THE development of satisfactory corn hybrids has been achieved through successful extraction of suitable inbred lines from heterozygous populations and the exceptional vigor shown by certain \( F_1 \) crosses among them. The first hybrids were produced from inbred lines derived directly from adapted open-pollinated varieties. In recent years, there has been a trend toward the extraction of new lines from hybrid combinations of previously isolated lines. These “second, third, etc. cycle” lines have been somewhat more vigorous, and although some have resulted in increased superiority of the resulting hybrids as demonstrated in the Cooperative Uniform Single Cross comparisons of the North Central Corn Conference, it is of interest to note that relatively few have contributed appreciably higher yield in crosses than have the better lines extracted originally from open-pollinated varieties. This suggests the existence of a ceiling, as it were, for combining ability insofar as current methods of line improvement are concerned. It is possible that the frequency of favorable genes in the populations sampled is too low to permit the extraction of exceptionally high combining lines with the sample sizes commonly used. If this be true, increasing sample size may afford a solution to the problem, although perhaps not the most efficient solution.

The preliminary results of a second and seemingly more efficient approach are reported in this paper. The study was designed to determine whether the frequency of favorable growth factors in a heterozygous population might be increased through a process of recurrent selection prior to the extraction of inbred lines, thereby increasing the chances of isolating genotypes of superior combining value. Although further study is needed before the method can be adequately evaluated, the data thus far obtained are suggestive of the potential value of the method and seem worthy of presentation at this time.

Review of Literature

Methods of breeding improved lines of corn have been presented in detail by numerous workers including Hayes and Immer (9), Hayes and Johnson (4), and Richey (10), and will not be discussed here. These methods are, in general, somewhat static in that they involve primarily straight selfing within varieties and advanced-generation hybrids, and none as proposed by Jenkin (6) for grass improvement seems largely as a means of increasing the gene frequency for specific combining ability in corn. The plan is to self-pollicate stock for a repetition of the same breeding cycle. Several such cycles a composite of the intercrossed seed of selfed selected lines is to be used as a parent with the inbred line tester in the production of seed for commercial use. This proposed breeding procedure is to adjust genotypes to a mixed population relative to the inbred line tester. Hull (5) has suggested a technique for reciprocal recurrent selection as a means of increasing the gene frequency for specific combining ability in corn. The plan is to self-pollicate plants in a heterozygous population and outcross them to an inbred line as a tester. On the next test cross, the most promising selfed lines (Sj) are to-row and intercrossed. The resulting seed is then used as foundation stock for a repetition of the same breeding cycle. Several such cycles a composite of the intercrossed seed of selfed selected lines is to be used as a parent with the inbred line tester in the production of seed for commercial use. These plans await substantiation in actual practice, and are both of considerable theoretical interest and having merit in breeding procedure.

Sprague and Brimhall (11) have presented the results of several cycles of recurrent selection for oil content in corn. Their data provide a measure of this procedure as a breeding method.

Experimental Procedure

A High-yield and a Low-yield synthetic were made from \( S_0 \) lines from Krug yellow dent, an open-pollinated variety described by Lonnquist (8). These lines had been selected on the basis of performance in topcrosses with the parental variety, Krug. Following two generations of random mating, 152 \( S_1 \) populations were sampled for inbreeding. The \( S_2 \) plants were selfed and simultaneously outcrossed to \( Wf_9 X M_{14} \) as a tester. The topcrosses of 152 \( S_1 \) plants of the High-yield synthetic, together with comparable topcrosses of four of the original eight \( S_1 \) Krug lines used as foundation material, which were available, were compared in a triplicate experiment grown in 1948. Data were obtained for yield of grain, root lodging, and dropped ears. Topcrosses involving 77 \( S_1 \) plants from the Low-yield synthetic were also discussed by Lonnquist (8).

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