

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. <u>General appearance.</u>	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

102 CONTRIBUTIONS OF CORN YIELD TESTS

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 over-emphasized 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 kernels 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.

²Photographs 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.

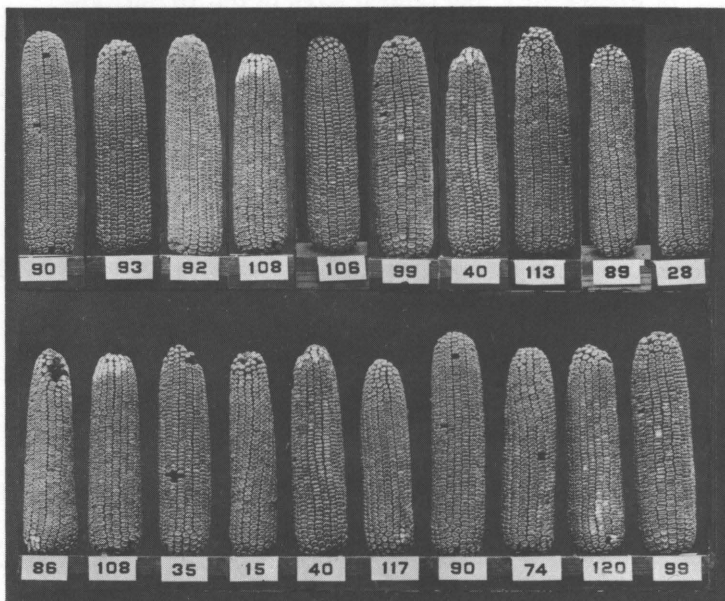


Fig. 10.1. Old show-type seed ears (above) compared with the lowest yielding of 120 farmers' samples (below).

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.

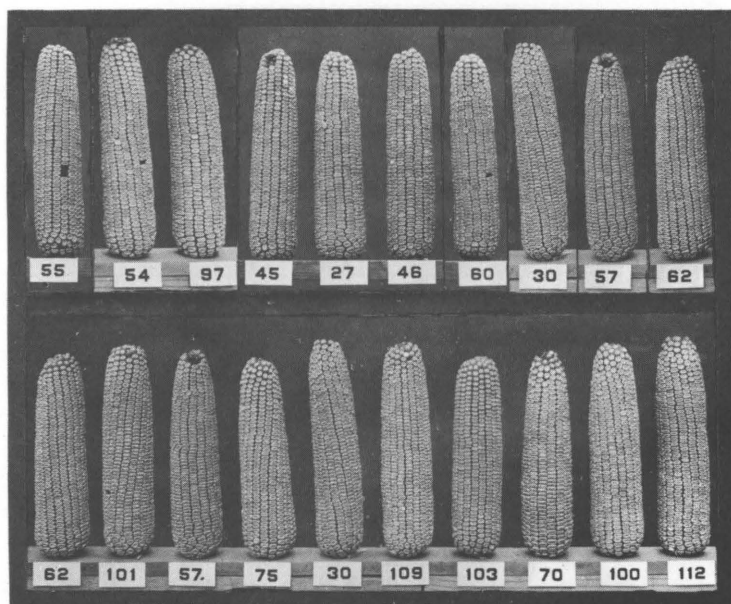


Fig. 10.2. Illinois utility-type seed ears (above) compared with the highest yielding of 120 farmers' samples (below).

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

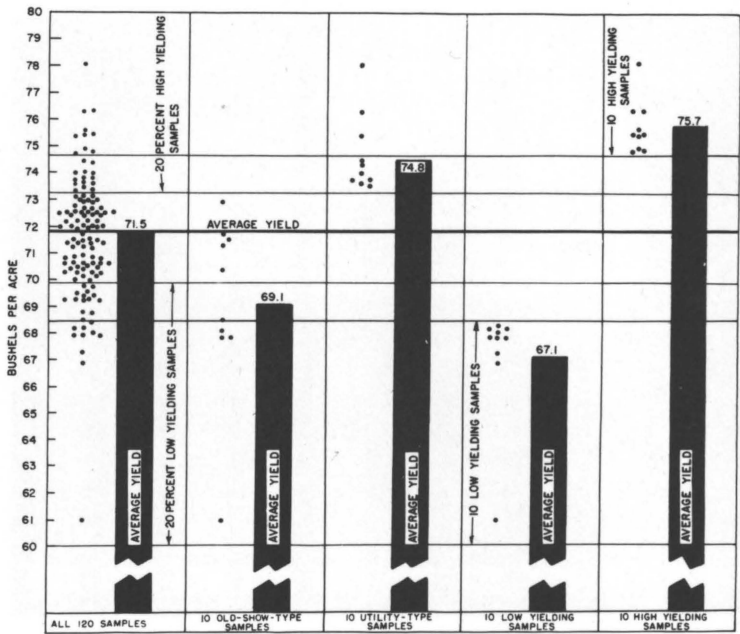


Fig. 10.3. Ten old show-type and 10 utility-type samples compared with all 120, and the 10 high-yielding and the 10 low-yielding samples in the Woodford County Corn Yield Test.

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