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COMPARATIVE PERFORMANCE OF PROMISING ADVANCED WHEAT GENOTYPES WITH COMMERCIAL WHEAT CULTIVARS IN SINDH

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ABSTRACT

An experiment was carried out to evaluate the comparative performance of promising advanced wheat genotypes. Fourteen genotypes with three check varieties viz. Kiran-95, T.J-83 and T.D-1 were evaluated for yield and yield associated traits. Experiment was laid-out in randomized complete block design (RCBD) consisting of three replications during the crop year 2012-2013. The analysis of variance (ANOVA) revealed significant differences between varieties for different traits of advanced lines and commercial checks. The highest grain yield was produced by the genotype BWS-78 (7708 kg ha^{-1}) followed by EST-29/9 (6979 kg ha^{-1}) although non-significant for each other. The high yielding genotype BWS-78 also took less number of days (124) to maturity, semi-dwarf plant height and comparatively better 1000-grain weight. However, maximum 1000-grain weight (45.3g) among the test genotypes was obtained by NIA-25/5 which was not significantly different than check variety T.D-1 (46.3g). Similarly, EST-29/9 had tall-dwarf plant height, early maturity and comparatively higher 1000-grain weight (45.0g) and ranked as second highest grain yielding genotype but was not significantly different than NIA-28/4, D-H-6/6 and D-H-6/7. The newly selected genetically improved genotypes possesses early maturity will be further confirmed and could be grown under late planting conditions.

KEY WORDS: *Advanced genotypes, Yield contributing traits, Grain yield.*

INTRODUCTION

Wheat (*Triticum aestivum* L.) is the main source of subsistence for people of Pakistan and cardinal among other cereal crops. It provides 19% total available calories to the masses (FAOSTAT, 2014). It not only provides food security but also play equally important role in the economic stability of the poor farming community. Wheat is cultivated during winter (rabi) season on an area of about nine million hectares. It contributes about 10.3 percent of value added in Agriculture and 2.2 % of GDP. During crop year 2015-16 wheat production reached at 25.482 million tons from an area of 9.260 million hectares (Anonymous, 2016). Wheat flour fulfills 72 % of nation's daily caloric intake with per capita consumption of approximately 124 kg per year, being highest in the world (Williams and Raza 2015). An increase in yield per unit area is highly desire to feed the ever-increasing world population that is currently 7.2 billion and estimated to reach 9.6 billion by 2050 (FAO, 2009). In a wheat breeding program, high grain yield is the prime objective of a plant breeder to develop new improved varieties. Grain yield is a polygenic character and is greatly influenced by the changing environments. The idea of yield components in breeding has received ample significance in improving potential yield (Khan et al., 2013). The yield is governed by the genotypic potential, suitable environment and the number of yield associated traits like semi-dwarf plant height, grains spike-1, number of fertile tillers per plant and seed index (Sial et al., 2013). Wheat varieties with desirable genetic potential could perform better in favorable and unfavorable environments (Calenderini and Slafer, 1999; Reynolds and Borlaug, 2006). Instability in weather and management practices affect wheat growth and yield (Al-Kaisi et al., 1997; Ghahraman and Sepaskhah, 1997; Zhang et al., 2003; Benson and Craig, 2014).

To evolve new improved high yielding varieties using the available genetic resources and their study for associated traits has immense importance in any plant breeding programme (Akash et al., 2009; Ullah et al., 2011). The main purpose of this study was to determine the performance of newly evolved elite wheat lines and their association with yield contributing traits. This study will provide basic knowledge regarding potential of new elite lines for successful future breeding programmes.

MATERIALS AND METHODS

Fourteen (14) advanced elite wheat genotypes with three check varieties viz. Kiran-95, T.J-83 and T.D-1 were studied to find out the comparative performance. The experiment was laid out in a randomized complete block design (RCBD) with three replicates at the experimental farm of Nuclear Institute of Agriculture, (NIA) Tando Jam during the crop year 2012-13. The plot size was 4.8 m2 with 04 rows, each of 4 m in length and row to row distance was set at 30 cm. The data were recorded on days taken to heading and maturity, plant height (cm), 1000 grain weight (g) and grain yield (kg ha-1) at the proper growth stage. Data were recorded on days to heading for each cultivar from the date of planting date to 75% spikes appeared in each genotype. Days to maturity were recorded as number of days from planting to the physiological maturity. Plant height was measured in cm from the base to the tip of the spike of a plant excluding awns, by means of a meter scale at physiological maturity. Central two rows of each plot were manually harvested with sickle near the culm base at maturity. Thousand grains were counted and weighed from randomly selected samples. The grain yield obtained after threshing the central two rows from each plot. Analysis of Variance (ANOVA) was statistically analyzed and means were compared using honestly significant differences (HSD), Tuckey's test at 0.05 level of significance by Statistical computer software "Statistix 8.1".

RESULTS AND DISCUSSION

Days to 75% heading: Mean square from ANOVA revealed highly significant (P <0.05) differences for days to heading (Table 2) among the studied wheat genotypes. In case of advanced genotypes, variation for days to heading was recorded ranged from 67 to 87 days. The minimum days to heading were observed in genotypes D-H-6/6 and D-H-6/7 (67and 68 days, respectively), whereas BWQ-4, NIA-25/5, NIA-10/8 and D-12/1 took maximum (87 days) days to heading (Table-2). Significant differences were observed for days to heading and maturity which help plants to escape the effects of high temperature on plant growth, development and final grain yield. Ear emergence is an important trait that determines the phenological behavior of the genotypes. Some of the researchers reported partial dominance for this trait and they also concluded that early maturing genotypes are very useful in late sown conditions (Iqbal et al., 1991; Patil et al., 1995).

Days to maturity: There were significant (P≤ 0.05) differences among the genotypes for the trait days to maturity (Table 1). Days to maturity ranged from 123 to 137 days for advanced genotypes and 121 to 124 days for check varieties. Early maturity (123 days) was observed in genotypes NIA-28/4, D-H-6/6 and D-H-6/7 whereas genotype D-12/1 took maximum days (137 days) to maturity (Table-2). The wide variation in days to maturity offered an opportunity to select early maturing genotypes for late sowing systems. These findings are in line with the results obtained by earlier workers i.e., Adary & Qualset (1978), Alptekin & Nusret (2005) and Bekele (1984) who also found the genetic variability among the genotypes for the trait.

Table -1: Analysis of variance (ANOVA) for yield and associated traits

Source	df	Days to75% heading	Days to maturity	Plant height (cm)	1000-grain weight (g)	Grain yield kg ha^{-1}
Rep	2	1.431	7.8235	1.647	0.0033	500180
Genotypes	16	175.01**	93.4681**	314.662**	16.7568**	3403569**
Error	32	0.598	1.5527	2.147	0.6653	568333
Total	50					

Note: Significant at 0.05 level of probability; df= Degrees of freedom

Table- 2: Overall mean performance of wheat genotypes for yield and yield associated traits

S/No.	Genotypes	Days to heading	Days to maturity	Plant height (cm)	1000-grain weight(g)	Grain yield (kg ha^{-1})
1	BWM-3	69.6efgh	126 de	96.0 f	40.5 ij	4375 ghi
2	NIA-9/5	81.0 b	133 b	90.6 g	43.0 fg	6250 bcde
3	NIA-10/8	87.0 a	136 a	96.0 f	43.7 def	5417 defg
4	MSH-17	71.0 ef	124 ef	89.0 g	41.0 hi	5417 defg
5	BWQ-4	87.0 a	136 a	101.0 cd	44.7 bcd	6250 bcde
6	BWS-78	70.0 efg	124 f	88.3 g	44.0 cdef	7708 a
7	D-12/1	87.0 a	137 a	109.0 a	44.0 cdef	5938 cde
8	NIA-28/4	69.0 efghi	123 f	97.6 ef	40.0 ijk	5729 cdef
9	NIA-25/5	87.0 a	136 a	99.6 de	45.3 ab	3750 hi
10	MSH-22	78.0 c	129 c	106.6 ab	38.0 l	5729 cdef
11	EST-28/11	77.0 c	129 c	106.3 b	42.2 gh	5313 defg
12	EST-29/9	74.0 d	124 f	101.0 cd	45.0 abc	6979 abc
13	D-H-6/6	67.0 i	123 f	77.0 j	39.5 jk	3646 i
14	D-H-6/7	68.0 ghi	123 f	77.0 j	41.0 hi	4583 fghi
15	Kiran-95	72 .0 e	121 g	103.0 c	44.4 bcde	6354 bcd
16	T.J-83	69 .0 fghi	123 f	83.3 h	43.4 efg	5313 defg
17	T.D-1	67.0 i	124 f	80.6 I	46.3 a	5000 efgh
	HSD value	2.3645	3.8100	4.4802	2.4940	2305.1

Note: *Different letters denote significant difference between treatments* (Tukey's *HSD test*, P< 0.05).

Plant Height (cm): The wide variation among genotypes was observed for plant height (Table 2). Plant height is one of the yield components for semi-dwarf wheat that contributes significantly to final grain yield. Plant height ranged from 77 to 109 cm in test entries while for check varieties, it ranged from 80.0 to 103.0 cm. Maximum plant height was attained by D-12/1 (109.0 cm). Significant differences among genotypes for plant height provide an evidence of genetic diversity and an opportunity to select genotypes with different stature groups. Although, semi-dwarf plant height is reported as a positive character for lodging resistance and harvest index (Arain et al., 2006), but selection of tall plants is helpful for biologically vigorous plants (Azam et al., 2013). Plant height of cereals is one of the important morphological characteristics besides yield, yield components and quality (Kün, 1996).

1000-grain weight (g): The seed index (1000 grain weight) is an important yield contributing trait particularly considered for harsh environments (Jamil et al, 2015). Highly significant differences were found in genotypes for 1000-grain weight (Table 2). Akram et al., (2008) also reported the significant variation between genotypes for 1000-grain weight in wheat. The highest 1000 grain weight was produced by the check variety TD-1 (46.3 g). However, in test entries, 1000-grain weight varied from 38.0 to 45.3 g, whilst maximum 1000-grain weight among advanced genotypes was observed in NIA-25/5 (45.3g) although was not significantly lower than the check TD. The 1000 grain weight in genotype EST-29/9 (45 g) was not significantly different from BWQ-4, BWS-78, D-12/1 and Kiran-95. Higher 1000 grain weight in NIA-25/5 may be due to less number of tillers in the genotypes, which results into more transference of assimilate towards the seeds. The possible reason for low yield in line NIA-25/5 could be late heading and maturity. The late maturing genotypes experiencing stress during grain development phase, hence, produce low yield. However, EST-29/9 is high yielding genotype the reasons for its high yield could be early in heading and maturity, and the genotype showed escape mechanism from the high temperature stress. Munir et al. (2007) reported 1000-grain weight as one of the major yield contributing trait, thus genotypes with higher 1000-grain weight could be selected as superior high yielding genotypes for future breeding. Direct selection for yield in early generations is often misleading in wheat as wheat yield is polygenic character (Akash and Kang, 2010).

Grain yield kg ha-1: Grain yield is a complex polygenetic trait governed by the genotype, environment and the genotype-environment (G×E) interaction. Mean square from ANOVA showed highly significant ($P<0.05$) difference among genotypes for grain yield (Table-1). Data for grain yield showed wide variation ranged from 3646 to 7708 kg ha-1(Table 2). Maximum grain yield was recorded in BWS-78 (7708 kg ha-1) followed by the EST-29/9 (6979 kg ha-1), and were not signifycantly different from each other. The possible reasons for high grain yield could be early maturity and comparatively higher 1000 grain weight as yield is a polygenic character and can be affected by any associated trait in different genotypes. Early maturity reflects the escape mechanism of these genotypes from high temperature stress. Moreover, lower yield in other early maturing genotypes might be due to their different genetic backgrounds and response to the environment. Genotype NIA-25/5 produced the highest 1000 grain weight (45.3 g) among all the test entries. Reduced yield in this line may be due more days for maturity (136 days). Moreover, wheat is highly sensitive to increased temperature during the reproductive stage, due to direct effect of temperature on grain numbers (Dias et al., 2010). During meiosis, temperatures exceeding 30°C are reported to cause abnormal development of both ovary and anthers which reduces floret fertility and, consequently, the number of developing grains (Grant et al., 2011).

CONCLUSION

It has been concluded from our research findings that newly evolved advanced wheat genotypes possess genetic variability as most of the traits were significantly different among each other in their response for different yield associated traits. Some genotypes possess genetic potential in terms of improvement in grain yield and various other related traits like maturity time and 1000-grain weight. Conclusively, genotype BWS-78 produced significantly high grain yield than all other contesting genotypes/varieties but was non-significant with EST-29/9. The high grain yield in the BWS-78 might be attributed to the earlier in ripening period and higher in 1000-grain weight as compa-red to other entries. The selected high yielding and early maturing genotypes (BWS-78 and EST-29/9) will be further confirmed and tested as potential genotypes suitable for late planting.

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