research article | International Journal of Plant Sciences, (July, 2010) Vol. 5 Issue 2 : 642-646

Estimation of components of genetic variance and graphical analysis in durum wheat (*Triticum durum* Desf.) under timely and late sown conditions

R.A.GAMI, C.J. TANK, D.M. THAKOR, S.V. BURUNGALE AND C.G. PATEL

Accepted : June, 2010

SUMMARY

Genetic analysis was carried out by 8 x 8 diallel analysis (excluding reciprocals) under both timely and late sown condition. t^2 test indicated the fulfillment of assumptions required under diallel analysis for all the characters under study except plant height and 1000-grain weight under timely sown condition and days to maturity, 1000-grain weight, duration of flag leaf and harvest index under late sown condition. Narrow sense heritability was low for grain yield per plant and most of the other trait except days to heading, plant height and length of main spike which had moderate to high heritability under both the conditions. A higher proportion of dominant genes were observed in parent GW 1189 for affecting dwarf plant height, under late sown condition. The parental line BAWAJI was found having maximum recessive gene for increasing the length of main spike under late sown condition. Similarly parental line GW 1240 had maximum recessive genes for increasing grain protein under timely sown condition.

Key words : Genetic analysis, Wheat, Recessive and parental line, Sowing effect

In the breeding of high yielding varieties of crop plants, the breeder is confronted with the problem of choice of parents. Elimination of poor yielding crosses on the basis of their performance in early generation had been recommended, but it was felt that knowledge of the genetic architecture of yield and its attributes will help to sort out the better crosses more efficiently. Several reports in past have appeared which indicate that diallel analysis is the quickest method of understanding the genetic nature of quantitatively inherited traits and to ascertain the prepotency of parents. Kearsey (1965) noted that Hayman and Jinks' diallel analysis provide more information than other methods, but has more necessary assumptions. The analyses proposed by Griffing (1956) do not provide any test to detect epistasis or linkage. Hayman and Jinks' analysis does provide such test. When using Griffing's analysis to estimate variance components, it has been suggested that simple tests, such as the Wr-Vr evaluation found in Haymans' (1954) model, be used to ascertain the presence of epistasis and/or linkage disequilibrium (Pooni *et al.*, 1984; Wright, 1985).

Correspondence to:
R.A. GAMI, Department of Genetics and Plant Breeding, C.P. College of Agriculture, S.D. Agriculture University, SARDARKRUSHINAGAR (GUJARAT) INDIA
Authors' affiliations:
C.J. TANK, D.M. THAKOR, S.V. BURUNGALE AND C.G. PATEL, Department of Genetics and Plant Breeding, C.P. College of Agriculture, S.D. Agriculture University, SARDARKRUSHINAGAR (GUJARAT) INDIA

MATERIALS AND METHODS

The present investigation consisted of eight diverse parental lines of durum wheat (*Triticum durum* Desf.) and their twenty-eight F1s (excluding reciprocals). The parental lines *viz*., GW-02-51, VDW-99-176, RD-1009, GW1139, GW1239, GW1189, BAWAJI and GW 1240 were selected from germplasm maintained at Main Wheat Research Station, Vijapur, (North Gujarat), during *Rabi*, 2007-08 to create a diallel set. The complete set of 36 genotypes comprising eight parental genotypes and 28 F1's were evaluated in Randomized Block Design (RBD) with three replications. The experimental material was raised in second week of December 2008-09. The observations were recorded both as visual assessment (days to heading, days to maturity and duration of flag leaf) and measurement on randomly selected five competitive individual plants (plant height, number of effective tillers per plant, length of main spike, spikelets per spike, grains per spike, 1000-grain weight, grain yield per plant, protein content, hectoliter weight and harvest index).

RESULTS AND DISCUSSION

The data are presented in Table 1. The results of t^2 test indicated the fulfillment of assumptions required under diallel analysis for all the characters under study except plant height and 1000-grain weight under timely sown condition and days to maturity, 1000-grain weight, duration of flag leaf and harvest index under late sown condition. Non-fulfillment of assumptions in these traits indicated the invalidity of the hypothesis of simple additive –

dominance model of gene action and involvement of epistasis and/or linkage disequilibrium.

The estimates of D which measure the variance due to additive gene effects were significant for days to heading, length of main spike, grain protein, hectoliter weight, duration of flag leaf and harvest index under timely sown condition. Under late sown condition these parameters were significant for grain yield per plant, days

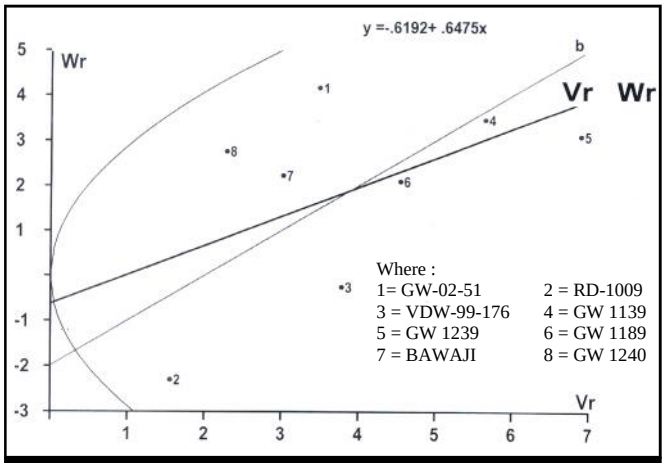

Fig. 1 : Wr, Vr graph for days to heading under late sown condition

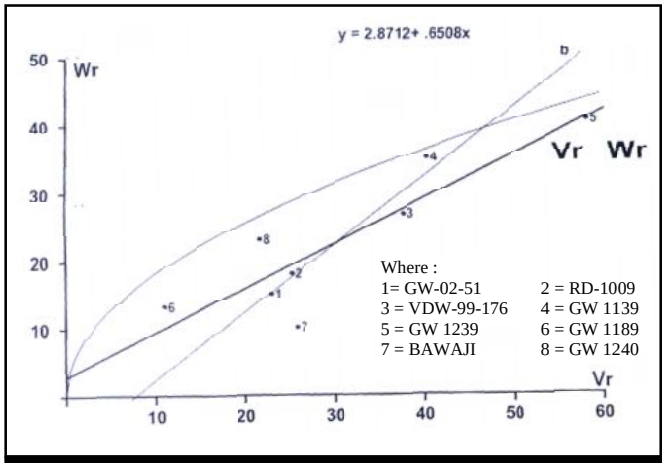

Fig. 2 : Wr, Vr graph for plant height under late sown condition

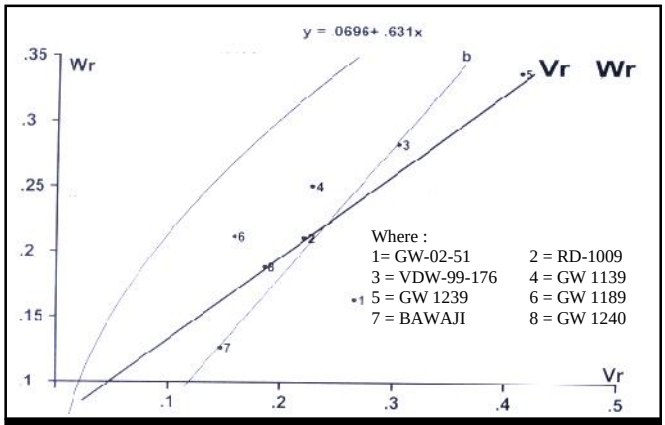

Fig. 3 : Wr, Vr graph for length of main spike under late sown condition

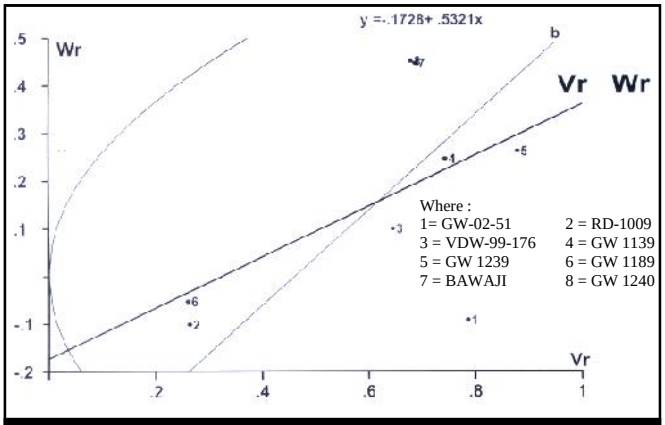

Fig. 4 : Wr, Vr graph for spikelets per spike under late sown condition

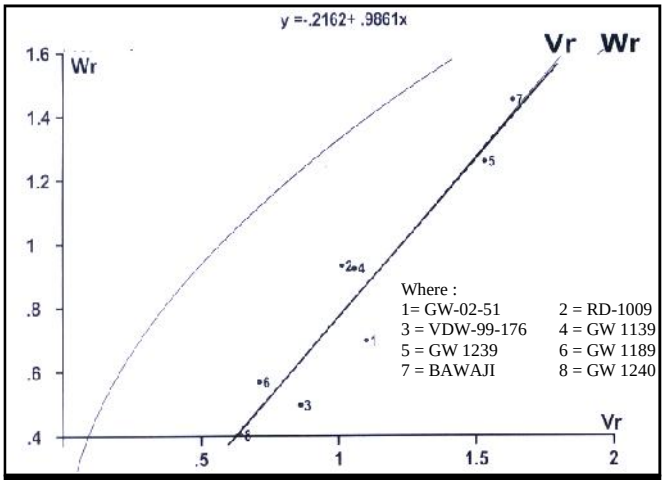

Fig. 5 : Wr, Vr graph for grain protein content under timely sown condition

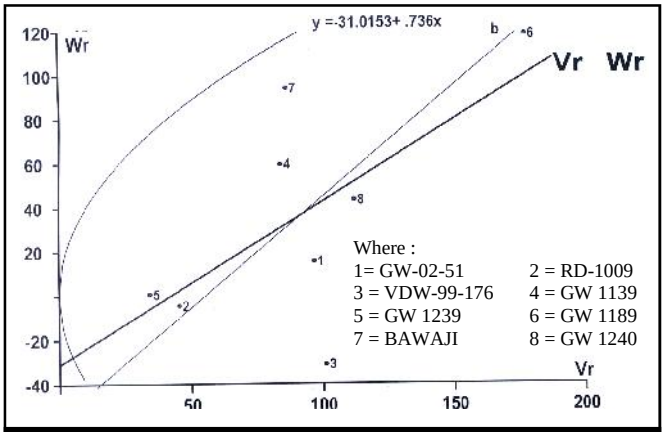

Fig. 6 : Wr, Vr graph for duration of flag leaf under timely sown condition

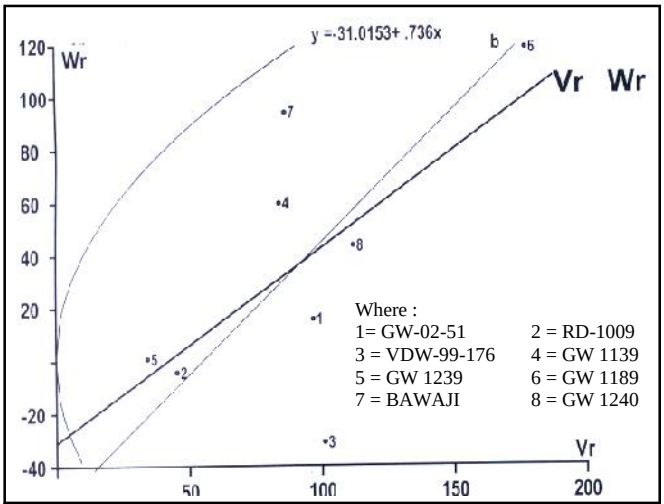

Fig. 7 : Wr, Vr graph for harvest index under timely sown condition

to heading, plant height, number of effective tillers per plant, spikelets per spike and hectoliter weight. Thus additive gene effects were significant for days to heading, length of main spike and hectoliter weight in both timely and late sown conditions. This was reflected in high heritability of days to heading and length of main spike for both the conditions.

The H_1, which measure the variance due to non-additive effects, was significant for all the characters under both the conditions except days to maturity in timely sown condition. This clearly indicates the predominance of non-additive gene action for all the characters under study. The estimates of dominance ratio $(H_1/D)^{0.5}$ greater than unity for all the traits except length of main spike under late sown condition indicating over dominance for most of the characters. Similar findings were reported by Singh *et al.* (1969), Paroda and Joshi (1970) and Singh and Dhaliwal (1971) who observed the similar findings for grain yield per plant.

The equal distribution of positive and negative genes in the parents helps the breeder in selecting particular desirable trait without loosing any other desirable traits. In the present study more or less symmetrical distribution of genes in the parental lines was observed for most of the characters in present study as the value $H_2/4H_1$ was closer to 0.25. Mather and Jinks (1971) while discussing the short comings of numerical component analysis suggested that $(H_1/D)^{0.5}$ at each locus is true for major degree of dominance only, where the distribution of dominance and recessive genes is symmetrical. Asymmetrical distribution of genes for may influence of over estimation of mean degree of dominance.

The values of component KD/KR indicated unequal frequency of dominant and recessive genes with higher frequency of dominant genes for all the characters studied except length of main spike and grain protein under both the condition of the sowing. Knowledge of number of genes/group of genes responsible for particular traits is important for the genetic progress through selection. The value h^2/H_2 indicated at least one group of gene was operating for grain yield per plant and most of other traits of present study.

Estimated narrow sense heritability was low for grain yield per plant and most of the other trait except days to heading, plant height and length of main spike which had moderate to high heritability under both the conditions. For grain protein the heritability was moderate to high under timely sown condition and it decreased under late sown condition.

The correlation between parental order of dominance (Vr + Wr) and parental mean (Y_i) was positive and significant for grain protein for both the conditions, plant height, length of main spike, grain per spike and hectoliter weight under late sown condition, which indicated involvement of recessive alleles for increasing the mean values. Thus, recessive genes were responsible for increasing grain protein plant height, length of main spike, grain per spike, hectoliter weight and early maturity. For grain yield per plant, the correlation under timely sown condition was negative indicating role of dominant genes for increasing mean values.

The regression of Wr on Vr was desirable and near unity for grain protein, duration of flag leaf and harvest index under normal sown condition indicating validity of simple additive-dominance hypothesis of gene action for these characters. Similarly under late sown condition the hypothesis was valid for days to heading, plant height, length of main spike and spikelets per spike. Therefore graphical analysis was performed for these traits only. For remaining trait including grain yield per plant the Wr-Vr graphs were much distorted and failed to give much information.

In graphical analysis the regression line intercepted Wr axes below the origin indicated over dominance for duration of flag leaf, harvest index and spikelets per spike under timely sown condition where as in late sown condition days to heading, plant height, grain protein and length of main spike. The wide scattering of parental array points along the regression line in the Wr-Vr graph (Fig. 1-7) for days to heading, spikelets per spike, grain protein and harvest index indicated considerable genetic diversity among the parents for these traits. A higher proportion of dominant genes were observed in parent GW 1189 for affecting dwarf plant height, under late sown condition. The parental line BAWAJI was found

having maximum recessive gene for increasing the length of main spike under late sown condition. Similarly parental line GW 1240 had maximum recessive genes for increasing grain protein in timely sown condition.

REFERENCES

Griffing, B. (1956). Concept of general and specific combining ability in relation to diallel cross system. *Aust. J. Biol. Sci.,* 9 : 463-493.

Hayman, B.I. (1954). The analysis of variation of diallel tables. *Biometrics,* **10** : 235-244.

Kearsey, M.J. (1965). Biometrical analysis of random mating population : A comparison of five experimental designs. *Heredity,* **20** : 205-235.

Mather, K. and Jinks, J.L. (1971). *Biometrical genetics* (2nd Ed.). Chapman and Hall, London.

Paroda, R.S. and Joshi, A.B. (1970). Genetic architecture of yield and components of yield in wheat. *Indian J. Genet.,* **30** (2): 298-314.

Pooni, H.S., Jinks, J.L. and Singh, R.K. (1984). Methods of analysis and the estimation of the genetic parameters from a diallel set of crosses. *Heredity,* **52** : 243-253.

Singh, K.B. and Dhaliwal, H.S. (1971). Study of combining ability and graphical analysis for yield and its components in F_2 generation in wheat (*Triticum aestivum* L.). *Indian J. Agric. Sci.,* **41** (12): 21-27.

Singh, K.B., Sharma, D. and Mehndiratta, P.D. (1969). Study of combining ability and genetic parameter for yield and its components in wheat. *Japanese J. Genet.,* **44** (5): 367-377.

Wright, A.J. (1985). Diallel designs, analysis and reference populations. *Heredity,* **54** : 307-311.

****
*****