Effect of a Single Height (Dw) Gene of Sorghum on Grain Yield, Grain Yield Components, and Test Weight

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IN THE United States, plant height is important in sorghum (Sorghum vulgare Pers.) grain production. Since nearly all sorghum for grain production is combine harvested, the 3-dwarf or 4-dwarf varieties are considered desirable, both from the standpoint of ease of harvesting and resistance to lodging. Acceptance of the 3-dwarf and 4-dwarf varieties has been with the assumption that reduction in height has not affected grain yield.

This paper reports a study of the effect of one height gene on the yield components, number of heads per plant, weight of kernels, and number of kernels per head. The effect of the height gene on test weight is also included.

REVIEW OF LITERATURE

Height in sorghum, as influenced by internode length, has been studied by several investigators. Sieglinger (8) reported two genes for dwarfness in broomcorn. Karper (4) reported two genes for dwarfness in milo. Laubscher (5) studied F2 populations of sorghum segregating for height and concluded that inheritance of height was complex. Quinby and Karper (6) made the most comprehensive study of the inheritance of height in sorghum. They concluded that four independently inherited genes plus a modifying complex influenced height, with the alleles for tallness being partially dominant. They concluded that the recessive alleles of the 4 genes had essentially the same effect in reducing height, and that 5 heights occurred in sorghum, depending on the dominant or recessive state of the four genes. The genes were designated Dw1, Dw2, Dw3, and Dw4. Karper and Quinby (7) suggested the use of 1-dwarf, 2-dwarf, 3-dwarf, and 4-dwarf to designate, respectively, the genotypes that were recessive for 1 gene, 2 genes, 3 genes, and 4 genes. Hadley's (1) results, from a study considering height in sorghum as a quantitative rather than a qualitative character, closely agreed with those of Karper and Quinby (6). He considered the genes to have unequal effects.

Sieglinger (8) stated that the two recessive genes he studied had no effect on reproduction or grain. Although he did not elaborate, Kanter (3) stated that 'Dwarf milo' and 'Standard milo' differ only, and that a tall reversion of 'Blackhull kafir' was identical to normal Blackhull kafir except for internode elongation. Quinby and Karper (6) stated that the Dw genes had no effect on leaf size and did not influence plant growth except for internode elongation. Hadley concluded that the dominant or recessive state of a single height (Dw) gene influenced yield and did not affect days to anthesis. They assumed that the gene studied was Dw4, but gave no evidence to verify the assumption. The validity of their conclusions was based on the assumption that they used isogenic lines differing only in the dominant or recessive allele of Dw.

Karper (4) studied an unstable height gene in Blackhull kafir. He considered the change from normal height to tallness a reversion (reverse mutation) to the wild type. All the tall reversions he studied proved to be heterozygous for the gene pair. Since dw1, dw2, and dw3 are stable in most sorghum varieties, dw4 is an unstable gene; however, the variety 'Early Hegari' has an unstable dwarfing gene, but is not recessive. Hadley (2) reported that each of the nine tall reversions he studied was heterozygous for a single Dw allele, but did not determine which gene was involved. The tall reversions did not have a difference in the phenotypic effect of the Dw alleles.

MATERIALS AND METHODS

The varieties 'Martin,' 'Plainsman,' and 'Redlan' were selected for this study. The height genotype of these varieties was known to be dw1, Dw2, dw3, dw4, and tall reversions were known to occur frequently. The source of each variety was Kansas certified seed.

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