SUCCESS in plant breeding often hinges upon the choice of suitable breeding tools and techniques. These include recognition of favorable or unfavorable associations between characters, one or more of which can be readily followed through breeding progenies. An association conducive to increased yield has been observed following the transfer of segments of chromosome V from Lion to Atlas barley by backcrossing. This discovery is of added interest because of the universal success that breeders in North America have had in obtaining high-yielding, smooth-awned progenies from crosses with the Lion variety.

MATERIALS AND METHODS

We are here reporting on only one of the many backcrossing programs fostered by the California cereal-breeding group. In 1929, G. A. Wiebe initiated a simple program designed to produce a long-haired rachilla marker on the Atlas variety. Lion, C.I. 923, was used as the donor parent. The senior author obtained this material after the fourth backcross and subsequently completed the backcrossing program with some modification in total objective, which gave rise to the material discussed here.

Although selection was directed only toward maintaining the long-haired rachilla marker, a persistence of awn types was noted. At the termination of the backcrossing, a limited number of lines having semismooth-awned rachillas were found. The genes conditioning awn barbing (Rr) and rachilla hair length (Ss) have been placed in linkage group V, with recombination values ranging from 28.1 to 42.7% (4). Robertson, et al. (5) found that partial smoothness resulted from the presence of a second gene which was hypostatic to and independent of (Rr). Lion possessed the recessive allele at each locus. Thus the linkage entered the present cross in the repulsion phase, independently inherited, hypostatic allele (Riri) producing partial barbing was contributed by the recurrent parent Atlas. Persistence of the (rS) repulsion-phase linkage and the independently inherited, hypostatic allele (Riri) producing semismooth awns was therefore a natural consequence from this choice of parents. A recombination value of 30.0% was found for the two linked genes, which was in agreement with reported values.

In 1943, two test stocks were constituted from the Lion X Atlas F3 population. California #1306 was a composite of 57 lines homozygous for (rrSS), while California #1309 combined 25 lines of the genotype (RRSS). These composites represent essentially a derived long-haired Atlas having semismooth and rough awns, respectively. The former probably represents a transfer of the (rS) segment intact, while the latter represents a recombinant of the two loci.

In order to obtain the fourth combination of the two allels involved, i.e., the double recessive (rrss), an additional backcross was made to Atlas (RRss) using California #1306 as the parent. From this cross, four F3 cross-over lines having the constitution (rrss) were bulked to give California #1362. Consequently, after 1947, the four combinations of the two alleles (RrSs) in a common genetic background were available for testing.

Preliminary yield data were obtained from paired plots of Atlas and California #1306 and Atlas and California #1362 grown from 1943 to 1945 and from 1948 to 1950, respectively.

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3 C.I. refers to the accession number of the Division of Cereal Crops and Diseases.