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Building New Corn Hybrids

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IOWA FARMERS no longer look upon hybrid corn as a new fangled idea that may or may not prove practical. Ten years ago less than 1 acre out of every hundred grown in Iowa was hybrid; in 1941, probably at least 95 acres out of every hundred are hybrid.

But even though Iowa farmers have accepted hybrids as distinctly superior to the open-pollinated strains they formerly grew, they know that hybrids aren't perfect. They would like to see them improved in various ways.

And so we are often asked by farmers: "Why can't we have hybrids with higher yields, stronger stalks, earlier maturity, better shanks that won't drop their ears, more eye appeal and improvements in other ways?"

And farmers want these improved hybrids right away—this year or certainly next.

But do you know how long it takes to develop a new hybrid? Well, we have found that if the "weather man" cooperates, a new hybrid can be ready for release about 10 or 12 years after the first inbreeding is started.

Why does it take so long to develop satisfactory corn hybrids? If you will follow along in the steps of development, you may get a better idea of the problems involved and why it takes so long.

Corn hybrids are produced from good inbred lines. These lines are produced by inbreeding or self-pollination and selection. The corn used to build these new lines is the best varieties or hybrids adapted to any certain area.

When the Iowa Station and the United States Department of Agriculture began its corn breeding program at Ames in 1922, 500 open-pollinated ears representing 16 different varieties or strains were used as source material. Since that time other varieties and numerous hybrids also have been used to start new inbred lines.

The first inbreeding or self-pollination is done on a large scale, often representing 1,000 or more plants which appeared desirable at the time of pollination. These are again carefully culled.
Approximately 75,000 hand pollinations are made each year in the corn breeding program at Ames. This is the first work in producing hybrids.

at harvest time since many will then exhibit faults which were not apparent earlier in the season.

The ears which are considered satisfactory for further inbreeding are planted in ear to row progenies the following year. Many rows will be discarded entirely because of undesirable seedling or mature plant characteristics.

Further selfings are confined to the best plants in the best progeny rows. This process of selfing and selection is continued for 3 or 4 years. The individual plants within a line have then become highly similar, but the difference between lines is often quite striking.

The next step is to test these lines in hybrid combinations. Top crosses (inbred x variety) are usually used for this first evaluation. Often half or more of the new lines will be eliminated on the basis of this first test because of some major weakness.

Following the top-cross test the remaining lines are combined into single crosses, and again comparisons must be made for yielding ability, disease resistance and other characteristics. A further elimination of lines follows the single-cross tests, and only the best lines are made up into double crosses for the final testing.

Some idea of how difficult it is to locate a good double cross may be had from the following comparison. Twenty inbred lines may be combined to produce 190 different single crosses. These 190 single crosses can be combined to produce 14,535 different double crosses, only a few of which will be good enough to be recommended for commercial planting.

The problem becomes even more complicated when one considers that a large breeding program has not 20 but 100 or more lines for testing. Fortunately, methods have been devised for predicting double-cross performance on the basis of single-cross performance so that only a small percentage of the total number of double crosses need be made and tested.

The 10 to 12 years required to develop a good hybrid might, then, be roughly apportioned as follows: 3 to 4 years inbreeding and selection, 1 year top-cross testing, 1 year to produce single-crossed seed, 2 years of single-cross testing, 1 year to produce double-cross seed and 2 or more years of double-cross testing.

At present we are trying out a new method which provides for the testing of new material as soon as inbreeding is begun. As far as our work has gone the method appears to be quite satisfactory and offers promise of a gain in the efficiency of developing new lines and possibly some saving in time. More studies will be necessary, however, be-

<table>
<thead>
<tr>
<th>Periods compared</th>
<th>No. of progeny rows</th>
<th>No. of pollinations</th>
<th>No. of yield test plots</th>
</tr>
</thead>
<tbody>
<tr>
<td>1922-1926</td>
<td>9,018</td>
<td>64,200</td>
<td>3,500</td>
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<td>1927-1931</td>
<td>19,766</td>
<td>151,786</td>
<td>19,278</td>
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<td>1932-1937</td>
<td>10,927</td>
<td>140,000</td>
<td>26,659</td>
</tr>
<tr>
<td>1938-1940</td>
<td></td>
<td></td>
<td>30,705</td>
</tr>
</tbody>
</table>
fore it can be recommended as a general breeding procedure.

When hybrid corn was first introduced it was necessary only that hybrids be superior to the adapted open-pollinated varieties. New hybrids to gain commercial acceptance now must be superior to the best hybrids already available in yielding ability or some one or more of the other important characteristics.

Thus each new advance in corn hybrids is more costly in time and labor than for the period preceding. This can best be illustrated by comparing the number of progeny rows we have grown, the number of pollinations made and the number of yield test plots planted for various periods during the past 18 years. This is shown in the accompanying table.

Prior to 1939 all testing of hybrids, whether top crosses, single or double crosses, was done at Ames. This was an unsatisfactory procedure, and in 1939, eight new outlying test fields were located. This number was increased to 11 in 1940.

On the basis of data obtained during the past 2 years, this expansion in the testing program appears to be very much worthwhile. We have found that performance of hybrids at Ames is a very poor guide as to their possible behavior in such areas as northern and western Iowa. The new test fields make it possible for all testing of new material to be done in that area of the state where the hybrids may eventually be used commercially.

State Corn Yield Test Results

Results of the 1941 Iowa Corn Yield Test will be released at Iowa State College during Farm and Home Week in early February. At that time a bulletin will be issued showing the results of all entries.

This Iowa Hybrid 13 is being grown on one of the Iowa State College fields for silage. It's good ensilage corn - grows tall and tillers vigorously.

“New” Soybean a Discard

Farmers in many sections of Iowa this year are being offered a supposedly “new wonder soybean” under such variety names as McClave, New London, Prolific, Bell, Ohio Champion, Illinois Champion and New Bush Soybean.

The advice of H. D. Hughes head of the Farm Crops Subsection of the Iowa Station, is “Don’t bite.” The “new” soybean isn’t new at all, but an old inferior, discarded variety.

This variety is so much like the one called Midwest which was grown in Iowa over 20 years ago that the crops specialists cannot tell them apart. The Midwest was tested by the Iowa Station from 1916 to 1922 and was then discarded because it was inferior in yield to other varieties being grown at that time.