HERITABILITY ESTIMATES AND GENE EFFECTS FOR SEVERAL AGRONOMIC CHARACTERS IN A SYSTEMATIC SERIES OF GRAIN SORGHUM (SORGHUM BICOLOR (L.) MOENCH) GENOTYPES

by 4589

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INTRODUCTION

Plant breeders with the task of developing superior genotypes in crop plants must deal largely with traits of quantitative inheritance. Most of the economic characters with which they work exhibit continuous variation generally explained by the polygenic inheritance or a modification thereof. Owing to the fact that Mendelian approach is not applicable to the study of polygenic inheritance, many statistical procedures have been developed so as to obtain basic genetic information. For example, knowledge about heritability indicates the relative degree to which a character is transmitted from parent to progeny. The magnitudes of such estimates also suggest the extent to which improvement is possible through selection. Estimation of various types of genetic effects including epistasis is of value to plant geneticists or breeders because it provides information useful in choosing the most advantageous breeding procedures for the improvement of the attribute in question. In sorghum, relatively little data are available relative to these aspects.

Sorghum is remarkable for its wealth of variability in almost all plant characteristics. Much of the research investigations reported earlier deal largely with phenotypic variability and correlations. A knowledge about heritability coupled with gene effects for such agronomic traits will be of great value in the selection concept and choice of selection procedure.

This investigation was designed to determine the magnitude of heritability estimates in the narrow sense for quantitative traits such as grain yield, kernel weight, plant height, and flowering time in 10 genetic groups of grain sorghum derived from a 5 variety diallel. The estimates of

gene effects and relative importance of additive, dominant, and digenic epistasis were also obtained for these attributes.

LITERATURE REVIEW

General Considerations

Prior to the rediscovery of Mendel's laws of inheritance, plant breeding was primarily an art. The most powerful selection tool employed was progeny test. Following the rediscovery of Mendelism, plant breeders were quick to realize the importance of rapidly expanding quantitative genetics to plant improvement.

Fisher (16) studied the nature of gene control of a quantitative trait in 1918. He showed how to separate the genetic variance into three components: that due to additive effects of genes, that due to dominance deviations from the additive scheme, and that due to deviations attributed to interalleic interactions or epistasis. This theoretical basis of quantitative genetic concept was subsequently established by Haldane (21) and Wright (51). Sewall Wright was the pioneer in the field of heritability studies. His concept of separation of genetic and environmental effects has laid a firm basis for development of modern quantitative genetics.

The study of quantitative inheritance in plants started with the works of Johannson (26), Nilsson-Ehle (38), and East (14). Johannson demonstrated that both heritable and nonheritable agencies contributed to somatic variation in segregating population, that the variation in a pure line was exclusively environmental and that selection would be ineffective within a pure line. East and Nilsson-Ehle, while confirming the work of Johannson, showed how quantitative inheritance conformed with Mendelian concept of inheritance.