Recurrent Selection as a Method for Concentrating Genes for Resistance to Helminthosporium turcicum Leaf Blight in Corn


The selection of desirable genotypes from populations segregating for characters controlled by several genes, indiscrinate in their expression, presents many difficulties. The desirable genotypes may be difficult to identify accurately. They also may occur in such low frequencies that the number of individuals required to provide a reasonable chance of including them may be almost prohibitive. For example, if a character is controlled by 10 pairs of genes, an F2 population segregating for all genes would require 1,048,576 individuals to provide opportunity of including one individual of each genotype. Backcrossing the F1 plants to one of the parents will reduce the number of genotypes expected in the following generation. If the recurrent parent contributes a majority of undesirable alleles, however, the frequency of desirable genotypes will be reduced and selection problems increased.

Review of Literature

East and Jones (2) and Hayes and Garber (5) were among the first to suggest intercrossing selected individuals as a method of concentrating genes for a desirable character. Jenkins (7) described a method for developing synthetic varieties by intercrossing S1 lines selected on the basis of their performance in topcrosses.

Hull (6) outlined a plan of recurrent selection for specific combining ability based on evidence that overdominance is the chief cause of heterosis. The plan is designed to develop maximum heterozygosity in hybrids between the selected parental strains.

Experiments designed to critically evaluate the efficiency of recurrent selection in developing strains with a high percentage of oil in the corn kernel and to determine the effectiveness of this breeding method in modifying combining ability were conducted by Sprague and Brimhall (13). Recurrent selection was at least 2.6 times more efficient than selection during inbreeding in developing high oil strains. One cycle of selection for combining ability resulted in a positive shift of 7 bushels per acre in mean yield when related to that of the tester parent.

Lonnquist (11) obtained highly significant differences between the yields of high-yield and low-yield synthetics developed from the Krug variety after one cycle of selection. Plants from these two synthetics were tested in crosses on the single cross WF9 × M14 (12). Frequency distributions of yields for the two populations of test crosses differed greatly, those for the high-yield synthetic having the higher mean and mode.

A breeding procedure designated as reciprocal recurrent selection was proposed by Comstock, et al. (1). The proposed scheme is designed to make maximum use of both general and specific combining ability regardless of the type of gene action involved.

Frey, et al. (4) reported results obtained in the first cycle of selection in each of two populations of intercrosses among F3 progenies of the cross Hy × I198. One set of F3 progenies had been selected on the basis of the ratio of zein to total protein and the second set had been selected for tryptophane content of the grain. No improvement was realized in the population selected for zein-