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## Genetic Analysis for Some Metric Traits in Hexaploid Wheat

Muhammad Asif, Ihsan Khaliq and Muhammad Aslam Chowdhry Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad, Pakistn

**Abstract**: Genetic mechanism of yield and its components was investigated in a complete diallel cross involving five wheat varieties/lines viz; HABA-4, HABA-12, Pitic-62, Pak-81 and LU26S. Plant height and peduncle length were conditioned by partial dominance with additive type of gene action while economic yield per plant, biological yield per plant and harvest index were controlled by over dominance type of gene action. Non allelic interaction was absent for all these traits.

Key words: Genetic, metric, traits, hexaploid

#### Introduction

Wheat occupies a prominent position in the cropping pattern of Pakistan since it is the main staple food of the rapidly increasing population of this country. To cope with ever increasing population, it appears to be a dire need to enhance the productivity of this cereal grain. Wheat production can be enhanced through the development of improved cultivars having wider genetic base capable of producing better yield under various agro-climatic conditions. The diallel cross techniques developed and advocated by Hayman (1954, 1958) and Jinks (1954, 1955) provide a fairly reliable mechanism especially in self fertilized crops like wheat to assess the genetic system and gene action involved in the expression of important plant attributes right in the  $F_1$  generation.

Shah and Khan (1970) crossed six wheat varieties in all possible combinations and observed that biological yield and grain yield were controlled by over dominance. Hussain *et al.* (1986) investigated from a  $6 \times 6$  diallel cross of wheat varieties that additive gene action with partial dominance was operative for plant height while grain yield per plant was controlled by over dominance. Khan *et al.* (1992) reported that additive gene action with some degree of partial dominance determined plant height and peduncle length. Srivastava and Nema (1993) revealed partial dominance was observed for biological yield per plant and grain yield per plant.

The present study was undertaken to determine the type of gene action involved in the expression of economic yield and some important yield components of wheat in a 5 x 5 diallel cross. The information so derived may be effectively exploited for further wheat imporvement breeding programmes.

### **Materials and Methods**

The proposed research for the study of gene action was conducted in the experimental area of the Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad. The experimental material was developed from a full diallel cross involving five spring wheat varieties/lines, viz; HABA-4, HABA-12, Pitic-62, Pak-81 and LU26S, during March, 1997.

Seeds of  $F_1$  crosses along with their parents were planted in the field, in a randomized complete block design with three replications during the crop season 1997-98. A single row of 5 m length for each genotype in each replication served as an experimental unit. Inter-plant and inter-row distances were of 15 cm and 30 cm, respectively. Two seeds per hole were sown with the help of a dibble and later after germination thinning was done to one seedling per site. At maturity, ten guarded plants were selected randomly from each genotype in each replication. The data on individual plant basis were recorded on plant height, peduncle length, economic yield per plant, biological yield per

plant and harvest index. The analysis of variance technique was applied to determine the significance of mean differences (Steel and Torrie, 1980) and where the differences were significant, the data were further subjected to diallel analysis technique delineated by Hayman (1954, 1958) and Jinks (1954, 1955).

### **Results and Discussion**

Analysis of variance for all the traits revealed highly significant differences among genotypes (Table 1). This indicated that the parents were diverse for the characters studied and this diversity could be exploited in further breeding programmes.

**Plant height (cm)**: The values of Vr/Wr graph indicated that plant height was governed by partial dominance with additive type of gene action, as the regression line intercepted the Wr-axis above the point of origin (Fig. 1). Similar findings have already been reported by Hussain *et al.* (1986) and Khan *et al.* (1992). The regression line was of unit slope, suggesting the absence of epistasis. The variety LU26S being closest to the origin had most of the dominant genes while the line HABA-4 had the maximum recessive genes being farthest from the origin. In view of the partial dominance with additive gene action, effective selection is possible for plant height in early generations.

**Peduncle length (cm)**: The Vr/Wr graphic representation revealed that regression line intercepted the Wr-axis above the origin indicating additive expression with partial dominance for peduncle length (Fig. 2). Similar results were reported by Khan *et al.* (1992).



Fig. 1: Vr/Wr graph for plant height

Table 1: Analysis of variance of 5 x 5 diallel.						
S.O.V	D.F	Mean Square				
		Plant height	Peduncle length	Economic yield per plant	Biological yield per plant	Harvest index
Replication	2	1.81	0.13	5.94	4.78	7.07
Genotypes	24	26.98**	11.02**	31.52**	123.13**	20.33**
Error	48	0.47	0.85	1.10	1.54	1.60

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Fig. 2: Vr/Wr graph for peduncle length

\* \*

The estimated regression line did not deviate significantly from unit slope indicating the non-existence of genic interaction. The distribution of varietal array points on regression line showed that line HABA-4 had maximum dominant genes while variety Pitic-62 carried maximum recessive genes for this trait. Additive type of gene action with partial dominance suggested the possibility of obtaining desirable transgressive segregates for peduncle length in early generations.



Fig. 3: Vr/Wr graph for Economic yield per plant.

Economic yield per plant (g): The values of Vr/Wr graph for economic yield per plant showed the over cominance type of gene

action as the regression line cut the Wr-axis below the origin (Fig. 3). Same results were obtained by Shah and Khan (1970), Hussain *et al.* (1986) and Srivastava and Nema (1993). Since the regression line did not deviate from the unit slope, so the non-allelic interaction was absent. The distribution of varietal array points on the regression line revealed that the variety Pitic-62 being closest to the origin had maximum dominant genes while the variety Pak-81 carried maximum recessive genes being farthest from the origin. The effective selection in early generations would be some what difficult due to the over dominance type of gene action.

**Biological yield per plant (g)**: The graphic representation of Vr/Wr showed that regression line cut the Wr-axis below the origin, which was an indication of over dominace type of gene action (Fig. 4).

The results are in agreement with those reported by Shah and Khan (1970) and Srivastava and Nema (1993). The estimated regression line deviated non significantly from unit slope, which showed absence of non-allelic interaction. From the distribution of array points on the regression line, it was apparent that line HABA-12 being the closest to the origin had maximum dominant genes while the line HABA-4 contained the maximum recessive genes being the farthest from the origin. Due to over-dominance type of gene action, the selection for biological yield per plant in early generations would be difficult.



Fig. 4: Vr/Wr graph for biological yield per plant

Harvest index (%): The graphic representation of Vr/Wr indicated that regression line cut the Wr-axis below the origin showing the over dominance type of gene-action for harvest index (Fig. 5). However, partial dominance was observed by Srivastava and Nema (1993). The regression line did not deviate significantly from unit slope indicating the absence of non-allelic interaction. The relative position of array points on regression line showed that the variety Pitic-62 carried most of the dominant genes being

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Fig. 5: Vr/Wr graph for harvest index

closest to the origin while the line HABA-12 being farthest from the origin had maximum recessive genes. The over dominance type of gene action indicated that selection in early generations would be difficult for harvest index.

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