THE ISOLATION OF ISOGENIC LINES AS A MEANS OF MEASURING THE EFFECTS OF AWNS AND OTHER CHARACTERS IN SMALL GRAINS

Some years ago in connection with experiments on the effect of awns upon the yield of wheat, a procedure was adopted for developing awned and awnless lines which are identical, or nearly so, for all genes except those involved in the expression of awns. This procedure, though genetically quite simple, has attracted the interest of a number of agronomists, several of whom have urged that it be called to the attention of others confronted with the same or similar problems.

The procedure involves the hybridization of an awned wheat (Kanred) with an awnless wheat (Clarkan). In this cross the expression of awns is governed by a single pair of factors. The awnless condition is partially dominant. In the F1 all plants are awnless except for the so-called “tip-awns”. In F2 three types of plants, awnless (AA), tip-awned (Aa), and awned (aa), appear in a ratio of 1:2:1. In this, and in succeeding generations until the final selections are made, the two homozygous types are discarded and the bulk stock is perpetuated from the heterozygous tip-awned plants.

Since wheat is a self-fertilized plant and since heterozygosity is reduced by approximately half with each generation of inbreeding, it is assumed that the population after 8 to 10 generations will comprise a number of different lines, each one almost completely homozygous for all genes except the pair involved with awns. By selecting in each generation plants heterozygous for awns, homozygosity in all genes except those governing awns will eventually be attained.

When this point is reached, awned and awnless segregates are to be isolated from a number of different lines. This can be done by growing plant rows from tip-awned and then bulking plants of the two types separately, i.e., homozygous awned and homozygous awnless, for increase and testing in yield trials. The awned and awnless segregates from the same line should be isogenic (identical in all genes) except for the genes involved in awns, and a few additional genes so closely linked that they are not released through crossing-over.

By comparing the awned and awnless members of a number of pairs of isogenic lines, it should be possible not only to measure the general effect of awns, but also to determine whether the effect varies with the genetic background. There are in this particular cross, for example, hard and soft wheat segregates, weak-strawed and stiff-strawed segregates, etc. In each of these categories isogenic awned

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