The Influence of Awns on Yield and Certain Morphological Characters of Wheat

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The influence of awns on the yield of wheat is of practical as well as theoretical interest. If the superiority of either awned or awnless types could be proved without question for a given locality, this information would be of value to the plant breeder for he could then select only the superior type for further testing.

The purpose of this study was to determine the influence of awns on yield of wheat by comparing specially developed awned and awnless lines of wheat in yield tests at Denton, Tex. Four associated factors, number of culms per unit area, size of kernels, test weight, and number of kernels per head were studied to determine their relationships to any differences observed.

REVIEW OF LITERATURE

Numerous comparisons have been made between awned and awnless varieties or groups of varieties. Early comparisons were made simply by comparing pure varieties of the two types, later pedigree lines were compared (1); and more recently several studies have been made using bulk or specially selected groups of bulk composites from crosses. Bayles and Suneson (3) compared awned and awnless bulk composites from crosses for 3 years at several locations in western United States. The two groups did not yield significantly different but the grain from the awned segregates was superior in both kernel weight and test weight. Finkner and Heyne (3) compared sister awned and awnless selections from F3 segregating lines of several crosses and from similar related lines of different backcross populations. Under Kansas conditions, the awned segregates were superior to the awnless group in yield, test weight, and kernel weight.

MATERIALS AND METHODS

Isogenic lines of awned and awnless wheats were developed for this study by a procedure suggested by Atkins and Mangelsdorf (2). This procedure involved crossing an awned variety (Kanred) with an awnless variety (Clarkan). The expression of awns in this cross is controlled by a single gene, and heterozygous plants are recognized by the presence of short awns or tip-awns. Since wheat is self-fertilized, homozygosity for all genes increases in each successive generation following the cross. In this experiment, the gene controlling the expression of awns was kept heterozygous by selection of a large group of tip-awned heads each season.

After 10 generations seed from 10 tip-awned spikes were space-planted, and true breeding awned and awnless lines were selected and increased. These awned and awnless lines from the same tip-awned spike were identical phenotypically except for the awned character. Pairs of lines differed from each other in height, leaf width, leaf color, grain size, and shape. Two pairs that differed in height are shown in figure 1.

Since the awned and awnless members of each pair were so similar after 10 generations of inbreeding, it was assumed that they might be compared for yield and other characters with the assumption that any differences observed might be due to the presence or absence of awns or to genes closely linked with those controlling the awn expression. In all yield tests the awned and awnless lines of each pair were kept together as a unit, and are referred to as a strain. The 10 isogenic pairs of lines were grown in a 10 x 10 Latin square planting design with the awned and awnless member of each pair grown side by side in all instances. The strains were randomized in rows and columns with the usual restrictions of the design. The experiment was conducted at Denton, Tex., from 1947 to 1952, but no data were obtained in 1949 or 1951 because of fall and winter droughts. Plots consisted of the usual 4-row nursery plots from which 16 square feet were harvested to determine yield and other measurements.

Data were obtained on yield, stand, weight of kernel, number of kernels per head, and test weight. The stand was determined by counting the number of mature culms per plot. Size of head was determined by threshing individually and counting the number of kernels per spike from 30 heads from each plot. Yield was determined in the usual manner, after which two 1,000-kernel samples were weighed from each plot. By necessity, test weights were taken only on bulked lots from each strain. Segregates from this cross were susceptible to leaf and stem rusts, and all plantings were dusted with sulfur throughout the season to prevent damage from these diseases.

Weather Conditions

Since awned varieties often are superior under stress conditions, a brief report of the weather during the period of the experiment is presented. The 1947 crop encountered favorable precipitation and temperatures during the fall of 1946, but was under stress in the spring because winter and spring rainfall were deficient and poorly distributed. The 1948 crop gave the highest yields for the period despite below normal rainfall. There was sufficient rainfall to establish the crop, followed by much

Fig. 1.—Two pairs of isogenic awned and awnless lines of wheat from the cross Kanred X Clarkan. Note difference in height by pairs.

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