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DIALLEL ANALYSIS OF PLANT HEIGHT, YIELD AND THE COMPONENTS OF YIELD IN SPRING WHEAT (*TRITICUM AESTIVUM* L. em. Thell.)

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Diallel analysis of plant height, yield and yield components was performed in a set of diallel crosses involving three semidwarf wheat varieties LU 26, 1050, LU-61-4 and an indigenous tall-statured variety C-591. Additive genetic variance predominated for plant height, spike length, yield per plant and number of kernels per spikelet spikelets per spike and kernels per spike showed partial dominance while tiller number and 1000-grain weight exhibited overdominance. Other genetic interactions were not reported for any character. The variety LU 26 combined well for grain weight and grain yield.

INTRODUCTION

Wheat (*Triticum aestivum* L. em. Thell), the major food crop of Pakistan, has always been an object of extensive research, to maximise wheat productivity in the country. Sustained research efforts of wheat breeders have led to the evolution of high yielding varieties which are responsible, in large part, for boosting wheat production in the country to the extent of self-sufficiency. However, the need to further amplify efforts for continued genetic improvment of wheat is even more intense today than before. As for his efforts, a plant breeder is always handicapped by the resources and the time at his disposal, genetic information on characters sought to be improved is therefore, an important need of the breeder.

The diallel cross technique developed and illustrated by Hayman (1954) and Jinks (1954) offers a method to assess the material and provide information on genetic mechanisms involved right in F_1. The studies by various workers on the nature of gene action, revealed additive gene action with varying degrees of plant height, yield and some of its components (1, 2, 3, 5, 7, 10, 11, 13, 14). Still other workers Hsu and Walton, 1970; Khalid *et al.* (1976); Shal *et al.*, and Zia and Choudhry, 1980, reported dominance and overdominance type of genetic control for various yield components. The present study presents a diallel analysis of four wheat varieties and valuable information which would help in further breeding.

MATERIALS AND METHODS

The study was carried out in the Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad during the years 1979-81. The experimental material comprised three local semidwarf wheat varieties LU-25, 1050 and LU-61-4 and an indigenous tall-statured variety C-591. These varieties were sown and all possible crosses including reciprocals were made.

In the following year the four wheat varieties and crosses were sown in the field using randomized complete block design with four replica-tions in single row plots spaced 30 centimeters apart with plants 24 centimeters apart. All the plots received equal cultural treatments.

At maturity ten guarded plants were measured for plant height, tillers per plant, spike length, spikelets per spike, kernels per spike, kernels per spike-let, 1000-grain weight and yield per plant.

The data were subjected to analysis of variance and where the differences of means were significant, the data were further subjected to diallel analysis. The type of gene action was inferred from the Vr/Wr graphs constructed for each character according to Hayman (1954) and Jinks (1954).

RESULTS AND DISCUSSIONS

Plant height

From Vr/Wr graph it was evident that the regression line with unit slope intercepted the covarrance axis above the origin. Additive type of gene action was involved in the inheritance of this character. These results are similar to those of paroda, 1974; Khalid, *et al.*, 1976 and Hussain, 1978. The relative position of array points on the regression line showed that the variety C-591 being close to the origin possessed maximum dominant genes for plant height while the variety 1050 being away from the origin contained most recessive ones.

Since the regression line did not deviate significantly from unit slope, non-allelic interaction was not indicated. Moreover from additive type of gene action for plant height it was concluded that selection for desirable height levels would be possible in early generations.

Number of tillers per plant

The Vr/Wr regression pattern revealed that the number of tillers per plant wa conditioned by overdominance. These results are in accord with the findings of Hsu and Walton, 1969; Khalil *et al.*, 1976; Shah *et al.*, 1972 and Munir *et al.*, 1977. Since the regression line did not deviate significantly from unit slope interaction component was not indicated Overdominance type of gene action would indicat that effective selection for tiller number in earlier generations would be difficult.

Spike length

Spike length is mostly conditioned by additive gene action as reported by Hsu and Walton, 1970 and Shah *et al.*, 1972. The present studies also provided a similar evidence as the regression line cut the Wr axis above the orioin. Partial dominance also appeared to be important to a limited extent.

Further as the interaction component was not much pronounced there were good chances for the recovery of transgressive segregates in the subsequent segregating generations.

Number of spikelets per spike

The regression line on Vr/Wr graph indicated partial dominance for number of spikelets per spike as also reported by Hsu and Walton, 1969; Chapman and McNeal, 1971; Hussain 1978 and Shakoor *et al*; 1979. Moreover from the distribution of varietal points on the regression line it was evident that the variety 1050 possessed most dominant genes while the reverse was true of C-591 which contained most recessive genes.

Partial dominance suggested that caution would needed while making selection for desired spikelet number per spike.

Number of kernels per spike

Also for this character the regression line cut the Wr axis above the origin and did not deviate significantly from unity, which revealed partial dominance. These results confirm the findings of Walton, 1972; Chowdhry *et al*, 1975; and Shakoor *et al.*, 1979. Also important from the graphic illustration was that the varieties 1050 and C-591 contained maximum dominant and recessive genes respectively for kernels per spike.

Partial dominance would suggest that recovery of transgressive segregates might be epected in subsequent segregating generations.

Number of kernels per spikelet

Graphic representation of Vr and Wr revealed that additive gene action with partial dominance controlled the inheritance of kernels per spikelet. Regression line with unit slope suggested that inter-allelic interaction was not operative.

In view of additive gene action, it was suggested that selection for kernels per spikelet would be fruitful in early segregating generations.

1000-grain weight

The position of regression line on Vr/Wr graph suggested that inheritance of 1000-grain weight was under overdominance as was also reported by Hsu and Walton, 1970 and Zia and Chowdhry, 1980. As the regression line did not deviate significantly from unit slope, interaction component was not present. The variety LU-26 showed highest general combining ability by possessing the greatest array mean and within LU-26 array the cross LU-26 × C-591 presented high specific combining ability. Moreover, the order of arrangement of varietal points on the regression line suggested that the variety LU-26 carried maximum dominant genes.

Overdominance type of gene action for 1000-grain weight suggested that selection for increased kernel weight would be difficult in early generations.

Yield per plant

Like other yield components, the inheritance pattern of yield per plant appeared additive in nature with partial dominance. These results are in accord with the findings of Hsu and Walton, 1969; Chapman and McNeal, 1971; Chowdhry *et al.*, 1975; Chowdhry and Azhar, 1977 and Shakoor *et al.*, 1979. From the relative position of array points on the regression line it was concluded that the variety LU-26 possessed most dominant genes for grain yield whereas the variety C-591 contained most recessive genes for this trait.

Grain yield is usually a complex character and not readily responsive to selection pressures. Additive gene action with partial dominance for yield per plant suggested that selection for desired types would have to be practised with great care from subsequent populations.

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