Comparisons of Planting Arrangements and Estimates of Optimum Hill Plot Size for Grain Sorghum Yield Tests

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The type and size of plot best suited for yield testing has been less firmly established for grain sorghum than for many other grain crops. Plot size investigations reported for similar crops and cultural practices commonly employed in sorghum production undoubtedly have received consideration in the establishment of plot types currently used, but few investigations of plot type or planting arrangements have been reported for sorghum. Hence, studies which might lead to more efficient use of land, labor, and seed supplies through modifications of current testing procedures should be of interest and value to sorghum breeders.

An important consideration relative to the desirability of any modified procedure would be how it compares with methods used currently for evaluation of strains. This should be particularly true if the suggested modification results in a marked change in planting methods or in arrangement of plants within the experimental unit. A prime objective of the investigations herein reported was to compare the relative performance of a number of sorghum strains in two types of hill plantings and in conventional drilled-row plots. A second objective was to estimate the optimum plot size for grain yield evaluations in hill plots.

LITERATURE CITED

In 1934, Jones and Singleton (2) introduced the ear-to-hill method for evaluating lines of corn. Only limited use of this method is made by most present-day corn breeders. However, Jungenheimer (3) has used the method extensively, both for the development of corn inbred lines and the evaluation of hybrids. The main advantage cited for the method is that it permits the observation of any modified procedure would be how it compares with methods used currently for evaluation of strains. This should be particularly true if the suggested modification results in a marked change in planting methods or in arrangement of plants within the experimental unit. A prime objective of the investigations herein reported was to compare the relative performance of a number of sorghum strains in two types of hill plantings and in conventional drilled-row plots. A second objective was to estimate the optimum plot size for grain yield evaluations in hill plots.

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and testing of a large number of lines on a relatively small area of land.

Bonnett and Bever (1) first suggested the use of head-hills as an evaluation technique for small grains but did not make direct comparisons of results from hill versus standard size plots. Consequently, Ross and Miller (7) compared yields obtained from both hill and conventional drilled plots of spring-seeded oats and barley. The coefficient of variation was consistently higher in hill tests than in either rod-row plots or large drill-plots, and yields differed significantly from those obtained in rod-row or drill plots. Better relationships between yields in hill tests and in drilled plots were noted with oats than with barley. Combined analyses indicated a significant variety by planting method interaction with respect to the hill method. Other measurements, such as heading date, test weight, plant height and lodging scores, were considered of little value because of difficulty in obtaining precise evaluations for these characters in hill plots. They concluded that hill tests with small grains have value only as a supplement to present yield testing methods, when large numbers of lines are to be screened, seed supply is scarce and land area for testing is limited.

Leininger and Frey (4) accepted the hill-plot method as sufficiently precise for comparing relative variability in successive backcross generations of oats. They used a plot size of 1 hill, with a 1-foot spacing in perpendicular directions between hills. Thirty seeds were sown in each hill, and plots were arranged in a randomized block design with 8 replicates.

Studies comparing sorghum yields in hill-plots with yields in conventional drilled-row plantings have not been published. However, Swanson (9) planted grain sorghum in hills spaced at intervals of 6, 12, 18, and 24 inches within a row, with 40 inches between rows. Plant populations were kept constant by varying the number of plants per hill. He noted a variety by spacing interaction for grain yield, and obtained highest yields from the 6-inch spacings.

MATERIALS AND METHODS

Data used in this study were obtained from a grain sorghum planting made at the Agronomy Farm, Ames, Iowa, in 1960. Twenty strains, including both open pollinated varieties and single cross hybrids, were planted in each of 3 plot types or planting arrangements. The experimental design was a split plot, replicated three times, with strains as whole plots and planting arrangements as subplots. One subplot consisted of 3 drilled rows spaced 40 inches apart, hand thinned to a spacing of 3 inches between plants. A second subplot consisted of 3 rows spaced 20 inches apart, with single-plant hills at 20-inch intervals in each row. The third sub-