Indian Res. J. Genet. & Biotech 7(2) : 227 – 234 (2015)

Correlation coefficient Studies among Advanced lines of wheat

Anjani Kumar Singh and A.K. Sharma

Regional Agricultural research Station (SKUAST-J) Rajouri 185 131 (J&K)

Received: January 2015; Revised: March 2015; Accepted: April 2015)

Abstract

The performance of eight improved cultivars of wheat genotypes were examined on field trials under cool climatic conditions of hills (950 m above mean sea level) under water deficit and normal condition during rabi-2007-08 and 2008-09. Combined analysis had a significant different at 1% level for genotype, environments and their interactions for all characters. Additive gene effect of biomass under normal situation and non- additive gene effect of seed weight and grain yield, respectively, in stress and non-stress condition could be utilized for the improvement of wheat cultivars suitable for elevation of mid hills.

Key words: Genetic variation, intermediate altitude, low temperature and water deficit.

Introduction

Wheat (*Triticum aestivum* L. emend. Fori & Paol.) is cultivated over vast areas of Jammu and Kashmir State with a total production of 4959 thousand q and average productivity of 17.82 q ha^{-1} (MOA, 2008) which is far below than national average (27.88 q ha^{-1}). In hills wheat is raised as rainfed crop which mainly thrives on receding moisture of rainy season. Maximum yield potential of crop can be realized in presence of favorable environment. Thresholds like rain fall and temperature do always exist to determine the yield in addition to describe physiological and developmental features of plant characteristics and to delineate the length of cropping season at growing site. At mid hills climate remains cool, with maximum ranging from 32^0C to 12^0C and minimum ranging from 11^0C to -2^0C, but random occurring of intermittent drought poses to be a potent constraint in realizing the optimum level of wheat yields. The recurrence of drought like situation and to overcome the problem of chilling temperatures during early stages of crop growth provide the impetus for the development of cultivars with stress tolerance in order to bring stability towards wheat yields under mid hill conditions.

Wheat is cultivated in vast areas of Jammu and Kashmir state in relatively fertile lands of hills under rainfed and irrigated conditions. At intermediate altitude climate remains cool, but random occurring of drought condition. Improved wheat cultivars often fail to exhibit total yield potential when subject to grow in areas with low moisture availability under cool environmental situation at high hills. Relative improvement of cultivars, therefore, depends on availability of genetic variability exist within wheat population. The development of cultivars with stress tolerance becomes more necessary to bring stable yield under sustainable agricultural systems of wheat cultivation at intermediate altitude areas of this region. In the present investigation relative performance of cultivars were examined under water deficit stress and near optimum growing conditions at intermediate hills

Materials and methods

The eight genotypes (viz., VL-900, VL-898, VL-804, VL-872, VL-738, HS-295 and HS-240), were evaluated at Regional Agricultural Research Station, SKUAST-J, and altitude of 950m above mean sea levels. The prevailing climatic condition does not always permit double cropping at this elevation on same land because of prolong growing season, for both *kharif* and *rabi* crops, which overlaps each other. Planting of wheat cultivars during late October are found suitable for existing cropping pattern at intermediate altitude. Seeds were sown on October 29 and 20, respectively, for the year 2007 and 2008 on field at the rate of 100 kg/ha. Experiments were laid out in a randomized block design with three replications. The distance between two rows and the length of single rows as maintained 0.23 and 3 meters, respectively, with plot size 4x1.38 m^2. Recommended doses of fertilizers were applied to

Corresponding authors- e-mail: *apsinghagron@gmail.com*
Published by the Indian Society of Genetics, Biotechnology Research and Development
Biotech Bhawan 5 E Nikhil Estate, DPS Road, Shastripuram, Agra 282007
Online management by www.isgbrd.co.in

maintain the normal growth and development of plant at experimental fields. Weather data for rainfall, maximum and minimum temperature were observed at this station standard meteorological weeks was calculated and observations were analysed graphically to see if there is any observable variation in the environmental conditions over the two years. Figure 1 shows the prevailing environmental conditions characterized by rainfall during the wheat growing period in 2007-08 and 2008-09. Differences in rainfall for this duration between the two years were compared. This showed that the year 2007-08 suffered from an early season water stress that lasted up to the last week of December. The year 2008-09 was designated as normal. Similarly, Figure 2 shows the prevailing environmental conditions with respect to the weekly averaged meteorological maximum and minimum temperatures over the two years. A comparison of these suggests that the difference between the weekly average maximum and minimum temperatures up to the 52nd meteorological week was greater for the water stress year (2007-08) than the normal year (2008-09). The influence of water deficit stress on wheat cultivars in this investigation was examined by comparing the performance on field trial conducted during 2007-08 and 2008-09. Observation were recorded for days to 50 % heading (days), plant height (cm), days to 50 % maturity (days), 100-seed weight, (g), grain yield (kg/plot), straw yield (i.e. biomass; kg/plot) and harvest index (%). Standard procedures were employed for the computation of analysis of variance on individual environment and combined over two environments. Mean performance of characters were estimated for each environment separately. Standard statistical procedures were followed for estimating genetic constants i.e. Data thus generated was subjected to computation of analysis of variance on individual environment and combined over two environments using WINDOSTAT ver. 8.5 software. Correlation coefficients were calculated following the formula suggested by Searle, (1971).

Result and discussion

Maximum yield potential of crop realize in presence of favorable environment. Threshold, like rain fall and temperature, do always exist to determine the yield in addition to describe physiological and developmental features of plant characteristics and to delineate the length of cropping season at growing site. The results revealed that atmospheric temperature on 2007-08 remained relatively cooler in comparison to that experienced on 2008-09 while wheat cultivars were exposed to water deficit stress during 2007-08 at mid hill altitude. Mean square of the treatment effects for grain yield and other characters, resulting from separate analysis for individual environment and for combined analysis over two environments (table-1), were significant. These results suggested the existence of genetic variation for grain yield and other characters in the population and showed differential reaction of wheat cultivar in their relative adaption to water deficit stress environments at intermediate hills.

Grain yield had significant positive correlation with biomass (0.548) in stress environmental condition (Table-2). This indicated that ability for grater biomass production in stress situation was a good indicator for obtaining high yield. Under stress free situation harvest index exhibited significant positive and negative correlation with grain yield (0.712) and biomass (-0.305), respectively. This indicated that effective partitioning of photosynthates had enabled them to establish desired relation of grain yield and biomass with harvest index and negatively significant inverse association of harvest index with both grain yield (-0.596) and biomass (-0.563) in stress situation. It explained that physiological deterrence of plants fall in requirement of optimum moisture level. This suggested that harvest index could not be utilizes as a good selection criterion for improving grain yield among wheat cultivars in stress situation because it failed to maintain normal physiological function at post-flowering grain filling stage of crop growth to restore the desired relation with grain yield at an exposure to water deficit condition at intermediate altitude. Moreover the natures of this response upon improved wheat cultivars at mid hills appeared to be more complex in nature and were possibly influenced by synergistic effect of multiple stress of environment, as indicated by the presence of poor relation among grain yield, biomass and harvest index at different combination of stress and non-stress environments (0.458, 0.250,-0.114,-0.178,-0.082 and 0.022) Grain yield and harvest index for stress environment constituted significant positive correlation with seed weight (0.453, 0.454) and non-stress (0.790, 0.548) environments. Between stress and non-stress environment seed weight had significant positive association (0.480) but showed an independent behavior with grain yield in non-stress (0.125). It was, therefore, apparent that seed weight reported by (Reynolds *et al*., 1996) could be utilized as an effective selection criterion for the enhancement of grain yield in stress environment at intermediate hills. High biomass concomitantly increased the number days to maturity (0.296) in stress environment and imposed restrictions for desire improvement on grain yield at intermediate altitude among improved cultivars. This suggested that a method of indirect selection related to the expression of dehydration stress inducible gene may prove effective for increasing yield

and water deficit stress situation at intermediate altitude. This result that additive gene effect of biomass in normal situation and non- additive gene effect of seed weight and grain yield respectively in stress and non-stress condition could be utilized for the improvement of wheat cultivars at intermediate altitude; however indirect selection through modern screening techniques seemed to identify tolerant genotypes more efficiently. Therefore, emphasis on these characters in selection and improvement of seed yield in wheat breeding may be rewarding and effective under rainfed area previous studies of different workers Sharon *et. al*., (2000), Blum *et. al*.,(1997), Tomar *et. al*., (2003) Kazmi , R H *et. al(*.2005) also support the present findings of this investigation.

Table1. Individual and combined (comb) analysis of variance of seven characters in cultivars grown under water deficit stress (ST) and non-stress (NS) environments at mid hills altitude

Source	Sou-rce		Df	Days to flowering	Days to maturity	Plant height	Seed weight	Grain yield	Bio-mass	Harvest Index
Replication	2	NS	15.8	17.2	2.3	0.1	2864.6	124763.4	4.2	
		ST	6.3	13.8	0.8	6.2	136291.4	1808064.0	3.4	
	2	Comb	11.1	15.5	1.5	0.1	69578.0	966413.3	3.8	
Genotypic (G)	6	NS	61.1**	29.0**	111.5**	2.6**	305529.3**	628181.3**	5.1**	
		ST	139.2**	22.4**	113.0**	1.6**	203247.1**	1571769.0**	7.4**	
	6	Comb	179.3**	16.2**	215.3**	3.1**	318056.0**	402083.5**	6.4**	
Year (Y)	1	Comb	780.1**	3259.5**	8.1**	3.9**	3631488.0**	31410690.0**	89.5**	
GXY	6	Comb	21.4**	35.2**	9.1**	1.1**	190716.4**	179786.0**	6.1**	
Error	12	NS	1.4	7.4	2.4	0.1	5083.7	88804.1	3.8	
		ST	1.7	15.9	2.3	0.2	46677.8	1942814.0	3.2	
	20	Comb	1.6	11.6	2.4	0.2	25880.9	1015816.0	3.5	

Table 2: Estimates of correlation coefficients among different characters of wheat cultivars at intermediate altitude under stress and non-stress environments

Character	Non-stress	Stress	Non-stress vs stress	Stress vs Non-stress
DF vs DF	1.000	1.000	0.988**	0.988**
DM	-0.638**	0.144	0.001	-0.659**
PH	-0.361*	-0.298	-0.235	-0.407
SW	-0.454*	-0.580**	-0.602**	-0.563*
GY	0.216	-0.312	-0.244	0.258
BM	-0.098	-0.219	-0.215	-0.047
HI	0.191	-0.676**	-0.652**	0.117
DM *vs* DM	1.000	1.000	-0.245	-0.245
PH	0.415*	-0.507*	0.379	-0.386
SW	0.564*	-0.010	0.856**	-0.711**
GY	0.115	-0.356	0.665**	0.182
BM	0.492*	0.296	0.236	0.151
HI	0.188	0.043	0.494*	-0.486*
PH *vs* PH	1.000	1.000	0.975**	0.975**
SW	0.129	0.316	0.430	0.132
GY	-0.756**	-0.147	-0.150	-0.733**
BM	0.371*	-0.290	-0.217	0.421
HI	-0.519**	0.003	0.144	-0.423
SW *vs* SW	1.000	1.000	0.480*	0.480*
GY	0.125	0.453*	0.790**	0.151
BM	-0.343	0.070	0.193	0.372
HI	0.647**	0.454*	0.548*	-0.009
GY *vs* GY	1.000	1.000	0.458	0.458
BM	-0.027	0.548*	0.025	-0.114
HI	0.712**	-0.596**	-0.146	0.738**
BM *vs* BM	1.000	1.000	-0.178	-0.178
	-0.305	-0.783**	-0.300	0.082
HI *vs* HI	1.000	1.000	0.022	0.022

**,* Significant at 1 and 5 percent levels of probability, respectively
DF= Days to 50 % flowering, DM= Days to 50% maturity, PH=Plant height
SW= Seed Weight, GY= Grain Yield, BM= Bio-mass, HI=Harvest index

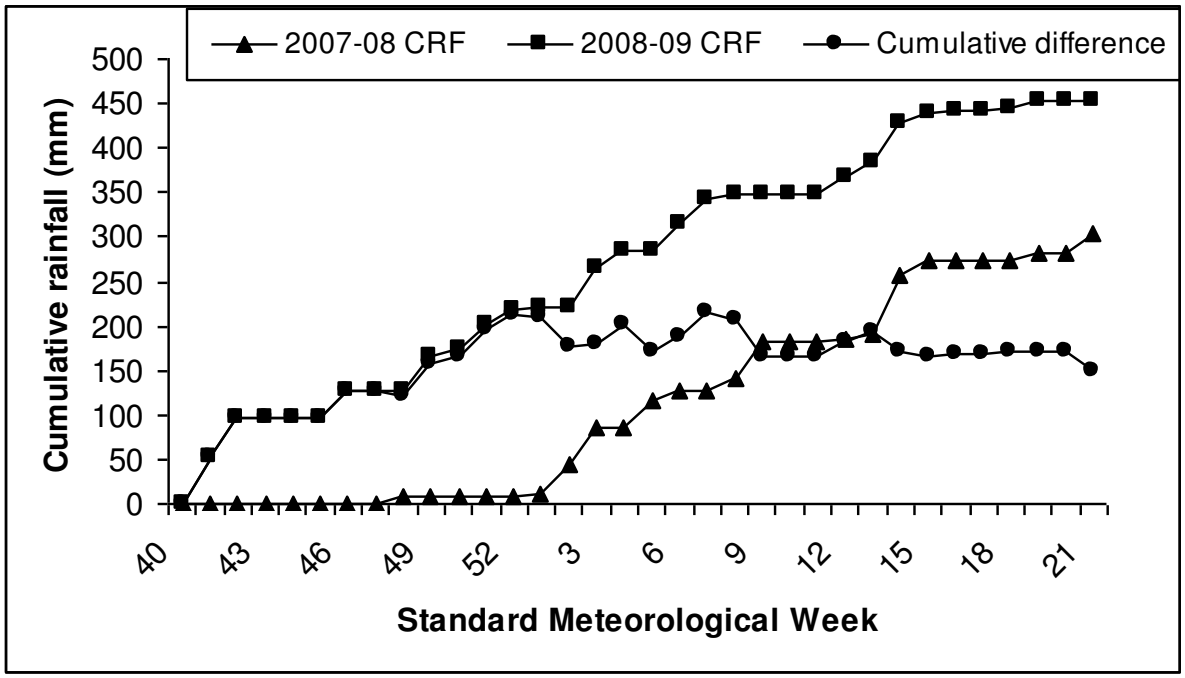

Figure 1: Rainfall distribution during the wheat growing seasons of 2007-08 and 2008-09 as recorded at the agrometeorological observatory, RARS, Rajouri.

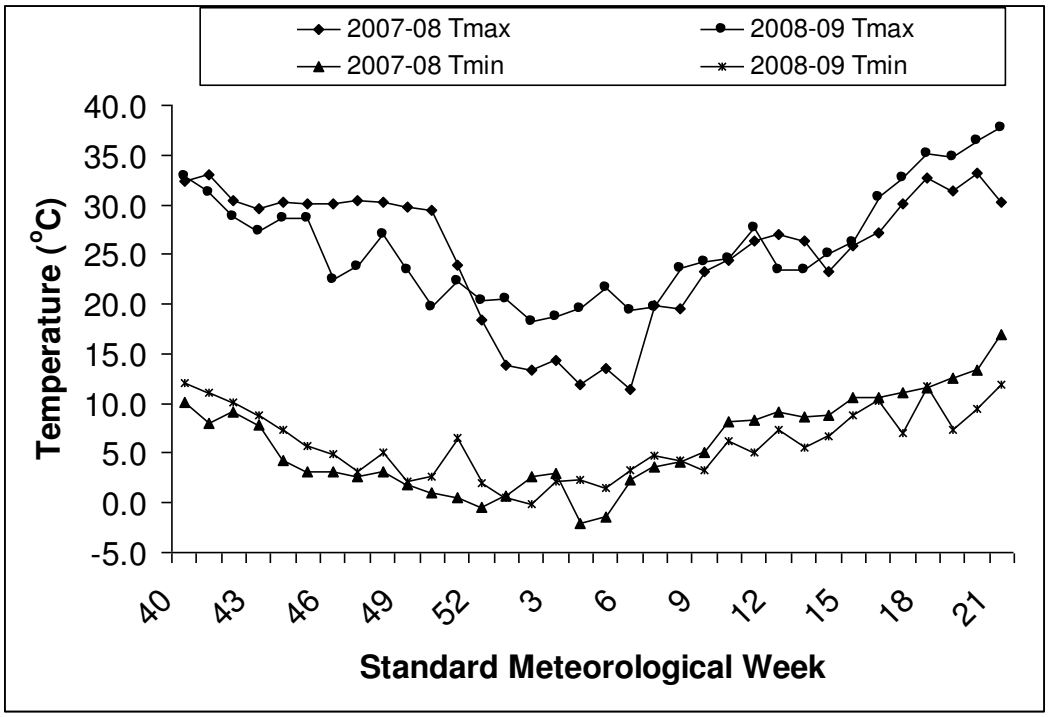

Figure 2: Distribution of maximum and minimum temperatures during the wheat growing seasons of 2007-08 and 2008-09 as recorded at the agro-meteorological observatory, RARS, Rajouri.

Table 2: Estimates of correlation coefficients among different characters of wheat cultivars at intermediate altitude under stress and non-stress environments

Character	Non-stress	Stress	Non-stress vs stress	Stress vs Non-stress
DF vs DF	1.000	1.000	0.988**	0.988**
DM	-0.638**	0.144	0.001	-0.659**
PH	-0.361*	-0.298	-0.235	-0.407
SW	-0.454*	-0.580**	-0.602**	-0.563*
GY	0.216	-0.312	-0.244	0.258
BM	-0.098	-0.219	-0.215	-0.047
HI	0.191	-0.676**	-0.652**	0.117
DM *vs* DM	1.000	1.000	-0.245	-0.245
PH	0.415*	-0.507*	0.379	-0.386
SW	0.564*	-0.010	0.856**	-0.711**
GY	0.115	-0.356	0.665**	0.182
BM	0.492*	0.296	0.236	0.151
HI	0.188	0.043	0.494*	-0.486*
PH *vs* PH	1.000	1.000	0.975**	0.975**
SW	0.129	0.316	0.430	0.132
GY	-0.756**	-0.147	-0.150	-0.733**
BM	0.371*	-0.290	-0.217	0.421
HI	-0.519**	0.003	0.144	-0.423
SW *vs* SW	1.000	1.000	0.480*	0.480*
GY	0.125	0.453*	0.790**	0.151
BM	-0.343	0.070	0.193	0.372
HI	0.647**	0.454*	0.548*	-0.009
GY *vs* GY	1.000	1.000	0.458	0.458
BM	-0.027	0.548*	0.025	-0.114
HI	0.712**	-0.596**	-0.146	0.738**
BM *vs* BM	1.000	1.000	-0.178	-0.178
	-0.305	-0.783**	-0.300	0.082
HI *vs* HI	1.000	1.000	0.022	0.022

**,* Significant at 1 and 5 percent levels of probability, respectively
DF= Days to 50 % flowering, DM= Days to 50% maturity, PH=Plant height
SW= Seed Weight, GY= Grain Yield, BM= Bio-mass, HI=Harvest index

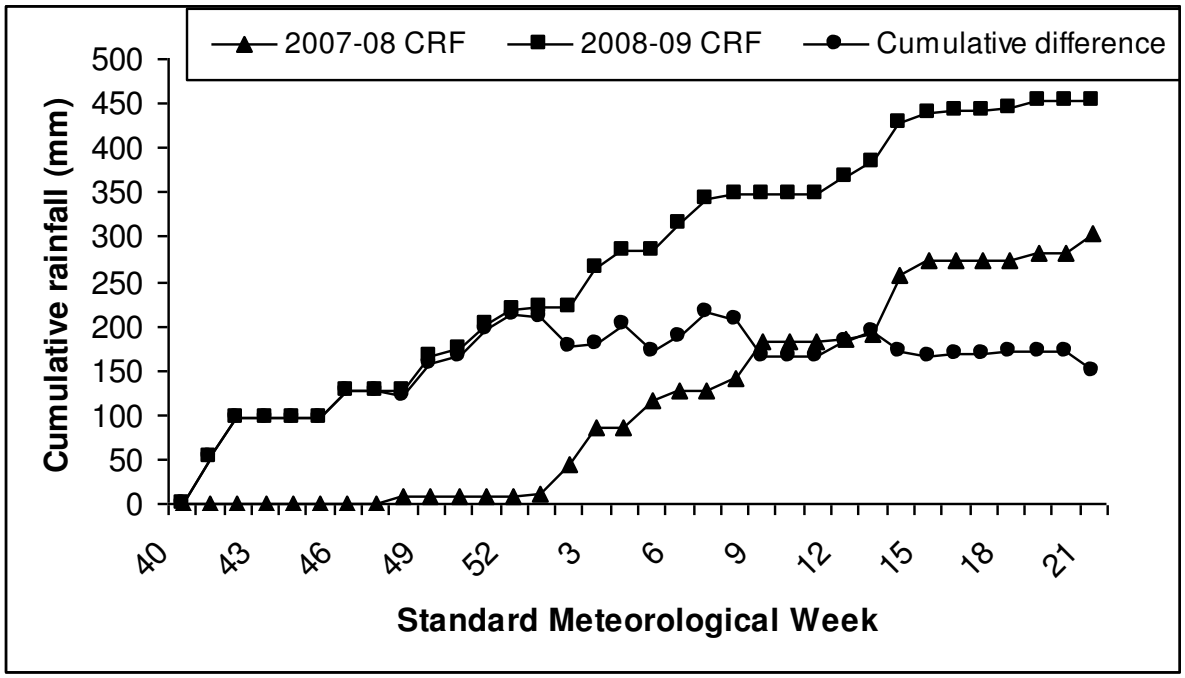

Figure 1: Rainfall distribution during the wheat growing seasons of 2007-08 and 2008-09 as recorded at the agrometeorological observatory, RARS, Rajouri.

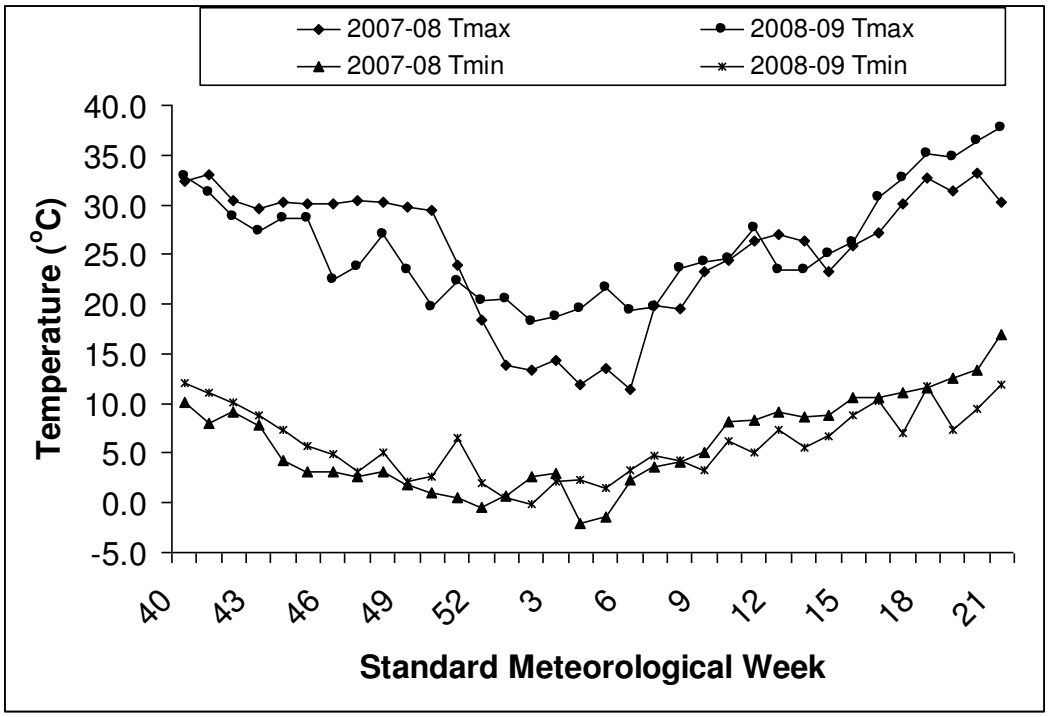

Figure 2: Distribution of maximum and minimum temperatures during the wheat growing seasons of 2007-08 and 2008-09 as recorded at the agro-meteorological observatory, RARS, Rajouri.

References

1. **Blum A., Sullivan CY and Nguyen H.T.** 1997. The effect oof plant size of wheat respance to drought stress .II water deficit , heat and ABA. *Aust. Journal. Plant Physiol.*, **24**:43-48

2. **Burton, G.W**. 1952. Quantitative inheritance in grasses. Proc. IV Institute Grassland Congress. **1**: 155-157.

3. **Dewey, D. R. and Lu, K.H.** 1959. A correlation and path coefficient analysis of components of crested wheat grass seed production. *Agron.* J. **51** : 515-518.

4. **Hanson, C. H., Robinson, H. F. and Comstock, R. E.** 1956. Biometrical studies of yield in segregating population of Korean lespedza. *Agron*. J. **48** : 268-272.

5. **Reynolds M.P., Rajaram M.P. and Mc Nab A.** 1996. Increasing yield potential in wheat. Breaking the barriers. *In*; Proc.of workshop held in Mexico.pp.101-133

6. **Sharon J., Hariprasad A.S., Lakshmi Kant, Mani V.P. and Chauhan V.S.**2000. Association and contribution of yield attributes to seed yield in wheat under varying environments in north western hills. *Ann .Agric. Res*., **21**:274-278

7. **Searle, S. R.** 1961. Phenotypic genotypic and environmental correlations. *Biometrics* **57**: 474-480.

8. **Singh, T. and Sharma, R. K.** 2007. Genetic variability, character association and path analysis of yield and its component characters in duram wheat. *Progressive Agriculture* **7(1/2):** 15-18.

9. **Tomar RK., Tripathi R.P., Garg R.N., Dwivedi B.S., Gupta V.K., Sahoo RN.,Chakraborty D and Mahabir A.V.** 2003. Influence of soil moisture regmis on plant water relationship, growth and productivity of wheat (T*riticum aestivum L*.) cultivar under shallow water table conditions in of Uttaranchal. *Ann.Agric.Res*., **24**: 723-736.

10. **Kazmi ,RH., Khan, MQ. and Abbasi MK** 2005.Yield and yield components of wheat subjected to water stress under rainfed conditions in Pakistan. Acta Agron. Hungrica. 51**(3)**315-323.