Comparison of Three Types of Testers for the Evaluation of Inbred Lines of Corn

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The practical phase of corn breeding is based upon the development of inbred lines and the evaluation of these lines in hybrid combinations. Performance of inbred lines *per se* does not provide an entirely adequate measure of their value in hybrid combinations. Therefore, the development of simple and adequate methods of testing new lines has been a major problem in the development of new hybrids.

In the period from 1920 to 1930, the customary procedure was to make and test the $n(n-1)/2$ combinations which are possible among a set of $n$ lines. As the number of lines increases, the amount of material to be grown and compared in yield trials soon becomes prohibitive. This difficulty led to the introduction and general adoption of the top cross test for the preliminary evaluation of new lines. Since the adoption of the top cross test, a number of studies dealing with choice of testers have been reported. These have served to clarify the general problem of choice of testers but have not provided satisfactory answers to all of the problems.

A desirable tester may be defined as one that combines the greatest simplicity in use with the maximum information on the performance to be expected from the tested lines when used in other combinations or grown in other environments. No single tester can completely fulfill these requirements. The choice of a tester is determined to a considerable extent upon the expected use for a particular group of lines. If these are destined as replacements for lines in existing hybrid combinations, the tester chosen will certainly differ from that selected if the lines are to be screened for average performance and the survivors tested subsequently in new combinations. The literature on the choice of tester parents has been reviewed by Green (1), Keller (2), and others and no detailed review will be presented.

**MATERIALS AND METHODS**

Sixteen lines currently used in the commercial production of hybrid corn were used in this study. These 16 lines were considered as a random sample of lines of proven merit. They were divided into two groups at random; one being designated as testers and the other, lines to be tested. Two double crosses were available involving the testers. These were Iowa 4419 $[(L289 \times Os420) \times (B24 \times Oh28)]$ and Iowa 4300 $[(L317 \times Hy) \times (187-2 \times W32)]$. The four component singles, and therefore, constituted the testers used. The lines to be tested were M14, B25, B6, B7, B23, W22, N6, and Oh40B.

All of the test cross seed used in these experiments were produced by hand pollination in 1949. Crosses were made reciprocally and the seed bulked at time of harvest. The yield was grown once per replication, single cross testers twice, and double cross testers four times per replication. This was done to assure equal accuracy in comparing the means for the three types of testers.

Planting was in 2 x 10 hill plots with 5 kernels dropped per hill and the stand was later thinned to 3 plants per plot. Ear height and number of plants per plot were recorded during the growing season, and root and stalk lodging and number of dropped ears were recorded at harvest.

The experiment was planted as a 14 x 14 triple lattice, but one replication was discarded at harvest time because of stand variation. Some stand variation remained after discarding and a covariance analysis of harvest weights was used, as suggested by Cox, Eckhardt, and Cochran (3).

The data were analyzed by obtaining estimates of variance components for the different attributes involved, with emphasis on determining how each type of tester evaluated the 16 lines.

**EXPERIMENTAL RESULTS**

The means and ranges of the several attributes studied for the three types of testers are presented.