Diallel Crosses of Maize in Experiments Repeated Over
Locations and Years

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Knowledge of variances of general and specific combining ability and of their interactions with different environments is useful in formulating corn breeding procedures. Variances accounted for by general and specific combining ability were compared in different materials by Sprague and Tatum (19). In highly selected material the variance of specific combining ability was larger than the variance of general combining ability, while in unselected material the variance of general combining ability was the larger. General combining ability was assumed to be primarily a measure of additive gene action and specific combining ability of deviations from additivity.

Rojas and Sprague (18) obtained estimates of the variances of general and specific combining ability for yield and of their interactions with years and locations in experiments conducted at several locations for a 3-year period. Components of variance involving specific effects were consistently larger than corresponding ones involving general effects. The fact that inbreds entering into the single crosses were selected would tend to reduce the level of variance of general combining ability to that of specific combining ability and probably also reduce the variance of their interactions with years and locations. Variances of interactions of both general and specific effects with years were larger than with locations, as might be expected.

Since Rojas and Sprague used selected material, it seemed advisable then to use all possible crosses among lines that had undergone no previous selection and that traced to a common random mating population. The purpose of this study was to compare variances of general and specific combining ability and of their interactions with years and locations in unselected material.

Experimental Procedure

The source of material used in this study was a 16-line synthetic variety designated Low Ear. The 16 lines combined into the synthetic in 1932 in the greenhouse at Arlington, Virginia, were chosen because they had low ear placement on the stalk. Only one of the lines, WF9, remains in extensive commercial production today.

After the original crosses, the synthetic was grown under isolation in Iowa for six generations and allowed to pollinate at random. In 1949 a bulk population of the synthetic was grown at Ames, Iowa, and random plants were selfed. In 1950, 211 of the S, lines were grown in progeny rows at Ankeny, Iowa, for evaluation of their corn borer resistance. Ten of the lines showing good resistance to borer leaf feeding were chosen for parents in a diallel series. Plant vigor, maturity, and yield were not considered in making the selections. It is felt that these lines represent a sample of S, lines unselected for yield.

In 1951 the 10 S, lines were grown from remnant rows in the breeding nursery and the 45 possible crosses were made. Approximately 20 ears were pollinated in each pair of rows to reduce any bias from inadequate sampling and to pollinate seed for the subsequent yield tests. Seeds from the crosses of each pair of rows, including reciprocals, were bulked in F, family.

In 1952 (Y1), 1953 (Y2), and 1954 (Y3) yield crosses were conducted in the north central section of Iowa. Storm Lake (L1), Clarion (L2), and Independence (L3) was grown in 2 by 5 hill plots with 3 replicates per plot. The total corn was obtained at harvest for each plot and hill plots by standard correction factors developed in the Corn Breeding Program. Data from the experiment at location 3 could not be utilized because of unequal replicates.

Analysis of Data

The procedure for analysis of a diallel experiments variances of general and specific combining ability, for all crosses among a group of lines without restriction as given by Rojas and Sprague (18). Following the analysis of the eight experiments was analyzed separately. The analysis of variance and the mean square expected values are given in table 1.

A combined analysis of all experiments is not possible because of the not uncommon occurrence of a missing location 3 in 1954. Instead of making separate analyses of the data, as is usually done, an ad hoc method was developed for a single combined analysis. This method is similar to that presented by Ditchburne (6).

The distribution of experiments was as follows:

<table>
<thead>
<tr>
<th>Y1</th>
<th>Y2</th>
<th>Y3</th>
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<tbody>
<tr>
<td>1</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>2</td>
<td>+</td>
<td>+</td>
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<tr>
<td>3</td>
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