CONFLICTING conclusions have been drawn by corn breeding investigators concerning the practicability of testing lines of corn for combining ability in early stages of the inbreeding process. Jenkins (1) has presented data suggesting that inbred lines acquire their individuality as parents of top crosses very early in the inbreeding process and remain relatively stable for combining ability thereafter. From a comparison of yields of test crosses of $S_0$ plants and their $S_1$ progenies, Sprague (5) concluded that the early testing procedure appears to be of value where yield is an important consideration, where other important factors can be evaluated efficiently by means of a suitable tester, and where the gene frequency conditioning desired characteristics other than yield is relatively high.

Singleton and Nelson (4) reported a study in which each of four successive generations of 10 lines of an open pollinated sweet corn variety were test-crossed with an established sweet corn inbred and grown in yield trials in 1940 and 1941. They were unable to determine the ultimate combining ability of a line earlier than the third generation of selfing. It was concluded that yields of early generation crosses do not provide a satisfactory or an efficient means of selecting for ultimate combining ability.

Richey (2) presented a critical re-analysis of the data provided in Jenkins' (1) paper. He concluded that segregation for yield was occurring during the successive generations of inbreeding, indicating that the lines did not remain stable in combining ability, and that the early testing procedure would have been ineffective in this material. Richey (3) also provided another interpretation of Sprague's (5) study and concluded that the data indicate a probable expenditure of considerable effort for a very small gain from early testing. In a regression analysis of data from Brunson, Richey (3) demonstrates that of 35 families tested in the $S_0$ and $S_2$ generations, only the five very low combiners were adequately indicated as such. He concludes that the early test would have been misleading as to the potentiality of the parents among the 30 higher yielding families.

The present paper is a report of a study of the combining ability of inbred lines, representing selected inbred lines of the $F_2$ and $F_3$ generations of a cross of selected inbred lines, in crosses with each of the inbred parents of a Minnesota double-crop hybrid, 608. The results obtained furnish further evidence of the problem of early testing and provide a means of isolating potential sources of superior germ plasm for the improvement of Minhybrid 608.

Experimental Methods

Thirty selfed ears from early maturing $F_2$ plants of A116 and L317 were selected for combining ability. An attempt was made to select the most desirable lines for the desired characters except that no plant was selected if noticeably injured by disease. Seed from the 30 selfed ears were used as tester parents. The inbreds A392 and A392 were selected as desirable testers because of their diversity of origin from A116 and L317, and to provide a number of possible sources of improvement for the inbred parents of Minhybrid 608. Sufficient seed of each of these four inbreds were obtained to provide an adequate number of plants to be used as inbred parents.

In order to obtain a random sample of the gametic combinations of an $F_2$ plant, pollen from approximately 30 plants of each inbred line was bulked and placed on five ears of each of the four inbreds. The sampling of the $F_3$ population was accomplished by placing pollen from each of five plants taken at random in each of the four inbreds. Because of hot, dry weather, seed was obtained for all desired crosses. Seed of each of the six possibilities between the four tester inbred lines was obtained by growing check plots in the yield trial. Sufficient crossed seed was obtained for yield trials from the $F_2$ and three $F_3$ plants of each of the original 30 families.

A yield trial to compare the performance of the $F_2$ and three individual plants of the $F_3$ generation was grown when crossed with the four inbred tester lines were grown in six replications, two at each of the three locations. Data from two replications at one location were considered unreliable because of poor stand and were not utilized. Plants were planted in 12-hill plots in a split-plot design, with $F_2$ and $F_3$ plants with one tester were grown together in each replication, making four blocks per replicate. Single-crosses between the four inbred testers and double-cross, Minhybrid 608, were grown in each replication. The $F_2$ and three $F_3$'s of each family tester inbred were grown in sub-blocks within a block. "Family" as used here refers to an $F_2$ plant together with its $F_3$ progeny. "Lines within families" designate the five very low combiners as indicated by Richey (3) and the five very high yielding lines selected by Jenkins (1) for yield potential in order to isolate the effects of large differences in combining ability.