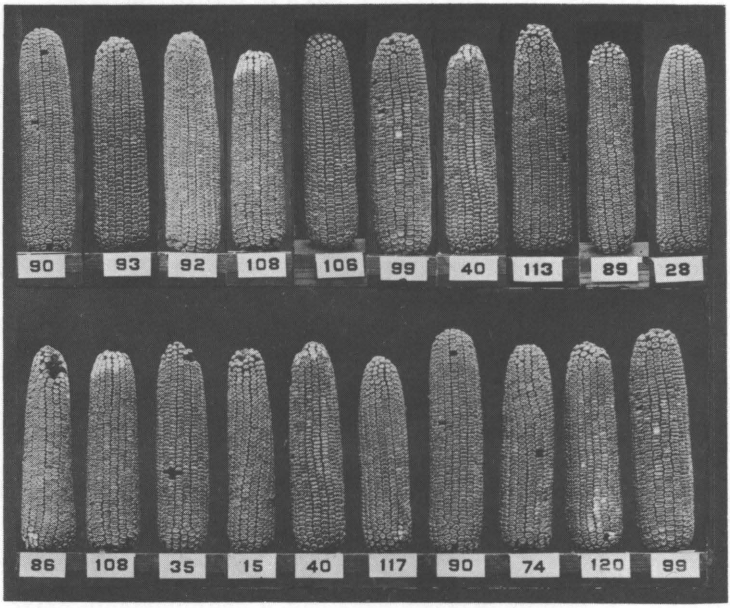


Fig. 10.1. Old show-type seed ears (above) compared with the lowest yielding of 120 farmers' samples (below).

MOST PRESENT-DAY HYBRIDS CONFORM TO THE TYPE THAT THE CORN YIELD TESTS SELECTED

I spent several hours at the Prairie Farmer Farm Progress Show near Farmer City, Illinois, in 1957 making a careful study of about 100 strains of hybrid seed that most Corn Belt companies had growing there. Bushel baskets of field-run ears were on display. I repeated the study at the Farm Progress Show in Cedar County, Iowa, in 1959.

Almost all of the hybrid strains conformed closely to the most desirable type of corn selected by the corn yield tests. Most of the hybrids intended for the center of the Corn Belt have a predominance of 18-row ears, with some earlier strains having 16 rows and later strains 20 rows.

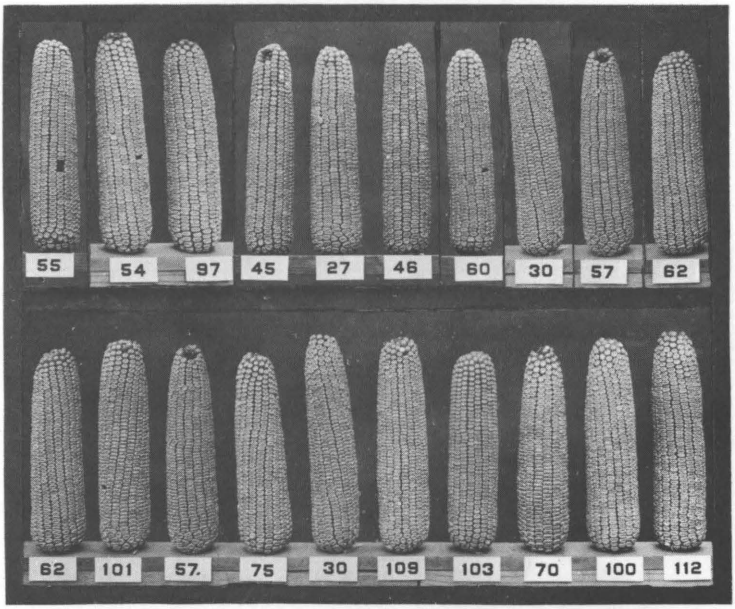


Fig. 10.2. Illinois utility-type seed ears (above) compared with the highest yielding of 120 farmers' samples (below).

Most had medium indentation. Some had medium-smooth and a few had medium-rough kernels. None were very smooth or very rough. Most hybrids had medium to medium-long kernels. Very short or very long kernels as judged by old-time standards were rare. Well developed kernels with plump kernel tips and horny endosperms were the rule.

I do not believe that long continued selection of seed according to the findings of corn yield tests would have led to the selection of strains of open pollinated corn at all equal to present day hybrids. Far from it. It would not have eliminated barren, nubbiny and weak stalks, nor would it have bred insect and disease resistance and many other desirable characteristics into the corn. I do believe, however, that if hybrid corn had not been developed, the many laboratory studies and field tests that

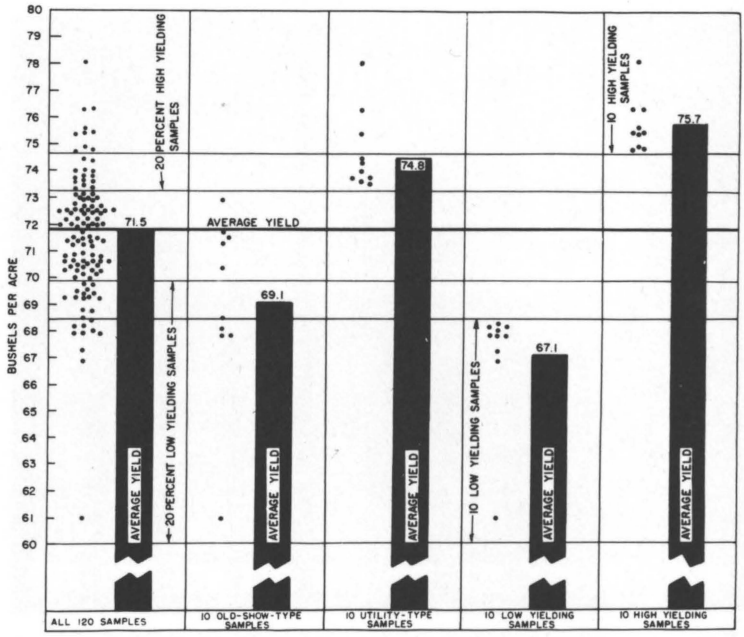


Fig. 10.3. Ten old show-type and 10 utility-type samples compared with all 120, and the 10 high-yielding and the 10 low-yielding samples in the Woodford County Corn Yield Test.

were going on across the Corn Belt would have brought about great improvement in the yield and quality of open pollinated corn.

11. The Iowa Seed Corn Specials

THE EFFECTIVENESS of Iowa's historic Seed Corn Specials was due in no small part to the information available from the County Farm demonstrations with corn. Those demonstrations gave the lecturers important information regarding the quality and condition of the seed corn being planted.

The story of the Seed Corn Specials was so well told by J. S. Trigg, Editor of the *Iowa State Register*, in his May 12, 1905, issue, that it is reproduced in part. Mr. Trigg spent nine days on the Special.

Photographs which occupied about one-half of the front page showed the crowds gathered on the streets, at depots waiting for the train, in the lecture car, and in an uptown hall. A photograph of the six men who did most of the speaking appeared there and is reproduced here as Figure 11.1. An Iowa map locating the stops was also shown and is reproduced as Figure 11.2. Charts much used on the Specials are shown in Figures 11.3, 11.4, and 11.5.

THE ACHIEVEMENT OF IOWA'S SEED CORN SPECIAL

"The most important crop grown in the state of Iowa is corn. Nine million acres of the best land in the West are devoted to its production.... Considering the fertility of the soil, the average yield per acre has been so low as to attract attention. It remained for Professor Holden of

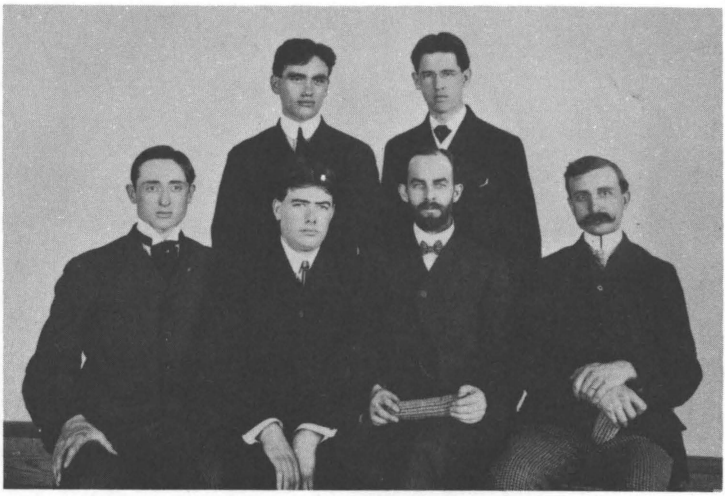


Fig. 11.1. Lecturers on the "Seed Corn Specials." Seated from left to right. M. L. Bowman, senior author of the textbook, *Corn*, published in 1908; M. L. Wilson, who later became director of U. S. Agricultural Extension Service from 1940 to 1953; Perry G. Holden, Professor of Agronomy and later director of Iowa Agricultural Extension Service; and J. W. Jones, then assistant in Agronomy. Standing, from left to right; M. L. Mosher, author of this report, and Louis G. Michael, then Experiment Station chemist and later a "corn development envoy" to Russia (see Chapter 12).

Ames College to discover the reason and seek to apply a remedy. It was found, upon careful examination of many fields of corn, that there was a great irregularity, and usually a deficiency, in the stand of corn resulting in a small crop, and the cause of this poor stand was directly attributable to poor and defective seed.

"A careful examination of the cornfields of Iowa last year disclosed the fact that there was not, taking the cornfields of the state as a whole, to exceed two-thirds of a stand. By a careful selection and testing of the seed corn it would be entirely possible to get a 90 percent stand. Could such a stand be secured it is entirely reasonable to assume that it would result in an increased

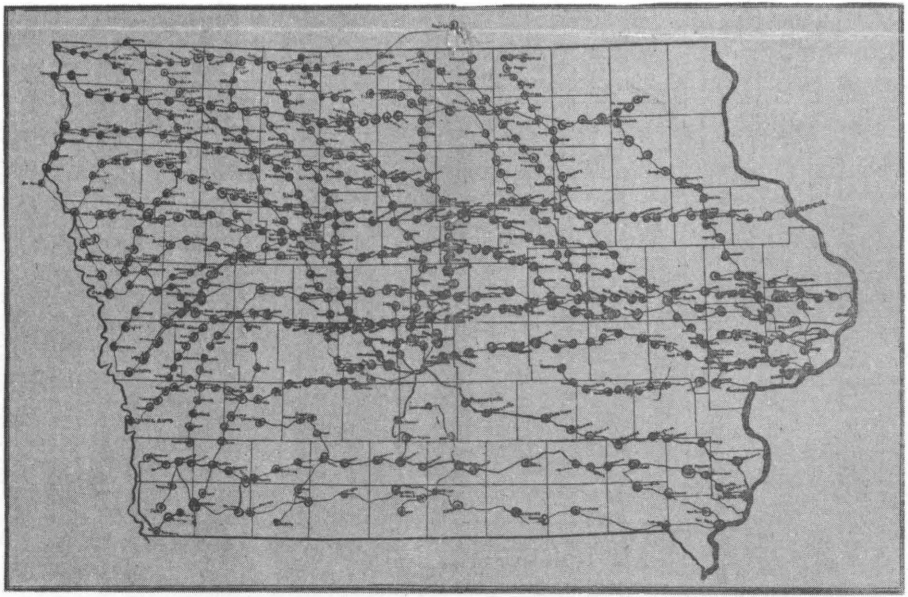


Fig. 11.2. Map showing stops made by the Seed Corn Special. "The above outlined map shows how fully the state was covered. It should be said that on the 'Q' road, which courses through the southern part of the state, the stops were made forty miles apart and free transportation given to the farmers from intermediate counties, quite fairly covering its territory." (From the *Iowa State Register*)

Fig. 11.3. This chart was used regularly on the Seed Corn Specials to emphasize a good seed corn development program.

yield of at least five bushels per acre and such an increase would amount to 45,000,000 bushels, worth to the farmers of the state not less than 40 cents a bushel or $18,000,000; a sum sufficient to warrant many times over all the work and the money invested in this seed corn train scheme.

"... It is interesting to note just how the idea of the special train propaganda originated. As we have been able to trace it out, we find that during a discussion upon the seed corn question, a year ago last April, Superintendent Given of the Chicago, Rock Island and Pacific road first made the suggestion that it would be a good plan for the railroad to send out a car and give instruction to the farmers along the line of the road upon the subject of the importance of paying more attention to their seed corn.

"The idea was no sooner suggested than it was eagerly and heartily indorsed.... The first seed corn train was sent out over the Rock Island, and later over the Burlington. It was such a success that this year the scope of the work was extended to other lines.

"The campaign opened February 13 and closed April 19, during which nearly the entire state was covered, 570 towns were visited, and 935 lectures delivered to 110,163 corn growers of the state.

"The plan of operating the trains was as follows: The railroad company furnished free of charge a train made up of three commodious passenger coaches for audience rooms, and two private cars for the accommodation of the lecturing force. They also advertised the schedule of the train extensively by posters and through the local newspapers.

"On an average about 12 towns were visited each day. In many cases a hall was secured in advance, where one was located convenient to the train, and the audience would be seated and waiting when the train arrived. At the larger number of the towns, however, the lectures were delivered in the cars. Quite frequently the three cars were filled and three lectures would be delivered at the same time.

"A period of 30 minutes was allotted to each stop for the lecture, which was usually much too short for the audience.

"The substance of the lecture given called the attention of the corn grower to the great losses resulting from a poor quality of seed and the consequent irregular and deficient stand. He was shown how it was easily possible for him to determine the germinating power of each ear of corn saved for seed, by the use of a testing box.

"The method of testing seed corn presented involved testing the germinating power of each individual ear of corn, a method very simple and effective in operation, enabling the corn grower to remove every defective ear before it was shelled and used for seed. He was also

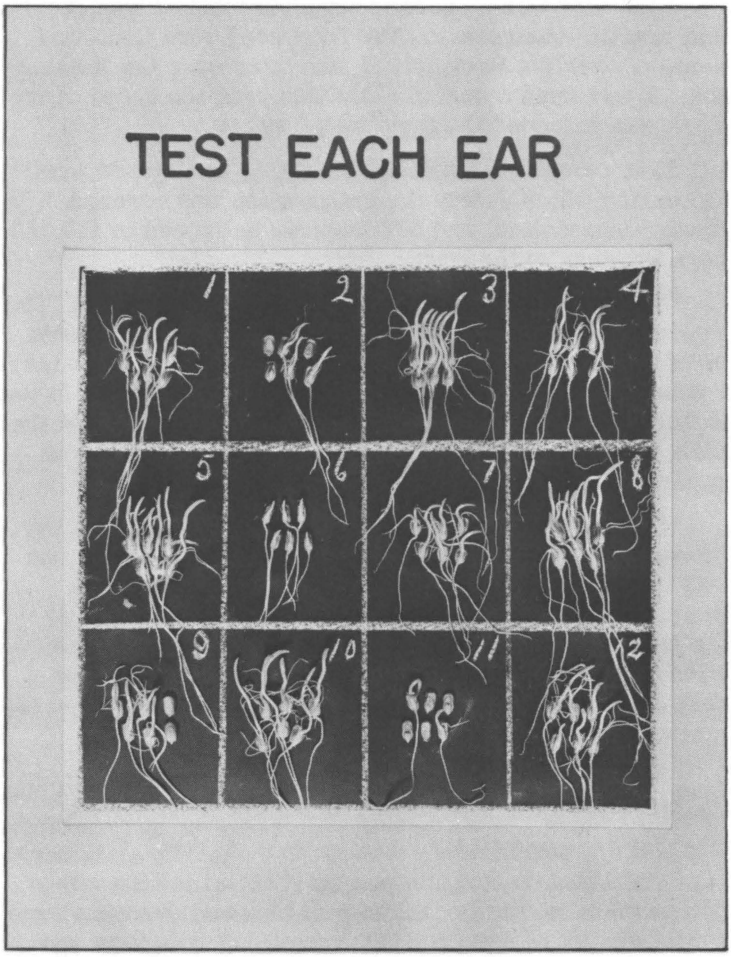


Fig. 11.4. The chart "Test Each Ear" was the heart of the seed corn lectures.

given instructions how to select, save, and care for his seed corn; and also shown how he might greatly improve the quality of his seed corn by careful breeding up.

"The greatest interest and enthusiasm was manifested at every place reached by the trains. The average attend-

ance at each meeting was 193 and the audiences were almost exclusively made up of men engaged in growing corn. At not a single place during the whole trip was there anything approaching a failure to have a good meeting. While at some places a few men were found who were at first skeptical of the practicality and value of the plan of testing seed corn presented, there were few such to be found after the lecture was concluded.

"It is doubtful whether any of the valuable experimental work done by our Agricultural College was ever before so generally, helpfully and practically put within reach of the farmers of any state, and the result is going to be that greater attention will be paid to the quality of the seed corn planted in Iowa this season than ever before.

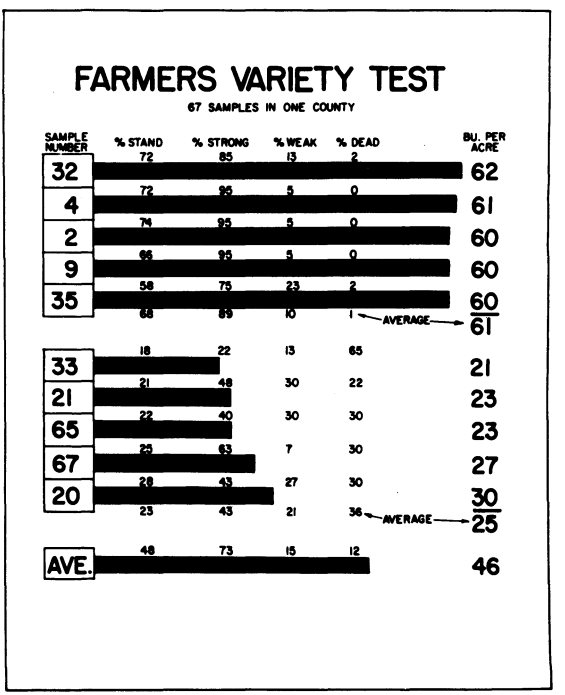


Fig. 11.5. The chart "Farmers' Varieties Tests" was used on the Seed Corn Specials to show the poor quality of much seed corn being planted by Iowa farmers.

"The trains over the different lines of roads were handled in excellent shape by the road officials. Appointments were kept on time and the large audiences well looked after.

"The interest of the railroads in the work is in the line of promoting a better type of agriculture on the farms tributary to their roads; better crops meaning more traffic for them. The cost to the railway companies to operate these trains is estimated to have been about $15,000 and aside from any financial return which may come to them in the future, they have given the farmers of the state an evidence of disinterestedness and a desire to promote their interest which will be remembered.

"The corps of lecturers included P. G. Holden, Professor of Agronomy; Professor J. W. Jones, assistant in farm crops; L. G. Michael, station chemist; M. L. Bowman, farm foreman, and M. L. Mosher and M. L. Wilson, senior students at Ames Agricultural College."[1]

The following data accompanied the above article:

Facts about Iowa's Seed Corn Specials

	Railroad	Miles traveled	Days	Stops	Talks	Attendance
In 1904	C.R.I. and P.	474				
	C.B. and Q.	930				
	D.M.,I.F. and N.	76				
	Total in 1904	1,480	8	100	150	17,600
In 1905	C.R.I. and P.	1,862	12	148	195	19,890
	C.B. and Q.	1,139	5	40	80	19,378
	D.M.,I.F. and N.	76	1	8	9	510
	C.M. and St.P.	1,488	10	131	210	23,000
	C. and N.W.	1,958	13	149	300	33,420
	Ill. Central	1,332	8	94	141	13,965
	Total in 1905	7,855	49	570	935	110,163
	Total both years	9,335	57	670	1,085	127,763

[1]Copy of a diary showing attendance, speakers, and notes at all stops on the Seed Corn Special of 1905 and a reproduction of the lectures is filed in the libraries at the Iowa State University, the University of Illinois, and the Michigan State University to serve as a supplement to this book.

12. Some World-wide Results of the County Farm Corn Demonstrations

Two Point-IV Type Programs
Undertaken before World War I

THE INFLUENCE of the County Farm corn demonstrations begun in Iowa in 1903 soon reached out into other states and other countries.

RUSSIA

It was about 1908 that officials of Bessarabia, a province of southwestern Russia, invited Professor Holden to come and show them how to grow more corn. Corn was their most important food and feed cereal.

Professor Holden was only just getting the Iowa Extension Service in Agriculture and Home Economics well started and it did not seem desirable for him to go. However, he did agree to send one of his assistants, Louis G. Michael, who had been at the Iowa college for five years as Experiment Station chemist.

Michael in 1958 wrote to me about his experiences in Russia as follows:

"Professor Holden was in the initial stages of his corn program when I arrived at the Iowa State College to take over the professorship of Agricultural Chemistry. At his request I was one of the group that accompanied him on the trip of the "Seed Corn Special Train" in 1904 and 1905.

"The message of the Holden corn gospel spread beyond the confines of the United States. The local government of Bessarabia (Russia) invited Professor Holden to

come over and show them how to grow more corn. Since he could not go he asked me to substitute.

"Armed with the *A. B. C. of Corn Cultivation,* the illustrations of which showed very clearly how to "do it yourself," I arrived in Kishinev, the capital of Bessarabia, in early 1910.[1]

"The peasants were not keen to follow the principles laid down in the 'Azbuka,' as the Russian translation of the *A.B.C.* was called. They had two major objections: (1) It was flying into the face of providence. They said, 'All is as God wills. If he wants us to have a better harvest, He will give it to us.' (2) The die-hards said, 'We don't want to grow more corn in the land we have. We want more land.' Also, they preferred to follow local customs; that is, to broadcast corn on the unplowed land and then to plow it under.

"But we were able to organize boys' and girls' clubs with the help of some of the more enlightened school teachers and village priests. The children followed "Azbuka" and selected ears from their fathers' home cribs which were tested for germination. Each child planted a row on fall-plowed land and tended his own row until harvest time. The comparative results were astounding. Then came the formerly-skeptical peasants saying, 'Why don't you show *us* how to do this thing? Why do you waste your time on children?'

"So we organized young men's clubs and they were coached into rational procedures that in some cases doubled their production.

"We had some twenty odd varieties of nothern grown American corn sent over but they didn't do well. The best results were obtained with three varieties: Italian, Chinquanxino; Hungarian, Orangaway; and a local variety from Bessarabia. All were flint corns.

[1] This paper-bound book, *The A.B.C. of Corn Cultivation,* by P. G. Holden, had about 200 pages and was well illustrated. It had wide distribution in the Corn Belt. It was translated into Spanish and 50,000 copies distributed in Mexico. See page 121.

Fig. 12.1. Members of a Boys' Club at Ackerman, Bessarabia, Russia, standing at the ends of their individual rows of corn in 1913. The boys were of German decent.

"From this start in the spring of 1910, mass selection was begun with these flint corns. This was followed by ear-to-row planting and the detasselling of alternate rows. No hand pollination was practiced.

"Everything was progressing satisfactorily — boys' and girls' clubs, young men's clubs, village participation, a central breeding station on the Tzar's estate at Rominestie — when war was declared. Most of my staff of 60 young men, all members of the young men's clubs, and many of the teachers went to the front. I departed in 1916.

"I revisited Bessarabia in the early 1920's. I was told that the seed stocks which I had left at Rominestie had been fed to the hogs. In some places corn was being planted in rows, but otherwise there was no trace that I had passed that way.

"In the early 1930's I again visited Bessarabia and was told that the government had, on the basis of my work, decided that Chinquanxino, Orangaway, and the local Bessarabia were the best varieties suited to Bessarabia conditions."

Although the project on which Louis G. Michael spent six of the best years of his life ended in apparent failure, it undoubtedly had indirect, if not direct, influence on

Fig. 12.2. Louis G. Michael, right, and M. L. Mosher meet in 1947 to talk over their experiences in Russia and Mexico nearly forty years earlier.

many Russian people. He continued to spend much of his life in active government service in the countries of eastern Europe and in Russia, as a representative of the USDA. He was Agricultural Attache in Moscow during World War II. At the time of his retirement in 1947 he was a special agent of the State Department.

During a visit in 1947 (see Figure 12.2) Mr. Michael and I compared our early experiences in carrying agricultural education to foreign countries.

MEXICO

Early in 1908, a letter was received at the Iowa State College from Sr. Luis Gorozpe of Mexico City asking for information that would help them to grow more and better corn in Mexico. Corn was then and is now the major food

grain of the Mexican people. Sr. Gorozpe was a prominent lawyer in Mexico City, who was closely associated with the long-time president, Porfirio Diaz, and with his son, Porfirio Diaz, Jr. The latter owned a 4,000-acre hacienda of good corn land near Toluca, about 50 miles west of Mexico City in the state of Mexico. Sr. Gorozpe was also heir and manager of the Hacienda de Tuzamapam, a 45,000-acre cattle and sugar hacienda near Jalapa, the capital of the state of Vera Cruz. This hacienda was only 25 or 30 miles from the Gulf of Mexico.

The letter was brought to Professor Holden's attention and he sent a collection of bulletins and books about corn. Among the publications was Holden's book, *The A.B.C. of Corn Cultivation.* This was the book that Louis G. Michael referred to as the basis of his program in Russia.

Shortly after receiving the publications, permission was asked for translating *The A.B.C. of Corn Cultivation* into Spanish for distribution by the government of Mexico. It was also asked that Professor Holden come to Mexico and help them to grow more and better corn for their people.

Professor Holden declined the invitation to go to Mexico, but recommended that I, then Crops Specialist in Iowa's newly organized Extension Service, go to their assistance. I spent one and one-half years in Mexico working on the two haciendas: Sr. Gorozpe's Hacienda de Tuzamapam near the Gulf of Mexico and near Jalapa in the state of Vera Cruz, and Sr. Diaz's Hacienda de Pate on the high central plateau near the city of Toluca, in the state of Mexico.

Corn growing on the two haciendas was as different as one can imagine. Conditions at Tuzamapam were tropical. Frost was unknown. Sugar cane was the major commercial crop. Pineapples, mangoes, coffee, and rice were common. Some strains of corn grew so tall that I was able to reach the highest ears only by standing in the stirrups of my saddle.

In contrast, all corn in the area around Toluca, which is 7,000 to 8,000 feet above sea level, was very short and the ears small. A kind of dent corn was grown but most ears showed dented kernels only near the butt of the ear. Most kernels looked more like popcorn than like the dent corn of the Corn Belt of the United States. It was the custom to plant the short-stalked, small-eared corn very thick, with as many as 20,000 to 30,000 kernels per acre. Yields of up to 60 and 70 bushels per acre were obtained on some of the experimental plots.

The average yields of all test plots planted on the two haciendas in 1909 were 36 bushels per acre at Tuzamapam and 27 at Pate.

It seemed to me that very little of lasting benefit was accomplished through my efforts. Most of the 1908 season was spent studying the language and becoming familiar with conditions. Some assistance was given to the young man who was translating the book, *The A.B.C. of Corn Cultivation* and who also served as interpreter. This man is pictured standing on the right in Figure 12.4.

I accompanied Sr. Gorozpe to the United States in the fall of 1908. Several of the Midwest Experiment Stations were visited and a few days spent at the National Corn Exposition in Omaha, and at the International Livestock Exposition at Chicago. While in Omaha hearings of the Country Life Commission, appointed that year by President Theodore Roosevelt, were attended.

Having been married in December, 1908, I returned to Mexico with my bride in January, 1909.

Work at the Hacienda de Pate

March is corn planting time on the high plateau in the state of Mexico. The selection of seed for the 1909 crop was a serious problem because of a freeze that had completely destroyed the 1908 crop.

Several weeks were spent visiting other haciendas in a radius of 10 to 20 miles of Pate, selecting and testing

Fig. 12.3. Local boys helping me select seed corn from the crib in a Point-IV type of project for the Hacienda de Pate owned by Porfirio Diaz, Jr., in 1909.

seed from corn kept over from the 1907 crop. Seed for several hundred acres was selected and tested. At Pate nearly 1,000 carefully selected ears were planted in March by the ear-to-row method. Such ears were selected from seed obtained on three haciendas and included two varieties grown at Pate. Other seed had been selected from two other haciendas, which was not planted ear-to-row. There was the same wide range in yield and quality of the crop produced from the seed obtained from different haciendas as was found in the farmers' variety tests in Iowa. There were also great differences in time of maturity. Selecting seed for the 1909 crop is shown in Figure 12.3.

Work at the Hacienda de Tuzamapam

Corn planting at Tuzamapam is delayed "until the rains come" in June. The difference in planting seasons made it easy to supervise work at the two haciendas.

The land at Tuzamapam used for growing corn was literally covered with rocks, from small pebbles to some rocks too large for one or even two men to lift. Because of this only the typical "wooden plows of the ages" could be used to advantage.

Much of the same program of ear-to-row planting of selected ears of seed was followed at Tuzamapam as at Pate. Time-of-planting, thickness-of-planting, and method-of-cultivation tests were also made. Comparison plots of the old and the new methods are shown in Figure 12.4.

A corn breeding program by the ear-to-row method was begun. Seed from the higher yielding, better quality rows was saved and carefully stored for use in 1910.

Grain weevils were very bad in that part of Mexico. Knowing that I would not be back the next year, I left

Fig. 12.4. Demonstration plots at Hacienda de Tuzamapan in 1909 showing corn raised by suggested new methods (left) and by the common method (right).

careful directions for the care of the seed to protect it from weevils and for the planting of the selected ears in order to make further improvements in the seed stocks.

I gave a series of five lectures and demonstrations in seed selection and corn growing in June of 1909. Giving these lectures in poor Spanish to illiterate Mexican Indians was about the toughest assignment in public speaking I ever had.

Return Visit to Mexico in 1951

Early in the spring of 1951 my wife and I returned to Mexico for a brief visit to the Haciendas de Tuzamapam and Pate, and found the extensive hacienda buildings at Pate had been completely demolished during the revolutions. One small section of one outside wall was still standing. One window in the standing wall opened into the room in which we had begun housekeeping in February, 1909.

I was much surprised when showing some old-time pictures taken at Hacienda de Tuzamapam in 1908 and 1909 to a small group of the haciendados to see one old man's face light up as he said, "I remember you! You gave some talks about corn in that building over there."

We were much pleased to learn that Sr. Gorozpe and his wife were still living. A brief visit with them in their apartment in a suburb of Mexico City was the high spot of the visit to Mexico. Sr. Gorozpe reported that they had "lost everything during the revolutions." He spoke about the work that had been done with corn and repeated it in a letter written a short time later. He said, "Certainly you were a good teacher for my workers and they obtained more corn every year because of your experiments in the fields." He was very liberal in his commendation of the work which I had looked upon for 42 years as a failure. The cordial reception of both Sr. and Sra. Gorozpe did much to counteract that keen sense of failure.

THE "TAIL THAT WAGGED THE DOG"

There is an old-time saying, "The tail wagged the dog," that has been used when an unimportant part of a larger project proves to be of more worth than the main project itself. Such was the case in this Point-IV type of project with corn improvement in Mexico. The "tail" that wagged the "corn dog" was the development of the citrus fruit industry in the area of Mexico in which the Hacienda de Tuzamapam is located.

This is what happened. During the summer of 1909 my wife and I visited the Alaska-Yukon-Pacific Exposition at Seattle and friends in California. Sr. Gorozpe asked for two things. One was to collect for him all of the literature handed out at the exposition exhibits. Two large suit cases filled with pamphlets were sent him. The second was to go to southern California and hire a mature, experienced orange grower to come to Tuzamapam and develop a commercial orange business along the lines of the California orange industry. Citrus fruits were common in that part of Mexico but were of uncertain quality and were grown only for local consumption.

H. F. Bradburne of Ontario, California, was so employed. Mr. Bradburne went to Tuzamapam and worked there with Sr. Gorozpe and others for about five years. (See Figure 12.5.) He was then forced to leave Mexico with his wife and small son because of the unpleasant relations between the governments of Mexico and the United States.

When I returned to Mexico in 1951, I found that a very thriving orange business had developed in that area, with several packing houses and one orange juice factory located at Coatepec, near which the Hacienda de Tuzamapam was located.

Inquiry revealed the fact that a multimillion dollar citrus industry had developed with some export as well as home markets. The Agricultural Attache in Mexico City said it was second or third in importance in all of Mexico.

Fig. 12.5. H. F. Bradburne from Ontario, California, planting citrus seeds in 1909 in a Point-IV type of project on the Hacienda de Tuzamapam in the state of Vera Cruz.

By mere chance I met a Mr. Hedin, who had purchased the first orange grove planted by Mr. Bradburne. During this interview with Mr. Hedin I expressed surprise to find the large commercial citrus industry where there had been none when I left the area in 1909. The answer came as a distinct shock; it was, "Back several years before World War I a man named Francisco Bradburne came down from California and got several orchards started. It all came from his work."

Mr. Hedin was no less surprised than I had been, when told my part in bringing Mr. Bradburne to Mexico. "Man alive!" he said, "if the Commercial Club of Coatepec had known that the man who selected Francisco Bradburne to come to Mexico was to be in town, they would have met him with a brass band and given a banquet in his honor."

It was a happy day for my wife and me to realize that I had had a small part in what proved to be a very worthwhile Point-IV type of program.

While these stories of the Point-IV type programs in Russia and Mexico may appear widely separated from the early Iowa Corn Yield Tests they, as well as the programs

discussed in Chapters 7 to 11, did lead directly from the work which the people of Sioux County began in 1903 under the inspiration and leadership of Professor Perry G. Holden.

Index