Research Article

Inheritance studies and relationship of morphological traits in wheat (*Triticum aestivum* L.)

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Abstract

Studies of inheritance and relationship of morphological traits in wheat crop (*Triticum aestivum* L.) were analysed in Rabi season during the year of 2013 to 2014. Current investigation was performed in different 3 replications with RCBD (Randomized complete block design) at the Wheat research station southern, Tandojam. Total 8 wheat genotypes were included Benazir, SKD-11, 2011 Advance line, V-11005, Imdad 2005, TD1-1, Anmol-91 and Hamal. The results of different genotypes showed significant difference ($P \leq 0.05$) by everyone due to their yield and growth traits such as spikelet's spikes, index of seed, tillers plant⁻¹, spikes of grains, height of plant, yield of plant grain and plant⁻¹ tillers. The Anmol-91 surpassed rest of genotypes with maximum plant height (94.53 cm), and V-11005 Advance line surpassed in tillering capacity (15.00) and spikelets spike⁻¹ (23.00), while longer spikes (15.02), higher seed index (51.33 g) and higher grain yield (23.53 g) were produced by genotypes TD-1 (15.02 cm) and Benazir (14.49 cm). Genotype Imdad-2005 was most promising for grains spike⁻¹ (86.03), and seed index was higher in TD-1 (51.33 g), Benazir (48.97 g) and V-11005 (48.53 g). It is concluded that genotype TD-1 significantly exceeded in grain yield plant⁻¹ (23.53 g) to other tested genotypes, followed by V-11005-Advance line (21.47 g) and 2011-Advance line (20.47 g); while lowest grain yield plant⁻¹ (18.26 g) was noted in genotype Anmol-91.

Keywords: Inheritance; Morphological traits; Relationship; Wheat

Introduction

Not only in Pakistan but throughout the world (*Triticum aestivum* L.) is considered as an important crop. There are many species being cultivated, among them in present two species are grown largely hexaploid bread wheat (genetic constitution

AABBDD) and durum tetraploid wheat (AABB). In present majority the grown cultivars of pasta and bread wheats are produced through conventional plant breeding, employing the wide range of genetic variation within these species [1].

The crop of Wheat (*Triticum aestivum* L.) is known as major food source crop in Pakistan due to this theme being a valuable staple food which invites the attention of growers, researchers and breeders for to increase the production level to fulfil the challenge of food due to the increasing in population day by day. Hence it is also very important to increase per unit yield by the development of stable and high yielding genotypes of wheat for different environments [2].

Development and higher production of wheat varieties are known as important goal of breeding plan and policies [3]. These objectives can only be achieved through enough quantity of variation between desired traits that can only be improved through the selection for future manipulations to outcome on the goal. Development of latest varieties which can be produced from different areas and can also utilize for future breeding program [1].

In order to find out the productive genotypes which have productive traits they can be utilized for future breeding policies as well as selection tool for bringing improvement in breeding program. The variability analysis among the desired traits and for the presence of specific traits which share in the production of crop that can be major device for successful future breeding program [2]. For the development of high productive new yielding varieties need proper information regarding present genetic variations improvement and higher production. Variability analysis is estimated the combination of genetic and environmental effects that can only be heritable traits formerly. Whereas only estimation of heritability could not show a proper idea to know required gain for future generation, these can also be said connection among advance genetic change in average value among the generation parameters [4]. Genetic variability is important tool such as genetic correlation coefficient and heritability for advance genetic variation are important tool for initiating the effective breeding program

[5]. The genetic variability assessment among wheat is important for breeding program of genetic conservation of resources that can also be consider be helpful tool for hybrid lines of breeding program.

Materials and methods

In order to evaluate the phenotypic correlation estimates in the wheat genotypes for yield and its related components, the whole experiment was conducted during Rabi season of 2013-14 in a three Randomized Complete Block design replications at Southern Wheat Research Station, Tandojam. Experimental material was based on eight wheat genotypes named as Benazir, Imdad-2005, TD-1, Anmol-91, Hamal, SKD-II, 2011-Advance Line and V-11005 Advance Line, containing approved commercial varieties and also the varieties in pipeline. For the sowing drilling method was used and 20-20 cm distance was kept in between the plant and rows. In each replication of all genotypes five randomly selected plants were labelled. After the necessary data collection in field conditions, other furthermore observations were taken at the laboratory. The data were recorded on the following traits: Plant height (cm), Tillers per plant, Spike length (cm), Spikelets per Spike, Grains per spike, Seed Index (1000 grain weight in g) and Grain yield plant⁻¹ (g). Whole collected data was analysed with the help of New Student Statistics Software SXW Package. Analysis of variance (ANOVA) was determined by [6] method.

Results

In this way to find out the relationship of morphological traits of wheat (*Triticum aestivum* L.). Present investigation was performed in the season of Rabi from 2013 to 2014. The average square mean was observed by the analysis of variance among various traits like length of spikes, height of plant, spikelet's of spikes are presented in (Table 1). While the results of average square mean traits like index of seed, spikes of grain and plant-1 yield are described in (Table 2). The production of different

genotypes of wheat such as length of spikes, plant tillers; spikes of spikelet's and height of plant are described in (Table 3). While the results of various traits including index of seed, spike of grains and plant-1 yield grains are shown in (Table 4). The yield of grain average square mean of the wheat crop and linked sharing traits of various genotypes presented in (Table 1 & 2) showed that each genotype were

observed significant ($P \leq 0.05$) different from each other in case of their yield and growth traits like length of spikes, grains of spikes, plant-1 tillers, index of seed, height of plant, plant-1 yield grain and spikelet's spikes. In these traits significant difference was observed in yield and growth traits of various wheat genotypes which may be related with parent's genetic material.

Table 1. Mean square by analysis of variance of Height of plant, Tillers Plant-1, Spike length, Spikes of Spikelet's

Source of variation	Degree of freedom	Height of plant	Tillers Plant-1	Spike length	Spikes of Spikelet's
Replications	2	0.545	0.2916	0.0155	1.4986
Genotypes	7	211.20**	4.7083**	1.7238**	6.1403**
Error	14	0.225	0.1011	0.0189	0.4502
Total	23				

** Probability level of significant was 1%

Table 2. The mean square of analysis of variance of number of tillers plant-1, grains spikes and seed index

Source of variation	Degree of freedom	Spike-1 grains	Plant yield grains	Seed Index
Replications	2	4.072	0.0179	0.1493
Genotype	7	248.709**	18.506**	9.5655**
Error	14	4.380	0.0941	0.3182
Total	23			

** = Significant at 1% probability level

Table 3. Performance of wheat genotypes for plant height, tillers plant⁻¹, spike length and spikelets spike⁻¹

Genotypes	Plant height (cm)	Tillers plant ⁻¹	Spike length (cm)	Spikelets spike ⁻¹
Benazir	81.13 d	11.67 f	14.49 b	22.27 a
Imdad-2005	83.20 b	12.33 d	14.42 b	20.34 b
TD-1	63.93 g	14.00 b	15.02 a	23.00 a
Anmol-91	94.53 a	11.67 e	12.57 e	19.00 c
Hamal	78.00 f	13.00 c	13.50 d	21.00 b
SKD-II	80.00 e	12.00 d	14.00 c	21.00 b
2011-Advance Line	78.00 f	14.00 b	13.60 d	22.56 a
V-11005 Advance Line	82.00 c	15.00 a	14.33 b	23.00 a
S.E.±	0.3873	0.2597	0.1124	0.5479
LSD 0.05	0.18307	0.15571	0.12410	1.11750

Table 4. Performance of wheat genotypes for grains spike⁻¹, seed index (g), grain yield plant⁻¹

Genotypes	Grains spike ⁻¹	Seed index (g)	Grain yield Plant ⁻¹ (g)
Benazir	64.80 c	48.97 b	20.20 c
Imdad-2005	86.03 a	46.40 c	19.20 d
TD-1	67.80 c	51.33 a	23.53 a
Anmol-91	75.00 b	44.26 e	18.26 d
Hamal	58.02 e	45.26 d	18.33 d
SKD-II	61.37 d	46.20 c	19.10 d
2011-Advance Line	63.23 d	44.40 e	20.47 c
V-11005 Advance Line	62.23 d	48.53 b	21.47 b
S.E.±	1.7089	0.2505	0.4606
LSD 0.05	23.6651	20.5372	20.9878

Yield and growth performance of different wheat genotypes

The data regarding height of plant-1, plant tillers, length of spikes and spikelet's spike-1 (Table 3 and 4) showed that genotype Anmol-91 surpassed all the tested genotypes and produced maximum plant height was noted in genotype Anmol-91 (94.53cm), followed by Imdad-2005 (83.20 cm), V-11005 Advance line (82.00 cm), Benazir (81.13 cm), SKD-II (80.00 cm), V-2011- (78.00 cm) and Hamal (78.00 cm); while TD-1 displayed lowest plant height (63.93cm). Similarly, The V-11005 Advance line surpassed the other tested genotypes in tillering capacity and tillers plant⁻¹ were maximum (15.00) was noted in V-11005 advance line, followed by 2011-advance line (14.00), TD-1 (14.00), Hamal (13.00), Imdad-2005 (12.33); while equally lowest tillers plant⁻¹ were noted in Benazir (11.67) and Anmol-91 (11.67).

Significantly ($P<0.05$) longer spikes were observed in cultivar TD-1 (15.02cm), followed by Benazir (14.49cm), Imdad-2005 (14.42 cm), 11005-advance line (14.33 cm), V-11005 (14.33 cm), SKD-II (14.00 cm) and 2011-Advance line (13.60 cm); while lowest length of spikes was found 12.57 cm in the Anmol-91. Genotypes Benazir, SKD-II and V-11005 Advance line showed competitive results with the commercial wheat cultivars.

V-11005-Advance Line was at par with the commercial genotype TD-1 equally

producing 23.00 spikelets spike⁻¹ ($P<0.05$), followed by genotypes 2011-Advance line (22.56), Benazir (22.27), Hamal (21.00), SKD-II (21.00) and Imdad-2005 (20.34); while Anmol-91 resulted in lowest number of spikelets spike (19.00). Genotype, TD-1, V-11005-Advance Line, 2011-Advance line and Benazir showed similarity ($P>0.05$) on higher side for this trait; while differences between Hamal, SKD-II and Imdad-2005 for spikelets spike⁻¹ were also non-significant ($P>0.05$).

Genotype Imdad-2005 significantly ($P<0.01$) surpassed other commercial and candidate lines with highest number of grains spike⁻¹ (86.03), followed by Anmol-91 (75.00), TD-1 (67.80), Benazir (64.80), 2011-Advance line (63.23), V-11005-Advance line (62.23) and SKD-II (61.37); while the lowest number of grains spike⁻¹ (58.02) were produced by the genotype Hamal. TD-1 and Benazir showed similarity in grains spike⁻¹, and non-significant ($P>0.05$) differences were also noted among genotypes 2011-Advance line, V-11005-Advance line and SKD-II for grains spike⁻¹.

The seed index results were found significantly higher ($P\leq 0.05$) 51.33g in the genotypes of TD-1 variety, followed by genotype Benazir (48.97g), V-11005 (48.53 g), Imdad-2005 (46.40 g), SKD-II (46.20 g); while lower seed index of 44.40 g and 44.26 g was noted in genotypes 2011-Advance line. Genotypes Benazir and V-

11005 Advance line surpassed rest of genotypes except TD-1 for seed index value.

Genotype TD-1 significantly ($P < 0.01$) exceeded in grain yield plant^{-1} (23.53g) to remaining tested genotypes, followed by V-11005-Advance line (21.47 g), 2011-Advance line (20.47 g), Benazir (20.20 g), while relatively lower grain yield plant^{-1} was observed in Imdad-2005 (19.20 g), SKD-II (19.10 g); while the lowest grain yield plant^{-1} (18.33 and 18.26g) was noted in genotypes Hamal and Anmol-91, respectively.

Discussion

Phenotypic correlation and heritability estimates in wheat genotypes were evaluated for yield and its components during Rabi season of 2013-14. Phenotypic correlation coefficients of different components of grain yield to obtain the genotypic improvement is the basic and major aspect of plant breeders and researchers which are working on wheat. [7-9]. The value of components having negative sign is accepted as zero for to prevent the unwanted reduction of the phenotypical variance at the prediction of genetic degree. So, the first priority is given to the heritability [10]. Eight wheat genotypes were evaluated which included Benazir, Imdad-2005, TD-1, Anmol-91, Hamal, SKD-II, 2011-Advance Line and V-11005 Advance Line.

The study showed that genotype Anmol-91 surpassed rest of genotypes with maximum plant height (94.53 cm), and V-11005 Advance line surpassed in tillering capacity (15.00) and spikelets spike^{-1} (23.00), while longer spikes were produced by genotypes TD-1 (15.02 cm) and Benazir (14.49 cm). Genotype Imdad-2005 was most promising for grains spike^{-1} (86.03), and seed index was higher in TD-1 (51.33 g), Benazir (48.97 g) and V-11005 (48.53 g). Genotype TD-1 significantly exceeded in grain yield plant^{-1} (23.53 g) to other tested genotypes, followed by V-11005-Advance line (21.47 g) and 2011-Advance line (20.47 g); while the lowest grain yield plant^{-1} (18.26 g) was

obtained in genotype Anmol-91. These results further more supported by [2, 3, 11], who find out that the different genotypes are highly significant for all the traits such as spikelets per spike, plant height, grains per plant, grain weight per spike, 1000-grain weight and spike length grain yield. Similarly [12] find out that huge number of tillers and grain yield are two major yield contributing factors in the selection of high yielding varieties of wheat. [13], showed that spike weight plant^{-1} is an important variable which contributes to the wheat grain yield variation, whereas, grain weight spike^{-1} and the genotypes which are used in this study are significantly varied due to their genotypic performance.

The association among the spike of grain and yield of grain was observed highly significant. Same findings were bowered by [14-17]. The mention traits were observed direct positive influence on the yield of grain. Another statement reported by [18, 19]. The direct influence may be similar as the association showed positive effect of genotypes; due to this the procedure of direct selection of these traits is suggested to found higher production. The association among the 1000 grain yield weight was found non-significant and negative, which is against the findings of [20]. The variation among the findings of may be due to different genotypes under the observation and environmental conditions. The direct influence of weight of 1000 grain on the production was also found negatively and non-significant, these findings are accordance with the findings of [2, 19].

Conclusion

It is concluded that genotype TD-1 significantly exceeded in grain yield plant^{-1} (23.53 g) to other tested genotypes, followed by V-11005-Advance line (21.47 g) and 2011-Advance line (20.47 g); while lowest grain yield plant^{-1} (18.26 g) was noted in genotype Anmol-91.

Authors' contributions

Conceived and designed the experiments: AA Rajper & SK Baloch, Performed the experiments: AJ Chandio, R Anjum & K

Baloch, Analyzed the data: SH Kaleri & B A Rajput, Contributed materials/ analysis/ tools:, SK Baloch & RR Kaleri, Wrote the paper: SK Baloch & RR Kaleri.

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