Phenotypic Epistasis for Ten Quantitative Characters in Maize

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Since there has been no general agreement on an adequate explanation of heterosis, Sprague (12) has stated that studies which will contribute information about gene action involved in heterosis should be vigorously explored. This study was undertaken to gather information with currently useful breeding materials relative to the prevalence of epistatic gene action and its interactions with environments. Additional knowledge along these lines should be valuable in planning future fundamental studies, in practical breeding efforts, and in interpreting maize inbred and hybrid performance experiments in diverse environments.

REVIEW OF LITERATURE

Hollander (4) and Kempthorne (8) have defined epistasis as involving interactions of non-allelic genes including multiplicative gene action. Jinks (7) concluded, in a review of diallel cross data, that measured overdominance for yield was partially spurious and in reality epistasis. A significant positive correlation existed between yield and intensity of non-allelic interaction. Gamble (3), using a factorial gene model analysis for inheritance of yield, plant height, kernel row number, ear length, ear diameter, and kernel weight in four environments, concluded that epistasis was important in the inheritance of the characters studied and was subject to environmental influences. Robinson et al. (1) found the complementary type of non-allelic interaction to be of importance in determining maize yield. Horner et al. (5) pointed out that work demonstrating step-like sequential biochemical reactions in the formation of genetically controlled products was very suggestive of complementary gene action.

Bauman (1, 2) described the basic method used with extensions in this study to detect epistatic gene action. Inbreds A and B and their F1 hybrid were crossed with a common inbred tester. A significant positive or negative deviation of the single cross × tester from the mean of the two inbreds × tester would necessarily be due to epistasis. He pointed out the following: (A) epistasis, even if present, may not be detected; (B) only a minimum amount of epistasis present will be detected; (C) the direction of the deviation is dependent on the distribution of alleles within the parents; (D) the type of epistasis will not be determined; (E) linkage will

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