THE USE OF MALE-STERILE IN BARLEY IMPROVEMENT

BARLEY breeders in America are very familiar with the composite hybrid mixtures sponsored by Harlan and Martini. These mixtures are designed to provide genetic recombinations between desirable parent stocks with diverse ecological origins, and to foster the economical and selective advancement of the individual hybrids therefrom during segregation and genetic stabilization. It is now suggested that unrivaled possibilities for continuing recombinations, coincident with plant competition favoring the most vigorous plants, are afforded through use of a simple recessive male-sterile character. The male-sterile plants fail completely to set seed unless fertilized by foreign pollen. In heterozygous populations from 30 to 80% of their florets are cross-fertilized under California conditions.

Jones's theory for the explanation of heterosis, as expanded by Powers, postulates that a large number of dominant or partially dominant genes contribute toward its expression, either because of the direct role of favorable dominants or through multiplicative effects of mediocre or even unfavorable genes. The work of Immer indicates that the greater the manifestation of heterosis in a barley cross the greater the proportion of high-yielding isolates which can be recovered in later generations. In the California work with barley, maximum F1 yields have been obtained from crosses involving two adapted varieties, although the largest percentage increases in yield above the means of two parents resulted from crossing two varieties from different ecological habitats. To obtain maximum heterosis, large gene as well as plant populations with a facility for continuous recombination under competitive conditions seems very desirable.

For the practical utilization of the male-sterile character, two hybrid populations have been developed at Davis, Calif. One, designated as Composite Cross XIV (C. I. 7132), was produced by crossing each of the eight leading barley varieties in California on male-sterile, C. I. No. 3568-1, and compositing the F1 seed. Male-sterile itself can be considered as a California adapted variety. The second, designated as Composite Cross XV (C. I. 7133), was derived by bulking F1 plants from 625 randomly chosen pollen parents, all crossed on male-sterile. The pollen parents were drawn from the F2 and F3 generations of three Composite Cross populations (C. I. 6619, 6620, and 6725) which were derived from 33 varieties variously combined. Thus, the one population embodies great genetic and ecologic diversity, while the other stems from parents with a common adapt-