IJPS INTERNATIONAL JOURNAL OF PLANT SCIENCES
e ISSN-0976-593X Volume **12** | Issue 2 | July, 2017 | 294-298

DOI: 10.15740/HAS/IJPS/12.2/294-298
Visit us - *www.researchjournal.co.in*

RESEARCH ARTICLE

Genetic correlation under diverse environments in bread wheat (*Triticum aestivum* L.)

L.G. VANPARIYA, M.S. PITHIA, R.M. JAVIA AND A.G. PANSURIYA

SUMMARY

F_2 generation of eight crosses of bread wheat were grown under timely and late sowing conditions to study the genetic correlation for grain yield and its components. Under timely sowing, negative and significant association with grain yield per plant was found in hybrid RWP 2002-2 x LOK-1 for days to heading, in GW 9715 x K 9102 for days to maturity and in AKAW 2862-2 x MACS 2496 for plant height. However, significant and positive relationship was displayed between grain yield per plant with number of effective tillers per plant in all the crosses except crosses CLN 5 x GW 322 and GW 9715 x K 9102. Positive and significant association of grain yield per plant with biological yield per plant and harvest index was observed in all the crosses except cross 3 and crosses 3 and 7, respectively. In case of late sowing, significant and negative genetic association for developmental traits was found for days to maturity in cross RWP 2002-2 x LOK 1 and for plant height in AKAW 2862-1 x MACS 2496, CLN 1 x GW 273 and P 11616 x PBW 524. While positive and significant association of grain yield per plant with number of effective tillers per plant, length of main spike, number of grains per spike, grain filling period and biological yield per plant was observed in all the crosses except cross 3 for length of main spike and cross 2 for number of grains per spike under late sowing. Above said yield contributing characters are useful for the indirect selection for the improvement of grain yield per plant under respective environment in bread wheat.

Key Words : Genetic correlation, Bread wheat, Diverse environment

How to cite this article : Vanpariya, L.G., Pithia, M.S., Javia, R.M. and Pansuriya, A.G. (2017). Genetic correlation under diverse environments in bread wheat (*Triticum aestivum* L.). *Internat. J. Plant Sci.*, **12** (2): 294-298, **DOI: 10.15740/HAS/IJPS/12.2/294-298**.

Article chronicle : Received : 07.05.2017; **Revised :** 10.06.2017; **Accepted :** 25.06.2017

MEMBERS OF THE RESEARCH FORUM

Author to be contacted :
R.M. JAVIA, Pulses Research Station, Junagadh Agricultural University, JUNAGADH (GUJARAT) INDIA
Email : rmjavia@gmail.com

Address of the Co-authors:
L.G. VANPARIYA AND A.G. PANSURIYA, Wheat Research Station, Junagadh Agricultural University, JUNAGADH (GUJARAT) INDIA

M.S. PITHIA, Pulses Research Station, Junagadh Agricultural University, JUNAGADH (GUJARAT) INDIA

Wheat is the second most important cereal staple food crop consumed by nearly 35 per cent of world population and provides 20 per cent food calories. India is the second largest wheat growing country of the world after the China. Wheat belongs to the genus *Triticum* of Poaceae family and believes to be originated from South West Asia. Three *Triticum* species *viz., Triticum aestivum* L., a hexaploid wheat (2n=42), *Triticum durum* Desf, a tetraploid wheat (2n=28) and

Triticum dicoccum Schubl, (2n=28) are presently grown as commercial crop in India, covering about 86, 12 and 2 per cent area, respectively. The bread wheat is cultivated in all the wheat growing areas of the country.

Yield is a complex character which is final product resulting from the interaction of yield attributing characters. For rational improvement of yield, the understanding of relationship of component traits with yield is essential, which aid to ensure effective selection for simultaneous improvement of more characters. Therefore, a plant breeder should have the deep knowledge and information on types of gene action and more of inheritance *i.e.* genetic analysis for yield and yield attributing characters.

Character association studies provide better understanding of yield components which helps the plant breeders to improve yield through indirect selection for highly heritable traits which are associated with yield. In case of wheat, it is especially important for formulating the selection criteria to develop varieties / pure lines having high yield and other desirable characteristics. In this context, this study is also important in wheat improvement programme. Further, segregating populations provide a better material for correlation studies due to less influence of independent segregation.

MATERIAL AND METHODS

The experimental material was comprised of eight crosses of bread wheat *viz.*, AKW 770 x MP 4010 (cross 1), AKAW 2862-1 x MACS 2496 (cross 2), CLN 1 x GW 273 (cross 3), CLN 5 x GW 322 (cross 4), GW 9715 x K 9102 (cross 5), NWL 1 x GW 496 (cross 6), P 11616 x PBW 524 (cross 7) and RWP 2002-2 x LOK 1 (cross 8) each with six basic generations, *viz.*, P_1, P_2, F_1, F_2, BC_1 and BC_2. The experiment was laid out in Compact Family Block Design with three replications in two sowing dates. The observations were recorded on five randomly selected plants from P_1, P_2 and F_1, forty plants from F_2 and twenty plants from BC_1 and BC_2 generations in each replication for thirteen characters. Each replication was divided in to six compact blocks, each consists of single cross and blocks were consisted of six plots of six basic generations of each cross. The crosses were assigned to each block and six generations of a cross were relegated to individual plot within the block. As a standard wheat variety, GW 366 was sown in each compact block having all the six generations of a single cross. The single plot of one row for each parent, F_1 and standard variety, four rows for each F_2 generation and two rows for each back cross were sown under timely sown (20th November) and late sown (5th December) conditions which designated as E_1 and E_2, respectively.

Genetic correlations between traits :

Phenotypic covariance of a pair of traits was estimated in F_2 generation. The mean phenotypic covariance calculated for F_1 generation was considered as an estimate of the environmental covariance. Genetic correlations (r_G) were estimated as per Falconer and Mackay (1998).

RESULTS AND DISCUSSION

Yield is a complex character and is the multiplicative end product of several yield components (Whitehouse *et al*., 1958). Hence, the selection of superior genotypes based only on grain yield in all cases would not be much effective, but several characters often have to be handled together. Searle (1965) suggested that attempts to change the average merit of character in a population by means of selection programme could be made by selection on the basis of phenotypes of main trait or through indirect selection based on other traits or considering the interrelationship. Thus, for rational improvement of yield and its components, the understanding of correlation is very useful. However, phenotypic selection may sometimes mislead the plant breeders as phenotype is the result of interaction between genotype and environment. Therefore, the correlations were computed separately for both the environmental conditions. Further the formula suggested by Falconer and Mackey (1998) was utilized to calculate genetic correlation because the mean phenotypic covariance calculated for F_1 generation was considered as an estimate of environmental covariance. This helps breeder to reach nearer to true correlation coefficient which is largely due to genetic factor.

Genetic correlation under timely sown condition:

The results of genetic correlation co-efficients(r) of grain yield per plant with different traits in F_2 generation of eight crosses in bread wheat under timely sown condition are presented in Table 1.

The negative relationship between grain yield per plant and other developmental character like days to heading, days to maturity and plant height is desirable, while positive association is desirable for yield attributing traits in wheat. The negative and significant correlation co-efficient with grain yield per plant under timely sown condition was observed in cross RWP 2002-2 x LOK 1 (r= -0.338) for days to heading, in GW 9715 x K 9102 (r= -0.376) for days to maturity and in AKAW 2862-1 x MACS 2496 (r= -0.248) for plant height. Negative associations between grain yield per plant and days to heading were also reported earlier by Singh *et al.* (1982), Khan *et al.* (1987); Korkut (1994) and Snecor (2001). Such findings for days to maturity were also recorded by Singh *et al.* (1982) and Khan *et al.* (1987). Significant and positive correlation co-efficient between grain yield per plant and other yield contributing character was exhibited in cross AKW 770 x MP 4010 for number of effective tillers per plant (r=0.555), length of main spike (r=0.315), flag leaf area (r=0.208), biological yield per plant (r=0.681) and harvest index (r=0.189), in AKAW 2862-1 x MACS 2496 for number of effective tillers per plant (r=0.267), flag leaf area (r=0.565), grain filling period (r=0.573), biological yield per plant (r=0.830) and harvest index (r=0.518), in CLN 1 x GW 273 for number of effective tillers per plant (r=0.345), number of grains per spike (r=0.494) and grain filling period (r=0.629), in CLN 5 x GW 322 for flag leaf area (r=0.325), grain filling period (r=0.384), biological yield per plant (r=0.773) and harvest index (r=0.264), in GW 9715 x K 9102 for length of main spike (r=0.323), number of grains per spike (r=0.187), peduncle length of main spike (r=0.296), biological yield per plant (r=0.885) and harvest index (r=0.220), in NWL 1 x GW 496 for number of effective tillers per plant (r=0.202), peduncle length of main spike (r=0.244), biological yield per plant (r=0.701) and harvest index (r=0.481), in P 11616 x PBW 524 for number of effective tillers per plant (r=0.950), peduncle length of main spike (r=0.455) and biological yield per plant (r=0.913) and in RWP 2002-2 x LOK 1 for number of effective tillers per plant (r=0.189), flag leaf area (r=0.261), peduncle length of main spike (r=0.267), 1000-grain weight (r=0.379), biological yield per plant (r=0.923) and harvest index (r=0.200). Positive relationships of grain yield per plant were observed by Sidhu *et al.* (1976); Singh *et al.* (1985); Tiwari and Rawat (1993); Korkut (1994); Dhayal *et al.* (2003) and Patel (2006) for plant height and number of effective tillers per plant, by Korkut (1994) for peduncle length of main spike and flag leaf area and by Sidhu *et al.* (1976); Korkut (1994); Shukla *et al.* (2000) and Patel (2006) for biological yield per plant and harvest index. Nanda *et al.* (1980); Khan *et al.* (1987); Mikheev (1992); Korkut (1994); Snecor (2001) and Patel (2006) observed positive association of grain yield per plant with length of main spike, number of grains per spike and 1000-grain weight. The findings of above said workers are in accordance with the findings of this study.

Genetic correlation under late sown condition :

Genetic correlation co-efficients(r) of grain yield

Table 1 : Genetic correlation co-efficient (r) of grain yield per plant with different traits in F_2 generation of eight crosses in bread wheat (*Triticum aestivum* L.) under timely sown condition (E_1)

Characters	AKW 770 x MP 4010 (Cross 1)	AKAW 2862-1 x MACS 2496 (Cross 2)	CLN 1 x GW 273 (Cross 3)	CLN 5 x GW 322 (Cross 4)	GW 9715 x K 9102 (Cross 5)	NWL 1 x GW 496 (Cross 6)	P 11616 x PBW 524 (Cross 7)	RWP 2002-2 x LOK 1 (Cross 8)
Days to heading	-0.105	-0.150	-0.161	0.308**	-0.118	0.102	0.190*	-0.338**
Days to maturity	-0.103	-0.060	-0.041	0.090	-0.376**	-0.105	-0.059	0.219*
Plant height	-0.154	-0.248**	0.263**	0.205*	0.144	-0.161	-0.048	-0.056
Number of effective tillers per plant	0.555**	0.267**	0.345**	0.143	0.098	0.202*	0.950**	0.189*
Length of main spike	0.315**	0.056	0.066	0.048	0.323**	0.067	0.081	0.132
Number of grains per spike	0.097	0.089	0.494**	0.137	0.187*	0.019	0.001	0.060
Flag leaf area	0.208*	0.565**	0.145	0.325**	0.026	-0.103	0.064	0.261**
Grain filling period	-0.022	0.573**	0.629**	0.384**	-0.273**	-0.068	0.083	0.152
Peduncle length	0.176	-0.100	-0.038	0.174	0.296**	0.244**	0.455**	0.267**
1000-grain weight	-0.759**	0.104	-0.038	0.142	-0.369**	0.055	-0.600**	0.379**
Biological yield per plant	0.681**	0.830**	-0.038	0.773**	0.885**	0.701**	0.913**	0.923**
Harvest index	0.189*	0.518**	-0.038	0.264**	0.220*	0.481**	0.103	0.200*

*and ** indicate significance of values at P=0.05 and 0.01, respectively

Table 2 : Genetic correlation co-efficient (r) of grain yield per plant with different traits in F_2 generation of eight crosses in bread wheat (*Triticum aestivum* L.) under late sown condition (E_2)

Characters	AKW 770 x MP 4010 (Cross 1)	AKAW 2862-1 x MACS 2496 (Cross 2)	CLN 1 x GW 273 (Cross 3)	CLN 5 x GW 322 (Cross 4)	GW 9715 x K 9102 (Cross 5)	NWL 1 x GW 496 (Cross 6)	P 11616 x PBW 524 (Cross 7)	RWP 2002-2 x LOK 1 (Cross 8)
Days to heading	0.035	-0.131	-0.170	0.130	0.019	0.302**	0.116	-0.051
Days to maturity	-0.069	0.043	-0.088	-0.079	0.056	0.266**	0.008	-0.263**
Plant height	0.237**	-0.427**	-0.193*	0.175	0.295**	-0.007	-0.275**	0.093
Number of effective tillers per plant	0.882**	0.424**	0.539**	0.982**	0.441**	0.521**	0.702**	0.580**
Length of main spike	0.434**	0.202*	0.102	0.450**	0.341**	0.431**	0.440**	0.272**
Number of grains per spike	0.736**	-0.016	0.382**	0.692**	0.345**	0.320**	0.435**	0.501**
Flag leaf area	0.161	-0.207*	0.116	0.118	-0.078	0.161	0.130	-0.004
Grain filling period	0.509**	0.346**	0.368**	0.355**	0.240**	0.269**	0.526**	0.425**
Peduncle length	0.439**	-0.267**	-0.027	0.069	0.068	-0.001	0.060	0.257**
1000-grain weight	0.433**	0.146	0.147	0.089	0.151	0.138	0.469**	0.752**
Biological yield per plant	0.893**	0.824**	0.910**	0.955**	0.916**	0.926**	0.785**	0.819**
Harvest index	0.110	0.076	0.094	0.028	0.074	-0.138	0.540**	0.623**

*and ** indicate significance of values at P=0.05 and 0.01, respectively

per plant with different traits in F_2 generation of eight crosses in bread wheat under late sown condition (E_2) are presented in Table 2.

Looking to the late sown condition, the significant negative genetic association for developmental traits was found for days to maturity in RWP 2002-2 x LOK 1 (r= -0.263) and for plant height in AKAW 2862-1 x MACS 2496 (r= -0.427), CLN 1 x GW 273 (r= -0.193) and P 11616 x PBW 524 (r=-0.275). While significant and positive correlation co-efficient between grain yield and yield attributing characters was exhibited in crosses AKW 770 x MP 4010 (r=0.439) and RWP 2002-2 x LOK 1 (r=0.257)for peduncle length of main spike, in AKW 770 x MP 4010 (r=0.433), P 11616 x PBW 524 (r=0.469) and RWP 2002-2 x LOK 1 (r=0.752) for 1000-grain weight and in cross P 11616 x PBW 524 (r=0.540) and RWP 2002-2 x LOK 1 (r=0.623) for harvest index. The traits like number of effective tillers per plant, grain filling period and biological yield per plant were positively and significantly associated with grain yield per plant in all the crosses. Positive and significant correlation of grain yield per plant with length of main spike and number of grains per spike was also reflected in all the crosses except for cross 3 and cross 2, respectively.

The correlation coefficient varied with cross to cross and season to season in present investigation. It was also noticed that the magnitude of genetic correlation and the number of cases were higher under late sown condition as compared to timely sown condition suggesting late sown condition more favoured the expression of genetic correlation as compared to timely sown condition. The results suggests that selection of early maturing and short statured plants in segregating generations rewards to obtain elite genotype from such crosses which showed negative correlation, while the positive association of grain yield per plant with yield contributing characters is of immense importance regarding exercising selection pressure in F_2 and subsequent segregating generations in relation to yield attributes for genetic improvement of grain yield. Number of effective tillers per plant, length of main spike, number of grains per spike, grain filling period and biological yield per plant are to be considered as a major important yield contributing traits for grain yield improvement in wheat. The reason is, these traits showed positive and significant correlation with grain yield in many crosses under both the environments.

REFERENCES

Dhayal, L.S., Sastry, E.V.D. and Jakhar, M.L. (2003). Character association in wheat (*Triticum aestivum* L.) grown under normal and saline conditions. *Crop Improv.*, **30** : 95-98.

Falconer, D.S. and Mackey, T.F.C. (1998). Introduction to quantitative genetics (4th Ed.). Longman Ltd., England.

Khan, S.H., Mian, M.A.K. and Isham, A. (1987). Variability and inter relationships of quantitative characters in bread wheat (*Triticum aestivum* L.). *Sarhad J. Agric.*, **3** : 201-603.

Korkut, K.Z. (1994). Correlation and path coefficient analysis in bread wheat under two sowing conditions. *Acta Agro. Hungarica*., **41**: 168-172.

Mikheev, L.A. (1992). Correlation of grain weight per ear with yield components in wheat hybrid. *Selektsiyai Semenovodstve Moskva,* 2-3: 17-21.

Nanda, G.S., Hazarika, G.N. and Gill, K.S. (1980). Association analysis in wheat. *Sci. & Culture*, **46**: 200-202.

Patel, V.V. (2006). Character association and selection indices in F_2 generation of bread wheat (*Triticum aestivum* L.). M.Sc. (Ag.) Thesis, Junagadh Agricultural University, Junagadh, GUJARAT (INDIA).

Searle, S.R.C. (1965). The value of indirect selection I. Mass selection. *Biometrics*, **21**: 682-707.

Shukla, R.S., Mishra, Y. and Singh, C.B. (2000). Variability and association in bread wheat under rainfed condition. *Crop Res. Hisar,* **19** : 512-515.

Sidhu, G.S., Gill, K.S. and Ghai, B.S. (1976). Correlation and path analysis in wheat (*Triticum aestivum* L.). *J. Res*., **13**: 235-241.

Singh, H.B., Sharma, J.K. and Sethi, G.S. (1985). Correlation among different traits and their relative contribution to grain yield in wheat. *Him. J. Agric. Res.,* **11**: 86-91.

Singh, S.P., Pianchi, A.A. and Narsinghani, V.G. (1982). Character correlations and selection indices in F_2 population of wheat. *Indian J. Agric. Sci.,* **52** : 424-429.

Snecor (2001). Correlation and path analysis in common wheat (*Triticum aestivum*L.) under light texture soil. *Res. Crops,* **2** : 99-101.

Tiwari, V.N. and Rawat, A.S. (1993). Variability and correlation studies between grain yield and its components in segregating generation of *aestivum* wheat. *Bhartiya Krishi Anusandhan Patrika*, **8** : 19-24.

Whitehouse, R.N.H., Thompson, J.B. and Riberio, D.V. (1958). Studies on the breeding of self-pollinated cereals 2. The use of diallel cross analysis in yield prediction. *Euphytica,* **7** : 147-169.