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Assessment of Wheat Genotypes for Yield and its Components Developed through Gama Rays

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***Abstract*— *An experiment was conducted to assess the advance spring wheat mutant lines for some quantitative traits in ten genotypes of wheat (Triticumaestivum L.) evolved through mutation breeding techniques along with two check varieties (NIA- Sunahri and Kiran-95). The experimental trial was conducted in the field of Plant Genetics Division, Nuclear Institute of Agriculture (NIA), Tandojam, during Rabi season 2011-2012. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. The experimental material was examined for mean performance, correlation coefficient and regression coefficient of important yield components towards grain yield plant^{-1}. The mean squares (ANOVA) and mean performances of ten wheat genotypes revealed highly significant differences at ($p<0.01$) level fordays to 75% heading, days to 75% maturity, spikelets spike^{-1}, grains spike^{-1}and grain yield of main spike, while harvest index is significant at ($p<0.05$) level. The trait grain yield plant^{-1} was positively and highly significantly associated with days to 75% heading, spikelets spike^{-1}and grains spike^{-1} while significantly and positively correlated with grain yield of main spike (g), however, it was non-significantly associated with days to 75% maturity and harvest index (%).Regression analysis showed that an increase in the days to 75% heading, days to 75% maturity, spikelets spike^{-1}, grains spike^{-1}, grain yield of main spike and harvest index (%) will increase grain yield plant^{-1} by 0.261, 0.195, 1.120, 0.376, 10.432 0.398 grams, respectively. It was, therefore, suggested that days to heading, spikelets spike^{-1}and grains spike^{-1} should be given emphasis for future wheat yield improvement programs.*

***Keywords*— Wheat, correlation, mutation breeding, agronomic traits.**

I. INTRODUCTION

Bread Wheat (*TriticumaestivumL.*) has got a very unique position among all the cereals being cultivated throughout the world. It occupies the central position in formulating agricultural policies (Farooq, 2011). Creative human studies have produced tangible results in the evolution of new wheat varieties from the crosses of old and new varieties in view of an enhanced consumption pressure of growing population. The reduction in production of wheat stresses the need to develop genotypes with consistent performance over a wider range of environments.

Crop improvement using induced mutagenesis is now well Standardized. A large number of new promising varieties in wheat crop have successfully been developed world wide using both physical and chemical mutagens. Recent advances in technology combined with classic crop improvement using induced mutagenesis is now well being, mutation breeding offers new and exciting challenges for development of new varieties. (Datta, 2005).

Correlation is the simultaneous variation of two variables. It is often desirable to observe and measure the relationship between two series because in case of relationship, the fluctuation in one result into a proportionate variation in the other. Hence, the breeding work gets simplified and facilitated. (Bhutto et al., 2005).

II. MATERIALS AND METHODS

To evaluate ten wheat genotypes viz., Mutant-9, Mutant-12, Mutant-17, Mutant-22, Mutant-28, Mutant-29, Mutant-32, Mutant-34, evolved through mutation breeding techniques along with two check varieties (NIA- Sunahri and Kiran-95), the experiment was conducted in Randomized Complete Block Design (RCBD) during Rabi season 2011 with three replications at experimental area of Nuclear Institute of Agriculture (NIA), Tandojam. Fourrows/entrywere kept, with 30cm row to row distance and 2 meter row length. The data was recorded on days to 75 % heading, days to 75 % maturity, spikelets spike^{-1}, grains spike^{-1}, grain yield of main spike (g) and harvest index (%). The data collected was subjected to statistical analysis according to the Gomez and Gomez (1984) andSnedecor and Cochran (1987). Correlation coefficient and regression coefficient were calculated for following character combinations.

1. Days to 75% heading V/S Grain yield plant^{-1}
2. Days to 75% maturity V/S Grain yield plant^{-1}
3. Spikelets spike^{-1} V/S Grain yield plant^{-1}
4. Grains spike^{-1} V/S Grain yield plant^{-1}
5. Grain yield of main spike V/S Grain yield plant^{-1}
6. Harvest index V/S Grain yield plant^{-1}

III. RESULTS

The mean squares (ANOVA) and the mean performances of ten wheat genotypes are presented in Table- 1 and Table- 2 respectively. Table- 1 showed that genotypes are highly significant at 0.01 level for days to 75% heading, days to 75% maturity, spikelets spike^{-1}, grains spike^{-1}, grain yield of main spike (g), while harvest index is significant at ($p<0.05$).

Table.1: Analysis of variance (mean squares) of ten genotypes for twelve important agronomic characters of bread wheat

Characters	Replication mean square(DF.2)	Genotypes mean square (DF.9)	Error mean square (DF.18)	F-value
Days to 75% heading	0.1333	34.7444	2.4667	14.09**
Days to 75% maturity	0.10000	8.16296	0.84074	9.71**
Spikelets spike^{-1}	7.50533	5.09704	0.60904	8.37**
Grains spike^{-1}	29.457	250.199	34.560	7.24**
Grain yield of main spike (g)	0.10192	0.31122	0.04475	6.95**
Harvest index (%)	71.4885	30.1492	11.5059	2.62*

Table.2: Mean performance of yield and yield contributing characters of wheat genotypes.

Genotypes	Days to 75% heading	Days to 75% maturity	Spikelets spike^{-1}	Grains spike^{-1}	Grain yield of main spike (g)	Harve-st index (%)
Mutant-9	88	116.67	20.4	60.133	2.177	40.523
Mutant-12	88.667	116.67	21.267	64.067	2.277	38.365
Mutant-17	84	115.33	19.667	54.133	2.03	34.373
Mutant-22	82.333	115.00	19.533	55.067	2.203	35.123
Mutant-28	88.667	117.33	22.133	68.267	2.243	37.84
Mutant-29	90	117.00	22	64.467	2.247	40.72
Mutant-32	82.333	114.67	18.2	47.4	1.703	37.386
Mutant-34	89.333	118.33	20.2	51.533	1.553	36.914
NIA-Sunahri	81.667	113.33	18.867	52	2.23	37.277
Kiran- 95	89.333	113.67	19.4	77.2	2.717	29.84
LSD @ 5%	2.6941	1.5729	1.3387	10.084	0.3629	5.8187

Days to 75% heading

The analysis of variance for days to heading of different wheat genotypes is given in Table-1. The F-value of 14.09 showed highly significant difference among the genotypes. The mean performance for days to heading is presented in Table-2.The mean values revealed that the genotypes differed significantly from each other. The check variety NIA-Sunahri took minimum days to heading (81.667) followed by genotype M-32 and M-22, the genotypes M-29, M-34 and Check variety Kiran-95 took maximum days to heading as compared to all other genotypes. While the genotypes M-9, M-12, M-17, M-28 took more or less equal days to heading.

Days to 75% maturity

The analysis of variance for the character days to maturity is given in Table-1. The analysis of variance showing F-value of 9.71 indicated highly significantly difference among the genotypes. The mean performance for days to maturity is presented in Table-2. The mean values of genotypes were differed significantly from each other. These values were ranged from 113.333 to 118.333. In the present study check varieties NIA-Sunahri, Kiran-95 and genotype M-32 took minimum days to maturity. The genotypes M-28, M-29 and M-34 took maximum days to maturity.

Spikelets spike $^{-1}$

In Table-1, F-value (8.37) indicating highly significant difference among all genotypes for the character of spikelets spike $^{-1}$. In Table-2, the mean values of the genotypes are ranging between 18.2 to 22.133. The genotype M-28 produced maximum number of spikelets spike^{-1} (22.133) as compared to all other genotypes. The minimum number of spikelets^{-1}spike were produced by genotype M-32 (18.2). The mean performance of check varieties NIA-Sunahri and Kiran-95 statistically at par to rest of the genotypes.

Grains spike $^{-1}$

The analysis of variance for grains spike $^{-1}$of different genotypes and check varieties are presented in Table-1. The F-value of 7.24 indicated highly significant differences among all the genotypes. The mean performance of all the genotypes for grains spike^{-1} is depicted in Table-2, which reveals that the genotype differed significantly from each other. Their values are ranging from 47.4 to 77.2. The check variety Kiran-95 produced maximum number of grains spike^{-1} (77.2) followed by genotype M-28 (68.267), M-29 (64.467) and M-12 (64.067). However, the genotype M-32 reflected minimum number of grains spike^{-1} (47.4) followed by genotype M-34 (51.533) and check variety NIA-Sunahri (52.000).

Grain yield of main spike (g)

The data regarding analysis of variance for the character grain yield of main spike is summarized in Table-1. The F-value 6.95 indicating highly significant difference among the genotypes.The mean performance of M_5 genotypes and check varieties for the traits grain yield of main spike, is shown in Table-2, which revealed great differences among the genotypes. The mean values of all the genotypes are ranging between 1.553 to 2.717. The check variety Kiran-95 (2.717) and genotype M-12 (2.277) produced maximum grain yield of main spike followed by genotype M-28 (2.243) and check variety NIA-Sunahri (2.23). The genotype M-34 produced the lowest grain yield of main spike (1.553). While other genotypes remains at par to check variety NIA-Sunahri.

Harvest index (%)

The mean square for harvest index is presented in Table-1, the F-value 2.62 indicating significant differences among all the genotypes. The mean performance of genotypes for harvest index is depicted in Table-2, reveals that the genotypes differed from each other and the values are ranging b/w 29.84 to 40.72. The genotype M- 29 (40.72) showing maximum harvest index % followed by genotype M-9 (40.523). However, the check variety Kiran-95 (29.84) showing minimum harvest index %, while other genotypes remain at par to check variety NIA-Sunahri.

Table.3: The value of correlation coefficient (r), coefficient of determination (r^2), regression coefficient (b) and their significance for main agro-economical traits and grain yield plant^{-1} combinations in wheat.

S.No.	Characters	Correlation 'r'	Coefficient of determination $(r)^2$	Regression coefficient'b'	Remarks
1	Days to 75% heading v/s Grain yield plant^{-1} (g)	0.617	0.38024	0.261	**
2	Days to 75% maturity v/s Grain yield plant^{-1} (g)	0.351	0.12337	0.195	N.S
3	Spikelets spike^{-1} v/s Grain yield plant^{-1} (g)	0.790	0.62489	1.120	**
4	Grains spike^{-1} v/s Grain yield plant^{-1} (g)	0.674	0.45476	0.377	**
5	Grain yield of main spike (g) v/s Grain yield plant^{-1} (g)	0.543	0.29550	10.432	*

Correlation coefficients and regression analysis

Correlation coefficient coefficients (r), coefficients of determination (r^2), regression coefficients (b) and their test of significance (t) between grain yield and other quantitative traits were conducted in ten genotypes for twelve characters viz., days to 75% heading, days to 75% maturity, spikelets spike^{-1}, grains spike^{-1}, grain yield of main spike (g) and harvest index (%) are presented in table-3. The results are described hereunder

Days to 75% heading v/s grain yield plant^{-1} (g)

Highly significant correlation coefficient (r =0.617)** had been obtained between days to 75% heading and grain yield plant^{-1}, (Table-3). Coefficient of determination revealed that 38.02% of the total variability in grain yield plant^{-1} was due to its association with days to 75% heading. The regression coefficient determined an increase of 0.261 grams in grain yield plant^{-1} with increase a day in days to 75% heading.

Days to 75% maturity v/s grain yield plant^{-1} (g)

The Table-3 reveals that the character days to 75% maturity showed non-significant association (r= 0.351)$^{N.S}$ with grain yield plant^{-1} (g), which indicating that 12.34 per cent variation in grain yield plant^{-1} was caused due to the variation in days to 75% maturity. Regression coefficient indicated that with delay of one day in maturity, the grain yield increased by 0.195 grams.

Spikelets spike^{-1} v/s grain yield plant^{-1} (g)

The Table-3 shows a highly significant positive correlation between spikelets spike^{-1} and grain yield plant^{-1} (r= 0.790). The coefficient of determination indicated 62.48 per cent of the total variability in grain yield plant^{-1}to be accounted for its association with spikelets spike^{-1}. The value of regression coefficient indicated that because of a unit increase in spikelets spike^{-1} will result in simultaneous increase of 1.120 grams in grain yield plant^{-1}.

Grains spike^{-1} v/s grain yield plant^{-1} (g)

The Table-3 depicts a highly significant positive correlation (r= 0.674) between grains spike^{-1} and grain yield plant^{-1}. The coefficient of determination indicated that 45.48 per cent of the total variability in grain yield plant^{-1} can be accounted for its association with grains spike^{-1}. Regression coefficient indicated that with a unit increase in grains spike^{-1}, the grain yield plant^{-1} increased by 0.376 grams.

Grain yield of main spike (g) v/s grain yield plant^{-1}

A significant positive correlation (r= 0.543) has been computed between grain yield of main spike and grain yield plant^{-1} (Table-3). The coefficient of determination indicated that 29.55 per cent variation in grain yield plant^{-1} could be accounted for its association with grain yield of main spike. The coefficient of regression displayed that an increase of a yield in main spike will results in a corresponding increase of 10.432 grams in grain yield plant^{-1}.

Harvest index % v/s grain yield plant^{-1} (g)

The Table-3 reveals non-significant and positive correlation (r= 0.329) between harvest index and grain yield plant^{-1}. the coefficient of determination indicated that 10.83 per cent of the total variability in grain yield plant^{-1} was due to its relationship with harvest index (%). The regression coefficient indicated that with a unit increase in harvest index, the grain yield plant^{-1} increased by 0.398 grams.

IV. DISCUSSION

1) Mean performance of genotypes

The mean squares revealed highly significant differences among the genotypes for the characters viz., days to 75% heading, days to 75% maturity, plant height, tillers plant^{-1}, spike length, spikelets spike^{-1}, grains spike^{-1}, grain yield of main spike, grain yield plant^{-1} and biological yield. Whereas significant for harvest index and non-significant for 1000- grains weight. It reflects great genetic variability among the material studied.

The results regarding to mean performance of the genotypes for twelve important traits reveals that check variety NIA-Sunahri, genotype M-22 and M-32 were early in days to heading, whereas the genotypes M-29, M-34 and check variety Kiran-95 were late in days to heading. As for as days to maturity is concerned, the check varieties NIA-Sunahri and Kiran-95 were early in maturity and late maturing genotypes were M-28 and M-34.For the character spikelets spike^{-1}, genotypes M-28 and M-29 produced maximum spikelets spike^{-1}. The maximum grains spike^{-1} produced by check variety Kiran-95 followed by the genotype M-28. As far as the trait grain yield of main spike^{-1} is concerned, the check variety Kiran-95 produced maximum grain yield of main spike followed by the genotypes M-12, M- 28 and M-29. The maximum harvest index (%) value were attained by the genotypes M-9 and M-29, The present findings revealed great difference among the genotypes, which

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reflecting utilization of such variability for the improvement of crop as well as for the trait concerned. Several researchers like Memon*et al.* (2007), Mohammad *et al.* (2008), Anwar *et al.* (2009), Haq*et al.* (2010)and Mohibullah*et al.* (2012) indicated the observed variability among the genotypes in wheat in various morphological characters.

2) Correlation coefficients and regression analysis

Correlation coefficient and regression studies between grain yield and other quantitative traits were conducted in ten genotypes for the characters viz., days to 75% heading, daysto 75% maturity, plant height (cm), tillers plant^{-1}, spike length (cm), spikelets spike^{-1}, grains spike^{-1}, grain yield of main spike (g), 1000-grains weight (g), biological yield plant^{-1} (g) and harvest index (%) combinations with grain yield plant^{-1}. The results obtained for correlation coefficients (r), coefficients of determination (r^2), regression coefficients (b) and their test of significance (t) are presented in table-3. The results are described hereunder.

The present findings revealed that there existed a highly significant positive correlation between these two characters. These results are in agreement with the findings of Akhter*et al.* (2011), who also reported significant and positive correlation between these characters. The coefficient of determination indicated that variability of 38.02 per cent in grain yield plant^{-1} was due to its association with days to 75% heading. The regression coefficient determined an increase of 0.261 grams in grain yield plant^{-1} with a unit increase in days to 75% heading. Therefore early heading genotypes would be important selection criteria for improved grain yield plant^{-1} in the breeding material studied. A non-significant positive correlation has been obtained between days to 75% maturity and grain yield plant^{-1}. Coefficient of determination indicated that 12.34 per cent variation in grain yield plant^{-1} (g) was caused by its association with days to 75% maturity. Regression coefficient indicated that with a delay of one day in maturity, the grain yield decreased by 0.194 grams. Present results are supported by the findings of Anwar *et al.* (2009) and Haq*et al.* (2010). From these results it is evident that while selecting for increased grain yield plant^{-1}, early maturing plants should be selected.

In the present study, these two characters displayed almost positive relationship which exhibited that 62.48 per cent of total variation in grain yield plant^{-1} was induced by spikelets spike^{-1}. Regression coefficient also determined that, a unit increase in spikelers spike^{-1} produced a corresponding increase of 1.120 grams in grain yield plant^{-1}. present findings are also in agreement with those of Khan and Dar (2010), Haq*et al.* (2010) and Akhter*et al.* (2011) who also found similar results for these two characters. The very high positive correlation between spikelets spike^{-1} and grain yield plant^{-1}can be successfully exploited while selecting for high grain yield in any breeding programme.Highly significant and positive correlation has been recorded between these two characters. Present results are in agreement with those obtained byMajumder*at al.* (2008) and Akram*at al.* (2008) who also found similar type of relationship between grains spike^{-1} and grain yield plant^{-1}. Coefficient of determination indicated that 45.48 per cent of the total variability in grain yield plant^{-1} was due to its association with grains spike^{-1}. regression coefficient indicated that with a unit increase in grains spike^{-1}, the grain yield plant^{-1} increased by 0.376 grams. This high positive and significant correlation between these two characters shows that this yield component is considerably important in breeding programme for high yielding wheat varieties.

The present findings revealed that there existed a significant positive correlation between these two characters. These results are in agreement with the findings of Akhter*et al.* (2011) who also reported significant positive correlation between these two characters. The coefficient of determination indicated that the variability of 29.55 per cent in grain yield plant^{-1} was due to the corresponding variation in grain yield of main spike^{-1}. The regression coefficient revealed that a unit increase in grain yield yield of main spike^{-1} cause a linear increase of 10.432 grams in grain yield plant^{-1}. Therefore for breeding and selection programmes for high yielding varieties of wheat, emphasis should be placed on high yielding spikes genotypes.In the present study, these two characters displayed non-significant and positive relationship which exhibited that 10.83 per cent of the total variation in grain yield plant^{-1} was due to its relationship with harvest index (%). The regression coefficient also determined that a unit increase in harvest index, the grain yield plant^{-1} increased by 0.398 grams. Present findings are also in agreement with those of Mohammad *et al.* (2008).

V. CONCLUSIONS

It is therefore concluded that while formulating any strategy in a breeding programme for higher grain yield of wheat, emphasis should be placed on the selection for more number of tillers plant^{-1}, longer spikes, more number of spikelets spike^{-1}, more number of grains spike^{-1} and biological yield plant^{-1} which had highly significant direct and indirect influences on the grain yield of wheat.

REFERENCES

[1] Abdel – Hady, M.S. and Z.A. Ali. 2006. Effect of Gamma Irradiation on Wheat Immature Culture Regenerated Plants. Journal of Applied Sciences Research. 2(6): 310-316.

[2] Ahmed, B., I.H. Khalil, M. Iqbal and H.U. Rahman. 2010. Genotypic and Phenotypic Correlation Among Yield Components In Bread Wheat Under Normal and Late Plantings. Sarhad J. Agri. Vol. 26, No. 2.

[3] Akhter, N., T. Mehmood, M. Ahsan, A. Aziz, M. Ashraf, S. Ahmed, M. Asif and E. Safdar. 2011. Estimation of Correlation Coefficient Among Seed Yield and Some Quantitative Traits In Wheat (*Triticumaestivum* L.). African Journal of Agricultural Research. Vol. 6(1): 152-157

[4] Akram, Z., S.U. Ajmal and M. Munir. 2008. Estimation of Correlation Coefficient Among Some Yield Parameters of Wheat Under Rainfed Conditions. Pak. J. Bot., 40(4): 1777-1781.

[5] Anwar, J., M.A. Ali, M. Hussain, W. Sabir, M.A. Khan, M. Zulkiffal and M. Abdullah. 2009. Assessment of Yield Criteria in Bread Wheat through Correlation and Path Analysis. The Journal of Animal and Plant Sciences. 19(4): 185-188.

[6] Anwar, J., G.M. Subhani, M. Hussain, J. Ahmed, M. Hussain and M. Munir. 2011. Drought Tolerace Indices and Their Correlation With Yield in Exotic Wheat Genotypes. Pak. J. Bot., 43(3): 1527-1530.

[7] Aycicek, M. and T. Yildirim. 2006. Path Coefficient Analysis of Yield and Yield Components in Bread Wheat (*Triticumaestivum* L.) Genotypes. Pak. J. Bot., 38(2): 417-424.

[8] Bhutto, L.A., Z.A. Soomro, B.A. Ansari, A.R. Jarwar and B.H. Jalbani. 2005. Estimation of Phenotypic Correlation between Grain Yield and Its Main Components in Brassica Species. Indus Journal of Plant Sciences. Vol. 3(4): 327-331.

[9] Borzouei, A., M. Kafi, H. Khazaei, B. Naseriyan and A. Majdadbadi. 2010. Effect of Gamma Radiation on Germination and Physiological Aspects of Wheat (*Triticumaestivum* L.) Seedlings. Pak. J. Bot., 42(4): 2281-2290.

[10] Datta, S.K. 2005. Role of Classical Mutation Breeding in Crop Improvement /edited. Delhi, Daya. P:314.

[11] FAO.2009. Food Outlook. Global Market Analysis (June 2009). P: 61.

[12] Farooq, O. 2011. Pakistan Economic Survey 2010-11. Ch: Agriculture. P: 20

[13] Haq, W.U., M. Munir and Z. Akram. 2010. Estimation of Interrelationships Among Yield and Yield Related Attributes In Wheat Lines. Pak. J. Bot., 42(1): 567-573.

[14] Jamali, K.D., S. Arain, M.H. Naqvi, A.M. Soomro, M.A. Arain and S.A. Ali. 2007. Breeding For Yield and Yield Components in Semi-Dwarf Wheat (*Triticumaestivum* L.) Genotypes. Pak. J. Bot., 39(7): 2349-1352.

[15] Jamali, R., and K.D. Jamali. 2008. Correlation and Regression Studies in Semi-Dwarf Spring Wheat (*Triticumaestivum* L.).SydneyUniversity Press,11th International Wheat Genetics Symposium.

[16] Joshi, B.K., A. Mudwari and D.B. Thapa. 2008. Correlation and Path Coefficient Among Quantitative Traits in Wheat (*Triticumaestivum* L.). Nepal Journal of Science and Technology. Vol 9.

[17] Khan, M.H. and A.N. Dar. 2010. Correlation and Path Coefficient Analysis of Some Quantitative Traits in Wheat. African Crop Science Journal, Vol. 18(1): 9-14.

[18] Labeed, S.H. Mohammed. 2009. Study of inter correlation among yield and its components of some genotypes of bread Wheat (*Triticumaestivum* L.). University of Tikrit , College of Agriculture , Field Crop Dept. Salah alldin , Iraq. Vol. 9(1).

[19] Majumder, D.A.N., A.K.M. Shamsuddin, M.A. Kabir and L. Hassan. 2008. Genetic Variability, Correlated Response and Path Analysis of Yield and Yield Contributing Traits of Spring Wheat. J. Bangladesh Agri. Univ. 6(2): 227-234.

[20] Memon, S., M.U.D. Qureshi, B.A. Ansari and M.A. Sial. 2007. Genetic Heritability For Grain Yield and Its Related Characters in Spring Weat (*Triticumaestivum* L.). Pak. J. Bot., 39(5): 1503-1509.

[21] MINFAL.2010. Agricultural Statistics of Pakistan 2009-10. Govt. of Pakistan, Ministry of Food and Agriculture (Economic Wing), Islamabad. P:3.

[22] Mohammad, T., M. Amin, F.E. Subhan, M.I. Khan and A.J. Khan. 2008. Identification of Traits in Bread Wheat Genotypes (*Triticumaestivum* L.) Contributing to Grain Yield Through Correlation and Path Coefficient Analysis. Pak. J. Bot., 40(6): 2393-2402.

[23] Mohsin, T., N. Khan and F.N. Naqvi. 2009. Heritability, Phenotypic Correlation and Path Coefficient Studies For Some Agronomic Characters In Synthetic Elite Lines Of Wheat. Journal of Food, Agriculture and Environment. Vol. 7(3 & 4):278-282.

http://dx.doi.org/10.22161/ijeab/4.2.11 ISSN: 2456-1878

[24] Muhibullah, M., M.A. Rabbani, Irfanullah, M. Iqbal, Zakiullah, M.I. Khattak and O. Sayal. 2012. Correlation and Frequency Distribution for Different Parameters Among Bread Wheat (*Triticumaestivum* L.) Accessions. Pak. J. Bot., 44(1):255-259.
[25] Nofouzi, F., V. Rashidi and A.R. Tarinejad. 2008. Path Analysis of Grain Yield With Its Components in Durum Wheat Under Drought Stress. International Meeting On Soil Fertility Land Management and Agroclimatology. Turkey. P: 681-686.
[26] Sakin, M.A. and A. Yildirim. 2004. Induced Mutations For Yield and Its Components In Durum Wheat (*Triticum durum*Desf.). Food, Agriculture and Environment. Vol. 2(1): 285-290.
[27] Singh, S.B. and T.B. Singh. 2001. Correlation and Path Analysis in Common Wheat (*Triticumaestivum* L.) Under Light Texture Soil. Rep. On Crops. Vol. 2(1): 99-101.
[28] Snedecore, W.G. and W.G. Cochran. 1987. Statistical methods. 7th ed. The Iowa State University Press Ames IOWA, USA.