Character Association in M_4 Micro mutants in Wheat (*Triticum aestivum* L.)

ABSTRACT

To determine the association among yield related traits on grain yield of mutant wheat, an experiment was conducted at the Agricultural Research Farm of R. B. S. College, Bichpuri, Agra (Uttar Pradesh). The use of physical mutagens, like X-rays, gamma rays and neutrons and chemical mutagens for inducing variation, is well established. Induced mutations have been used to the Joint afford of FAO/IAEA Division of the Nuclear Techniques in Agriculture, more than 1800 cultivars obtained either as direct mutants or derived from their crosses have been released worldwide in 50 countries. Correlation of twelve characters was studied in induced mutants in wheat. Yield per plant showed significant and positive correlation with spike length and number of spikelets per spike. Improvement in yield could be possible by selection for traits which are positively correlated with yield per plant. This indicates that selection based on these traits could be more effective to maximize grain yield.

Key words: - Correlation analysis, Mutant Wheat, Selection, Physical Mutagens.

Introduction

Triticum aestivum L. (wheat) is one of the world's oldest crops and has been used for >8000 years as a food crop. Today, wheat is one of the most important sources of grain for humans, and is cultivated on greater areas of land than any other crop. Wheat is counted among the big three Cereal crops, with over 600 million tonnes being harvested annually. Although cultivated under a wide range of climatic conditions, the most extensive production of wheat is in areas where the winters are cool and summers are comparatively hot.

Induced mutations are of considerable values for comprehending evolution and accelerating the process of plant improvement. Keeping in the view the importance of mutations in breeding and of various agents coming under the broad category of both physical and chemical mutagens, gamma-rays, belonging to the former group have been utilized in inducing mutations in wheat variety 'HD 2329' in the present investigation.

Yield is a complex character resulting from multiplicative interaction of yield components and therefore, selection for this character becomes a difficult task. Since, grain yield is a complex trait, controlled by many genes, as well as environmentally influenced and determined by the magnitude and nature of their genetic variability in which they grow (Singh *et al*., 2000). In addition, grain yield is related with other characters such as plant type, growth duration and yield components (Yoshida, 1981). The correlation coefficient gives an idea about various associations existing between yield and yield components. The knowledge of factors responsible for high yield has been rendered difficult since yield is a complex character and there may not be genes for yield by itself (Grafius 1959). Various components and their multiplicative interaction results in total effect of yield. To get marked improvement in yield, it is essential to have information on the association between different characters and their contribution to yield. The correlation coefficient gives a measure of the relationship between traits and provides the

degree to which various characters of a crop are associated with productivity. Association of characters with yield, among themselves and the extent of environmental influence on the expression of these characters are necessary to develop stable genotypes. In such situations, correlation analysis could be used as an important tool.

MATERIALS AND METHODS

The investigation was carried out at the Agricultural Research Farm of R. B. S. College, Bichpuri, Agra. The experiment was carried out in a simple Randomized Block Design (RCBD) of three replications, in which each of the treatments accommodated four rows of three meter length with a spacing of 9x22.5 cm. The experimental material used in study comprised of six M_4 mutants of HD 2329 variety of *Triticum aestivum* induced by gamma rays, along with three cultivated varieties (U.P. 2338, R.R. 21, HD 2329) used as check. Dwarf plant, Semi- dwarf plant, Long spike, Tall plant, Long seed and High tillering plants were selected as desirable mutants from M_3 generation were used in the investigation. Seeds were shown in the field with spacing of row to row was kept 5 cm. All the agronomical packages and practices were applied to raise healthy crop. Observations were recorded both on plant basis and single plant basis. For single plant observations ten competitive plants from each plot were randomly selected. Correlation coefficients between all possible character pairs were computed from the mean values.

RESULTS AND DISCUSSION

Yield per plant showed highly significant and positive correlation with spike length (0.83) and number of spikelets per spike (0.74). This trait also had positive correlation with days to germination, days to 50% flowering, number of seeds per spikelet, number of seeds per spike and weight of 500 seeds. On the other hand it was found negatively correlated with germination percentage, seedling injury, and plant height at flag leaf stage and number of effective tillers.

Weight of 500 seeds exhibited strong negative correlation with plant height at flag leaf stage (-0.77) .This trait also showed non-significant negative correlation with germination percentage, seedling injury and number of effective tillers. This character was found positively and significantly correlated with days to germination (0.717) and number of seeds per spikelet (0.72). This trait also had positively correlated with days to 50% flowering, spike length, number of spikelets per spike and number of seeds per spike.

Number of seeds per spike was highly significantly and positively correlated with spike length (0.78), number of spikelets per spike (0.74) and number of seeds per spikelet (0.97) and also showed positive correlation with days to germination and days to 50% flowering .On the other hand it was found negatively correlated with germination percentage, seedling injury, number of effective tillers and plant height at flag leaf stage.

Number of seeds per spikelet was significantly and positively correlated with spike length (0.72) and also showed positive correlation with days to germination, plant height at flag

leaf stage, days to 50% flowering and number of spikelets per spike. This trait also had negative correlation with germination percentage, seedling injury and number of effective tillers.

Number of spikelets per spike exhibited strong positive correlation with spike length (0.83) .This trait also showed non-significant positive correlation with days to 50% flowering. However, it was found negatively correlated with days to germination, germination percentage, seedling injury, number of effective tillers an plant height at flag leaf stage. Plant height at flag leaf stage showed negative correlation with germination percentage. This trait exhibited positive correlation with days to germination, seedling injury, days to 50% flowering and spike length.

Spike length had positive correlation with days to germination, germination percentage and days to 50% flowering. It was negatively correlated with seedling injury.

Days to 50% flowering was highly significantly and negatively correlated with seedling injury and positively correlated with days to germination and germination percentage .Seedling injury was significantly and positively correlated with days to germination and negatively correlated with germination percentage.

Days to germination exhibited non-significant positive correlation with germination percentage.

Experimental findings of the present investigation revealed that, yield per plant and spike length exhibited high and positive correlation. Spike length showed positive and significant correlation with grain yield (Kashif and Khaliq, 2004; Singh *et al*., 2010). The increase in spike length is directly associated with increase in yield per plant (Sultana *et al*., 2002; Akram *et al*., 2008). The findings of Dutamo *et al*.(2015) and Mecha *et al*. (2017) reported that spike length had positive correlation with grain yield.

The grain yield was recorded negatively correlated with number of effective tillers is supported by Larik (1979).The yield per plant showed significant and positive correlation with number of spikelets per spike.

Yield per plant also showed positive correlation with days to germination, days to 50% flowering, number of seeds for spikelet, number of seeds per spike and weight of 500 seeds.

Weight of 500 seeds was significantly and positively correlated with days to germination and number of seeds per spikelet, while it was positively correlated with spike length and fully supported by Faizul *et al*. (2009). 500 seeds weight was positively correlated with spikelets per spike as reported by Tripathi (2003). Ganno *et al*.(2017) reported that thousand seed weight had a positive significant correlation with grain yield.

Weight of 500 seeds was positively correlated with seeds per spike as reported by Sinha and Sharma (2000).

Weight of 500 seeds was negatively and significantly correlated with plant height at flag leaf stage.

Number of seeds per spike exhibited positive and significant correlation with number of spikelets per spike. This finding is supported by Sinha and Sharma (2000).

Number of seeds per spike was positively and significantly correlated with spike length. Number of grains per spike had strong positive relationship with yield per plant (Ashfaq *et al*., 2003 ; Burio *et al*., 2004). Increase in grains per spike will also have a better influence on grain yield (Nabi *et al*., 1998 ; Ayciceek and Yildirim, 2006). Number of seeds per spike was positively and highly significant with number of seeds per spikelet, while it was negatively correlated with number of effective tillers, plant height at flag leaf stage, germination percentage and seedling injury.

Number of seeds per spikelet was positively correlated with number of spikelets per spike, days to 50% flowering, days to germination and plant height at flag leaf stage. This character was negatively correlated with number of effective tillers, germination percentage and seedling injury. The results of Sultana *et al*.(2002) suggested that the longer the spike length the higher was the number of spikelets per spike, grain number and grain yield.

Number of spikelets per spike exhibited positive and significant correlation with spike length. Safeer-ul-Hassan, *et al*. (2004) reported that spike length is positive and significantly correlated with number of spikelets per spike. Dutamo *et al*.(2015) and Mecha *et al*.(2017) reported that number of spikelets per spike had positive correlation with grain yield. Number of spikelets par spike showed positive and significant correlation with number of seeds per spike (Kashif and Khaliq, 2004; Subhani and Chowdhry, 2000). This character was negatively correlated with days to germination, germination percentage, seedling injury, plant height at flag leaf stage and number of effective tillers.
Spike length was positively and non-significantly correlated with germination percentage, days to germination and days to 50% flowering. Days to 50% flowering was negatively and significantly correlated with seedling injury while, this character was positively correlated with days to germination and germination percentage. Association studies between spike length, spikelet numbers and grain yield indicated a tendency of spike length to increase with increase of spikelet numbers and grain yield. Similar results were reported by Khaliq *et al*.(2004) and Khan *et al*.(2005).

Plant height at flag leaf stage was negatively correlated with germination percentage and positively correlated with days to 50% flowering, days to germination, seedling injury and spike length. Number of effective tillers was found positively correlated with plant height at flag leaf stage but it was reported negatively by Faizul *et al*. (2009). In the present investigation number of effective tillers was found positively correlated with germination percentage and seedling injury, while it was negatively correlated with days to germination, days to 50% flowering and spike length.

CONCLUSION

Scientific information about the relationship of yield and yield-related traits are very important for successful breeding strategies. Yield per plant had significant positive correlation with spike length and number of spikelets per spike and significantly correlated with days to germination, days to 50% flowering, number of seeds per spikelets and number of seeds per spike. These results indicate the true relationship between these traits and yield per plant. Consequently, these traits should be considered as important selection criteria in bread wheat breeding program for higher grain yield. The information generated by this research will be helpful for the breeders. The results obtained in the present study have great importance to future breeding program.

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Table 1 : CORRELATION COEFFICIENTS FOR DIFFERENT CHARACTERS

Characters	**Days to Germination**	**Germination Percentage**	**Seedling injury**	**days To 50% flowering**	**Spike length at flag leaf stage**	**Height tillers**	**No. of effective per spike**	**No. of spikelets per spikelet**	**No. of seeds per spike**	**No. of seeds per plant**	**weight of 500 seeds**	**Yield per plant**
Days to germination		-0.12	0.012	0.45	0.06	0.07*	-0.17	-0.18	0.44	0.28	0.717*	0.14
Germination % age			-0.45	0.496	0.21	-0.24	0.24	-0.15	-0.21	-0.26	-0.27	-0.1
Seedling injury				-0.81*	-0.55	0.026	0.34	-0.51	-0.57	-0.49	-0.34	-0.22
Days to 50% flowering					0.36	0.25	-0.08	0.33	0.57	0.41	0.48	0.23
Spike length						0.0014	-0.33	0.83*+	0.72*	0.78*	0.70*	0.83*+

Height at flag leaf stage			0.014	-0.38	0.072
-0.10	-0.77*	-0.13			
Number of effective tillers			-0.22	-0.64	
-0.67	-0.39	-0.017			
Number of spikelets per spike				0.65	
0.74*	0.33	0.74*			
Number of seeds per spikelet					
0.97*+	0.72*	0.57			
Number of seeds per spike					
0.65	0.65				
Weight of 500 seeds					
0.56					

*Significant at 5% level of probability.

+Significant at 1% level of probabili