Genetic Evaluation of Exotic Wheat Material for Yield and Yield Related Components

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Abstract

Wheat (Triticum aestivum L.) is a staple food which includes 60% of the daily diet of common man and is growing on large agriculture land of Pakistan, with per capita consumption of about 125 kg per annum. In wheat producing country, Pakistan ranks at 10th position throughout the world. On the basis of importance of wheat, the present research will be conducted to check the performance of exotic 262 SAWSN wheat germplasm with local commercial verities (Faisalabad 2008, Punjab 2011, Galaxy 2013). All exotic and local wheat material was sown during November, 2016 in augmented design. The experiment was conducted to evaluate the best performing breeding lines for plant traits such as days to heading, days to maturity, spike length, plant height, number of spikes per plant, grains per main spike, peduncle length, total biomass/ line, 1000 grain weight, total grain yield per plant and harvest index. The collected data was subjected to statistical analysis for evaluation of wheat breeding lines in comparison with local checks by using software SPAD (Statistical Package for Augmented Design). The result indicated that the mean value of spike length 41.10, 43.20 and 41.53 were observed for Faisalabad-08, Galaxy-13 and Punjab-11 respectively. Grain per spike varied from 43 to 15. Findings supported the genetic variability presence for harvest index traits in present genetic stock and it could be good source of genes for improvement of harvest index trait in wheat lines. The correlation of total grain yield was negative but significant with harvest index. From the research, our findings of

research data, cluster distance among two genotypes observed less than distance among cluster. The highest variance and mean value among the traits in the entire cluster is exhibited by total grain weight (TGW). Harvest Index% had minimum variance and mean value among the traits for all clusters. Difference of Eigen value of PC1 and remaining PC's was recorded higher.

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1. Introduction

Wheat (Triticum aestivum L.) is an important cash crop with its meaningful economic value as well as its accreditation at national and international market. Every household, especially in South Asia consume a bulk amount of wheat annually. As it is the necessary part of daily food for them. Many regions in the world go for its cultivation due to its adaptation to the broader range of moisture condition in the atmosphere (Noorka and Harrison, 2015). Most arable land of the world is under wheat cultivation. Its world trade is higher as the other crops in combined analytics. Its maximum adaptation is due to the acceptation of bread made by this. The material of bread made from it is much acceptable rather than other grain crops used for bread making (Oladunmoye, 2010).

Wheat is main food crop of people of Pakistan, which is used in form of different products by major portion of Pakistani population. As it is main cereal crop so it covers a large area under cultivation. The contribution of wheat in GDP was 1.9 % and in agriculture was 9.6% during fiscal year 2016-17. During current cropping season, wheat was cultivated on an area of 9052 thousand hectares which was lower than cropping season of 2015-16 but increased in yield by 0.5% was observed with yield 25.750m tons (Economic Survey of Pakistan, 2016-17). Pakistan stood at 8th position in terms of yield (FAO, 2017). In South Asia, Pakistan is the highest per capita wheat consumer. Wheat and rice are two main crops with the maximum consumption at household level. Wheat is exceeding dominantly in case of consumption at household level due to its best nourishment factors for humans (Pakistan Bureau of Statistics, 2018). Due to its adaptable agronomic activities, grain storage and easily convert able into flour to make it palatable, edible and satisfying food items. The usage of wheat in Pakistan is meaningful due to its considerable consumption and adaptation to the storage adaptability.

2. Materials And Methods

This study was carried out in the premises of College of Agriculture, University of Sargodha in cropping season of 2016-17. Plant material of this research consists of 272 SAWSAN lines and three commercial verities (Fsd-08, Pb.-11 and Galaxy-13). Soil bed was prepared according to need of crop, timely irrigation and fertilization was done for good plant growth. Other cultural practices

were done at proper time in each block containing advanced lines. Each block contains 22 SAWSAN lines and 3 lines of commercial verities to remove experimental error in statistical analysis. At physiological maturity plant parameters were measured namely Days to maturity, main spike grains, spikes per plant, biomass/ row, peduncle length, Plant height, spike length, weight of thousand grains, grain yield per plant and harvest index percentage. For the analysis of data obtained from above mention traits by standard method was subjected to Augmented Design analysis. Software used for this analysis was named SPAD (Statistical Package for Augmented Design). Significance of each trait was calculated to put this analysis for further evaluation (Federer, 1956).

3. Results And Discussion

The analysis of variance exhibited that all the genotypes performed significantly variable for plant height, days to maturity, Number of Spikes/Row, Peduncle Length, grains per spike, Total Biomass per Line, 1000-grain weight, grain yield per plant, seed index and harvest index signifying that studied materials hold valuable genetic resources for range of characters thus can comprehensively be used for upcoming breeding challenges.

Table 1. Mean squares from analysis of variance for various traits in bread wheat genotypes

SOV	DF	Plant Height	Days to maturity	Number of Spikes/Row	Peduncle Length	Grains per spike	Total Biomass per Line	1000-grain weight	Grain yield	Harvest index
Checks	2	590.83	122.50	0.10	19.53	3.94	44.43	323.38	23.87	27996.03
Advance line	261	1053.18	138.31	0.077	75.06	1.23	60.39	429.10	35.78	10765.58
Check vs Adv. Line	1	78.23	359.88	0.11	74.51	3.91	106.22	322.15	23.43	10118.29

3.1 Correlation Analysis

Correlation analysis help in screening of trait association among the studied lines. To get information about the association of yield and its related traits correlation analysis is very helpful.

	DM	PH	PL	SL	SpL/Spk	G/SP	TB	Spk/Row	HI
DM	1								
PH	-0.123*	1							
PL	0.2478*	0.1887*	1						
SL	0.1645ns	0.175*	0.254*	1					
SpL/Spk	0.0593*	0.0563*	0.0326*	0.3371*	1				
G/SP	-0.1259*	0.1211	-0.0348	0.1089ns	0.1129*	1			
TB	0.2055*	0.1568*	0.151NS	0.1559*	0.063*	0.0253ns	1		
Spk/Row	0.2345ns	0.1141*	0.0868NS	0.1119*	-0.0337*	-0.0747*	0.4041*	1	
HI	0.004*	-0.0461NS	-0.0382*	-0.0627*	-0.0602*	-0.0419*	-0.3436*	-0.1054*	1

DM= DAYS TO MATURITY, PH= PLANT HEIGHT, PL= PEDUNCLE LENGTH, SL= SPIKE LENGTH, Spl/Spk= NO OF SPIKELETS PER ROW, G/SP= GRAINS PER SPIKE, TB= TOTAL BIOMASS, Spk/ROW= SPIKES PER ROW, HI= HARVEST INDEX%

4. Path Analysis

To get more information regarding traits association, Path analysis further divide correlation results into direct and indirect effects. In this research, dependent variables were days remaining to maturity, plant height, length of spike, peduncle length, No of spikelets/spike, no of grains of mother spike, total biomass per row, no of spikes per row, TGW and harvest index percentage. The correction factor was 0.3098 which reported the presence of other factors controlling total yield of plant and cannot be directly studied.

Study claimed that result was indicator of variability of studied trait, which could be used for wheat breeding program in future. In case of plant height the lines verses standard commercial checks, similar significant difference was observed which depicted the availability of highly useable variability. Surprisingly, the mean value of spike length 41.10, 43.20 and 41.53 were calculated for Faisalabad-08, Galaxy-13 and Punjab-11 respectively. Analysis has provided information about genetic variability, which could be exploited for improving this trait in other wheat breeding

programs. The variability will be used to widen the genetic base of present genetic stock. It will also be exploited through selection for further breeding programs. Grain per spike varied from 43 to 15. Biomass per line is a trait, it can be further improved through selection for further breeding programs. Findings supported the genetic variability presence for harvest index traits in present genetic stock and it could be good source of genes for improvement of harvest index trait in wheat lines. Viewing it thoroughly the correlation of total grain yield was negative but significant with harvest index. From the study analysis of research data, cluster distance among two genotypes observed less than distance among cluster. This finding depicted the close genetic relation of studied SAWSAN lines. Categorically, highest mean and variance value among the traits in the entire cluster is exhibited by total grain weight. Harvest Index% had minimum variance and mean value among the traits for all clusters. Difference of Eigen value of PC1 and remaining PC's was recorded higher. It revealed that wheat genotypes under study had narrow genetic variance. Author would reinforce the further research and optimization of findings of the study. There should be facilities at academic, commercial and research level that could enhance the further research under suitable environment without any limitation.

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