Inheritance of Combining Ability in Maize Hybrids

JOHN M. GREEN

PRESENT-DAY corn breeding has as its objective the development of inbred lines that will produce desirable hybrids when combined with other available inbred lines. Open-pollinated varieties have been the most widely used sources of inbred lines in the past, but more recently new lines have been extracted from hybrid progenies of previously existing lines. The value of superior hybrids as source material for the development of new inbred lines has been shown by the data of Johnson and Hayes (5). From the results of a study of 70 inbreds selected from six single crosses involving lines varying in combining ability, they (2) concluded that combining ability was an inherited character. From a study of 51 inbreds Cowan (1) reached the same conclusion. The present report is concerned with the results of a study of the inheritance of combining ability in the progenies of three single crosses which represented combinations of high×high, high×low, and low×low combining inbred parents.

MATERIALS AND METHODS

Four inbred lines were used in the three single crosses included in this study. In a comparison of all possible single crosses among 13 inbred lines the average yields of the single crosses involving these four lines were: I198, 91.8; M14, 90.2; KB397, 85.5; and Ill. 4226, 80.3 as compared with 85.7 bushels per acre for all 78 single crosses. The single crosses used were I198×M14 (high×high), I198×KB397 (high×low), and KB397×Ill. 4226 (low×low).

Approximately 150 plants within the F2 progenies from each of these three hybrids were selfed and top crossed on two tester strains. Cross pollinations were made on five plants of U. S. 35, a standard double cross, and on 10 plants of Black Yellow Dent, an open-pollinated variety. The F2 plants were selected for freedom from visible abnormalities at the time of selfing, and they later were selected for lodging resistance at harvest time. The samples of F2 plants were unselected for combining ability except as combining ability may have been associated with the selection that was practiced.

The top crosses of 249 F2 plants, 83 from each of the three single crosses on each of the two testers were grown in an 8×8×8 cubic lattice in 1945 and 1946. The two testers, the three single crosses, and the top crosses of the three single crosses on the two testers were included in the test. The yield data were analyzed according to the procedure given by Homeyer, Clem, and Federer (3). The gain in efficiency over randomized complete blocks was 33 and 184% in 1945 and 1946, respectively. Yield in bushels per acre was computed from the field weight of ear corn adjusted for stand differences in 1945 by means of a covariance analysis, ad-