Analysis of Correlation and Regression among M_2 Wheat Mutant Population for Yield and its Associated Traits

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Abstract: Crop yield is the resultant product of components character which is not under the control of any single gene, therefore it is necessary for plant breeder to know the relationship between two traits. The present research was conducted to calculate the correlation and regression for yield and yield contributing traits in mutant population of bread wheat. The experiment was conducted at Nuclear Institute of Agriculture (NIA), Tandojam, during rabi season 2015-2016, in split plot design with three replications. Material under study was two wheat varieties (T.D-1 and ESW-9525). These two wheat varieties were evaluated along with control for yield and yield associated traits under normal field conditions. Mean square showed that there were significant differences between wheat varieties for days to 75% heading, days to 75% maturity, plant height (cm), spikelets spike^{-1}, grains spike^{-1}, 1000 grain weight (g), biological yield plant^{-1} (g), harvest index (%), spike length (cm) and grain yield plant^{-1} (g). Number of grains spike^{-1} showed positive and highly significant correlation with spike length, spikelets spike^{-1}, 1000 grain weight and biological yield of plant^{-1}. Significant and positive with days to 75% maturity and harvest index. However, negative correlation was found with height of plant and non-significant but negative with the trait of days to 75% heading. Grain yield plant^{-1} showed highly positive highly significant association with grains spike^{-1}, number of spikelets spike^{-1}, length of spike, harvest index and biological yield plant^{-1} and negative with plant height. Approximately 85.9%, 65.2%, 59% and 24.3% variation in grain yield plant^{-1} is due to grains spike^{-1}, biological yield plant^{-1}, harvest seed index and height of plant, respectively. This shows that taller plants produce lesser grain yield.

Keywords: Wheat, Correlation, Regression, Mutant, Yield.

INTRODUCTION

No any other crop is grown on ~~the~~ soil in the world as wheat and it is very closer near to 3rd after rice and corn in the total production of world. Wheat is such a crop that can be adapted in any environment and it almost cultivated on the places where wind is open and the soils are very dry and very cold for the more tropically inclined rice and corn, that give their performance at intermediate temperature levels.

Correlation is the simultaneous variation of two variables. It is often desirable to observe and measure the relationship between two characters. Correlation may be +ve or -ive. +ve correlation shows that increase in a single traits cause simultaneous increase in the other. -ve correlation reflects the increase in one character is associated with a decrease in the other [1]. The selection of genotypes with increased productivity is an essential part of plant breeding programs. The identification and selection of genotypes according to their morphological and physiological traits is an effective approach to breeding for higher yield. The present studies have therefore done to identify the mutant plants for various morphological traits of wheat genotypes in M_2 generation and to investigate the performance and relationship between the yield and its components in the same generation of bread wheat (*Triticum aestivum* L.) which will be helpful for breeders to overcome constrains in wheat productivity [2] reported that the relationship among yield increasing components influence on the grain yield (GY) direct or indirect way of bread wheat [3]. Evaluated twenty spring wheat varieties were studied to find out genetic variability and genetic association for grain yield and its components. Both phenotypic and genotypic variances were highly significant in all the traits with higher phenotypic variations as usual. Similarly, the low differences between the phenotypic and genotypic coefficients of variations indicated low environmental influences on the expression of these characters.

MATERIALS AND METHODS

Present study was conducted to calculate correlation and regression for yield and yield components of bread wheat (*Triticum aestivum* L.) varieties (T.D-1 and ESW-9525) which were sown along with parental lines under field conditions. The experiment was conducted at Nuclear Institute of Agriculture (NIA), Tandojam during rabi season 2015-2016.

This research was conducted with three replications in split block design. The crop was planted on 9th of

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November 2015. Seed of each mutant genotype was sown by dibbling with 20 seeds in each row of 4 m row length along with 2 rows of parental lines (20 seeds each) and row to row distance was kept at 30 cm. The data was collected from the central plants to avoid any border effects. Plant observed as mutant was tagged separately.

RESULTS AND DISCUSSION

The present studies were conducted to evaluate the association and regression between yield components of two varieties in mutant populations of hexapliod wheat. This research was conducted with three replications in split block design at Nuclear Institute of Agriculture (NIA) for different economical parameters in two wheat varieties namely T.D- 1 and ESW-9525.The data obtained for each character were analyzed statistically and differences among the mean were tested using (DMRT Test). Mean square results showed that there were highly significant differences at (p<0.01) probability level between wheat varieties TD-1 and ESW-9525 for all the traits at (p<0.05) probability level (Table **1**).

The Correlation coefficient between grain yield and its components of bread wheat are presented in Table **2**. Days to 75 % heading shows highly significant correlation with plant height and significant correlation with biological yield plant^{-1}, it suggested that increase in days to 75% heading will simultaneously increase significantly plant height and biological yield plant^{-1}, however, it was highly significant but negative with harvest index which exhibited that increase in days to 75% heading can cause highly significant decrease in harvest index. It showed that late maturity plants are taller with higher biological yield plant^{-1} but possess lower harvest index. Days to 75% maturity shows highly significant positive correlation with plant of height, length of spike, grains spike^{-1}, weight of 1000 grains and biological yield of plant^{-1} but significant with grain yield plant^{-1}, its common recommendation that when days to 75% maturity increase, will cause simultaneously highly significant increase in spike length, grains spike^{-1}, 1000 grain weight mean while the same cause character had significant but negative association with plant height and harvest index which exhibited that with the increase in days to 75% maturity significant decrease in plant height and harvest index was observed. It showed that late maturity plants are with larger spike, with higher biological yield plant^{-1} but saved lower harvest index. The previous researcher like [4] observed that days to 75% had positive correlation with 1000 grain weight. Plant height had highly significant positive correlation with biological yield plant^{-1}, it suggested that with the increase in plant height there was highly significant increase in biological yield plant^{-1}. Spike length, spikelets spike^{-1}, 1000 grain weight and grain yield plant^{-1} are highly significant but negatively correlated with plant height. It shows that with the increase in plant height highly significant decrease in all the above traits was observed. Grains

Table 1: Mean Squares for Different Morphological Traits of Wheat Genotypes

Source of variation	Replication (A)	Treatment (B)	Error (A×B)	Varieties (C)	(B×C)	Error (A×B×C	Total
	D.F= 2	D.F= 4	D.F= 8	D.F= 1	D.F= 4	D.F=10	29
Days to 75% heading	4.8420	4.0548*	0.5982	90.8280**	2.2412n.s	0.8135	138.617
Days to 75% maturity	0.711	29.705**	0.237	355.490**	17.047**	0.483	550.643
Plant height	1.64	10.96*	1.26	3366.35**	37.52**	1.38	3587.45
Spike length	0.06561	0.28120*	0.02763	0.02187*	0.03660n.s	0.01821	1.82743
Spikelets spike^{-1}	1.580	0.885*	0.089	181.794**	0.595n.s	0.390	195.490
Grains spike^{-1}	2.091	74.277**	2.239	418.507**	20.921*	3.538	856.777
1000 Grain weight	0.152	2.540*	0.377	588.844**	1.567n.s	0.250	611.814
Grain yield plant^{-1}	0.9375	75.7703**	0.1272	2.0363*	5.7467**	0.1609	332.606
Biological yield plant^{-1}	3.564	574.152**	0.996	20.485**	68.231**	0.445	2605.56
Harvest index	1.3192	63.0053**	0.6599	85.0993**	42.3481**	1.0669	525.099

** = Highly significant, * = Significant, n.s= Non significant.

spike^{-1} and harvest index are significantly and negatively correlated with plant height, it reveals that increase in plant height caused significant decrease in grains spike^{-1}and harvest index. It shows that increase in plant height, higher the biological yield plant^{-1} and lower the spike length, spikelets spike^{-1}, 1000 grain weight and also decrease in the dependent trait grain yield plant^{-1}.The present research demonstrate that increase in spike length simultaneously increase in spike related traits, so plants with longer spike length and short stature are needed which would increase the end product of the crop. It shows that increase in spike length of wheat varieties will certainly improve the grain yield of wheat. These results are in agreement with those obtained by [5] Spikelets spike^{-1} is highly significant and positively correlated with grains spike^{-1}, 1000 grain weight, grain yield plant^{-1} and harvest index. It suggested that simultaneously increase in all the above characters and significant correlates with biological yield plant^{-1}. It shows that spikelets spike^{-1} will cause a significant increase in yield trait plant^{-1} of wheat.

REGRESSION

The results for correlation coefficient can be described by r^2 whereas regression coefficient among the yield of grain and different quantitative were observed in the 2 varieties of wheat for various economical characteristics, details are presented in Table 3. The results of the current research showed the level of relation among the plant traits are measured through the correlation coefficient and rate change in the direction of one trait will be changed because of change recorded by regression. The above findings are major tools for applying the selection procedure that can predicate the correlated traits response [6] Due to importance of regression as well as correlation of current research can be showed through the relationship of character yield grain. The grain yield was observed positively high correlated with the length of grains spike^{1} and spikelet's spike, whereas index of harvest and biological production of plant was negative correlated with plant height. About 24.3, 59, 65.2 to 85.9% changes has been observed in yield of plant grain because of spike grains, while the biological yield plant and index of harvest with height of plant showed that plant which were tall had yield less amount of grain. The days of character to heading of 75% showed negative and non significant correlation r= - 0.027 with yield of grain plant^{1}, that showed (5.4%) changes because of relation with 75% heading days. The regression coefficient showed that if single day increased in heading about (75%), 0.395 g yield of plant grain reduced. The positive and significant correlation r= 0.374 has been observed among the yield of plant grain and maturity days to 75%. The correlation estimation values r^2 showed that 13.98%

Table 2: Matrix of Correlation of Grain Yield and its Yield Components in Bread Wheat

Characters	Days to 75% heading	Days to 75% maturity	Plant height	Spike length	Spikelets spike^{-1}	Grains spike^{-1}	1000 Grain weight	Grain yield plant^{-1}	Biological yield plant^{-1}	Harvest index
Days to 75% heading	1.00	0.162$^{n.s}$	0.513**	0.239$^{n.s}$	-0.197$^{n.s}$	-0.279$^{n.s}$	0.372*	-0.027$^{n.s}$	0.446*	-0.755**
Days to 75% maturity		1.00	-0.870**	0.749**	0.331$^{n.s}$	0.500**	0.686**	0.374*	0.697**	-0.412*
Plant height			1.00	-0.902**	-0.480**	-0.424*	-0.904**	-0.493**	0.848**	-0.449*
Spike length				1.00	0.801**	0.632**	0.980**	0.723**	0.829**	-0.026$^{n.s}$
Spikelets spike^{-1}					1.00	0.570**	0.738**	0.671**	0.435*	0.516**
Grains spike^{-1}						1.00	0.629**	0.927**	0.720**	0.415*
1000 Grain weight							1.00	0.769**	0.898**	-0.073$^{n.s}$
Grain yield plant^{-1}								1.00	0.808**	0.400*
Biological yield plant^{-1}									1.00	-0.211$^{n.s}$
Harvest index										1.00

total variation in plant grain yield because of changes in maturity days about 75%. The regression coefficient showed that increased in one day to 75% maturity, while the plant grain yield increased 0.154 g. similar statements was reported by [4] who had reported that same association among days to 75% maturity and plant grain yield. Due to this it has been suggested those higher days to 75% maturity is major selection procedure for improvement in plant yield in genetic breeding program. The height of plant was observed significant and higher negative correlation r=0.493 with plant grain yield. The coefficient showed that r^2 24.30% of all variability in plant grain yield because of relationship with height of plant. The regression estimation showed that increased in single unit height of plant, plant grain yield increased about .240 g. Findings of current research are in agreement with the findings of [7], they had also described same types of statement with association among height of plant and plant grain yield that indicated that production component can be affective criteria of selection for the improvement process of genotypes of wheat. The higher positive and significant results of correlation were observed among plant grain yield and length of spike. The coefficient showed that 52.27% with all variability in yield of plant grain due to relation with length of spike, whereas the regression coefficient showed increased in single unit in the length of spike will cause increase in 1.795gm of plant yield grain. Same type of results was observed by [3, 9] they had showed same association among said traits. Findings of current research showed that length of spike always showed higher relation with plant grain yield. The positive high and significant correlation results r=0.671 has been observed among the spike spikeletes and yield of plant grain. The correlation coefficient showed 45.02% all variability in plant grain yield because of the relationship with spikelet's spike. The regression values showed that increased in one unit of spike spikelet's will cause increase in 0.934gm of plant yield grain. The results of our research are also supported by the results of [7, 8] they has also observed same findings for these 2 Characters. The correlation results were observed positively high among the spike-1 spikelet's and yield of plant grain can be successful during the selection process for high production of breeding program. The high positive and high significant correlation r=0.927 were observed among spikes of grain and yield of plant grain. The coefficient showed that 95.93% of all viability in plant grain yield was observed because of its relation with spike grain. Whereas the results of coefficient showed that increased in single unit of spike grain will show increase 0.377. The findings of current study are in agreement with the results of [3, 9]; they had also reported that same association among spike of grain and plant yield grains. These findings showed that component production is different varieties. The results of correlation coefficient showed positively high and significant among 1000 weight of grain. The regression estimates showed that increased single unit of will cause increase in grain weight of 1000 gram. The biological character plant yield showed positive and high correlation r=0.808 with plant yield grain. The results of coefficient showed that 65.28% variability in plant grain yield showed because of biological plant yield relation. The results of regression coefficient estimates showed that increase in single unit of plant biological yield cause increase 0.343gm in plant yield of grain. The results of present study are supported by the findings of [10, 11] who had reported same association among 2 characters. The positive and significant correlation r=0.400 were found among harvest index and plant grain yield. The coefficient showed that 16% of all variability in plant yield of grain because its relation with index of harvest. The regression values coefficient showed that increased in single unit will increase in index of harvest, the grain plant yield increased about 0.563 gram in our study.

CONCLUSION

- The results of analysis of variance showed that there was significant different among the different varieties
- and among treatment. Varieties and treatment indirection was also significant.
- Variety ESW-9525 showed highest performance in yield of plant grain due to increase in yield components.
- It was observed that T_4 = 250Gy prove to be suitable dose for obtaining mutant plants for most of the trait studied, followed by T_3 = 200Gy.
- It is concluded that grain of plant yield showed positively high and significant correlation with length of spikes spike spikelet's 1000 grain weight biological plant yield and grain spike. While the significant and positively high correlation was observed with index of harvest. It is also concluded that yield of grain was significantly high but negatively correlated with plant height.

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