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GENE ACTION FOR YIELD AND YIELD COMPONENTS IN WHEAT

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Gene action for yield and its components was investigated in F_2 of a five-parent diallel involving Mexipak 65, Chenab 70, PARI 73, LU 15 and LU 21. Plant height expression was conditioned by partial dominance, while spike length, number of spikelets per spike, number of kernels per spike, 100-kernel weight, and grain yield showed overdominance. Other genetic interactions also appeared important for plant height, number of kernels per spike and grain yield.

INTRODUCTION

Of all the production requisites in a yield raising agriculture, genetic improvement seems most crucial to exploiting a production situation. Confronted with the problems of adaptation to an ever-evolving environment, the breeder has to work constantly to modify, alter or reinforce the genetic architecture of his varieties for sustained agricultural production. Since the plant breeder is handicapped by the resources and the time at his disposal, he would need to obtain the desired genetic information in early generations to enhance the efficiency of his crop breeding programme.

The diallel cross technique developed and illustrated by Hayman (1954) and Jinks (1954) provides early information on the genetic behaviour of parental varieties used in crosses. In such studies plant height which may be considered an indirect component of yield, was reported to be under both additive and non-additive genetic control (Akhtar, 1971; Chaudhry *et al.*, Daaloul 1974, and Paroda, 1974). Similarly, grain yield and the various components of yield in wheat are mostly conditioned by over-dominance (Whitehouse *et al.*, 1958; Hsu and Walton, 1970; Akhtar, 1971; Khan, 1973; Chaudhry *et al.*, 1974; and Vasudeva, 1974). The present study presents a diallel analysis of five wheat varieties in F_2 and valuable information is reported.

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MATERIALS AND METHODS

The study was carried out during 1976-77. The five wheat varieties used in the diallel cross were Mexipak 65, Chenab 70, PARI 73, LU 15 and LU 21. The parents and their F_2's including reciprocals, were field planted in a randomized complete block design with three replications and received normal cultural treatments. The experimental plot was a 7-ft. triple row with a distance of one foot between rows and of two feet between plots. At maturity, three 1-foot random samples from the central row of each plot were marked in each replication for recording data on (1) plant height (cm.) from the ground level to the tip of the spike excluding awn, (2) spike length (cm.) from the peduncle and to the tip of the spike on the tallest tiller, (3) number of spikelets per spike, (4) number of kernels per spike, (5) 100-kernel weight (gm.), and (6) grain yield per unit area. The data were analyzed by the diallel cross technique. The type of gene action was inferred from the Vr/Wr graphs constructed for each character according to Hayman (1954) and Jinks (1954) but not shown in this paper.

RESULTS AND DISCUSSION

Plant height

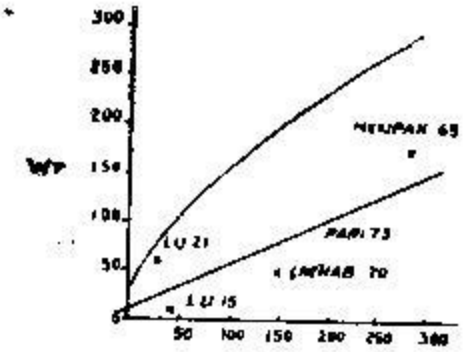
From Vr/Wr graph it was evident that the regression line deviated significantly from unity and intercepted the Wr axis above the origin. Partial dominance as also interallelic interaction were involved in the inheritance of this character. Akhtar (1971), Dadoul (1974) and Chaudhry *et al.* (1974) also reported similar results. Since the plant height inheritance was influenced by genetic interaction, selections of desired height levels would need to be made with caution.

Spike length

The Vr/Wr graph showed that the regression line cut the Wr axis on the negative side which signified overdominance type of gene action as were also reported in their studies by Akhtar (1971), Vasudeva (1973), and Chaudhry *et al.* (1974). The overdominance type of gene action would indicate that effective selection in the early segregating generations would be difficult.

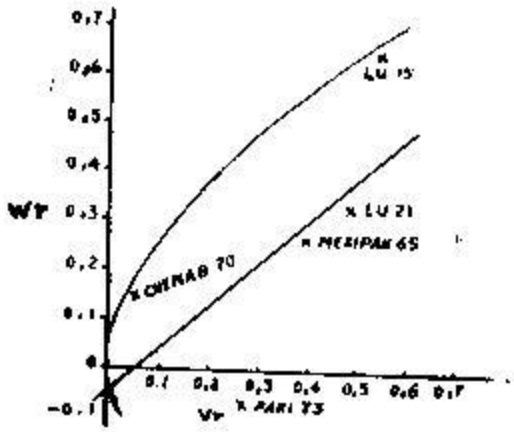
Number of spikelets per spike

Again, for this character, the regression line cut the Wr axis below the origin and did not deviate significantly from unity, which suggested overdominance with no other genic interaction. These results are similar to those



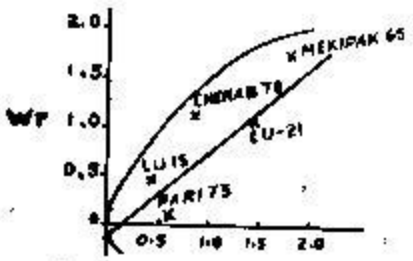
b= 0.439
± 0.188

Vr-Wr GRAPH FOR PLANT WEIGHT



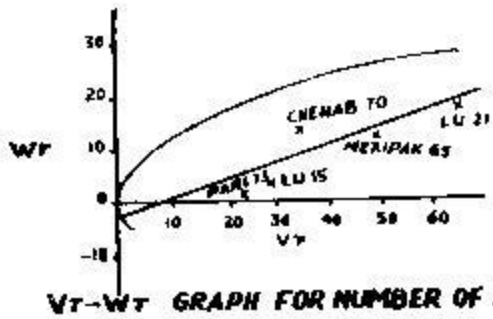
b = 0.895
± 0.575

Vr-Wr GRAPH FOR SPIKE LENGTH



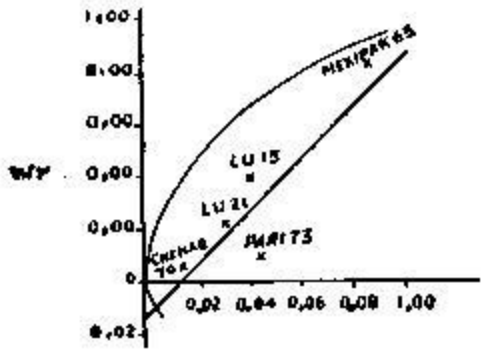
b = 0.949
± 0.164

Vr-Wr GRAPH FOR NUMBER OF SPIKELETS/SPIKE



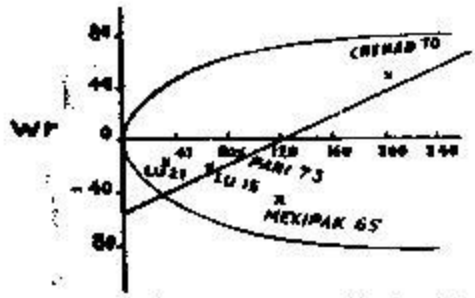
b = 0.387 ± 0.113

Vr–Wr GRAPH FOR NUMBER OF KERNELS/SPIKE



b = 1.113 ± 0.156

Vr–Wr GRAPH FOR 100-KERNEL WEIGHT



b = 0.488 ± 0.254

Vr–Wr GRAPH FOR GRAIN YIELD

of Akhtar, 1971; and Khan, 1973. With overdominance involved, selection for fixing this response would be difficult.

Number of kernels per spike

The position of the regression line on the Vr/Wr graph suggested that the inheritance of kernels per spike also involved overdominance as also reported by other workers like Akhtar, 1971; Khan, 1973; and Chaudhry *et al.*, 1974. Since the regression line deviated significantly from unity, non-allelic interactions were indicated. Also apparent from their relevant positions in the graphic illustration was the fact that PARI 73 possessed most dominant genes while LU 21 carried most recessive genes for number of kernels per spike.

100-grain weight

For 100-grain weight, it was indicated from the Vr/Wr regression line which intersected the Wr axis on the negative side that overdominance was involved. Similar results were also reported by Hsu and Walton, 1970; Akhtar, 1971; and Vasudeva, 1974. The relative positions of the array points suggested that Chenab 70 and Mexipak 65 carried most dominant and recessive genes respectively.

Grain yield

As for most other yield components, overdominance was apparent in the inheritance of grain yield also along with interallelic interactions as the regression line deviated significantly from the unit slope. These results are in accord with those of Whitehouse *et al*., 1958; Hsu and Walton, 1970; and Akhtar, 1971. Grain yield is usually a complex character, not readily responsive to selection. In the present study, overdominance appearing for yield and all yield components has made selection more tricky and the breeder would be well advised to keep it in view while making selections from these crosses.

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