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Adaptability and yield evaluation of different commercial wheat varieties under agro-ecological condition of Chilas Diamer

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Abstract

Gilgit Baltistan has unique agro ecological conditions that are totally different from the rest of country. The bread wheat varieties that are bred for the other parts of country are hardly adapted in this particular agro ecological condition. A study was conducted in Mountain Agricultural Research Station Chilas to assess yield performance and adaptability of different wheat varieties developed in other institutes of the country. The experiment was conducted on two-factor factorial RCBD design with three replications. Eight different varieties including two elite bread lines were tested. The data on some agronomical and physiological traits like plant height, number of days taken to 50% heading, number of days taken to maturity, number of grains per spike, grain yield and straw yield was evaluated. The maximum plant height was gained by variety BARS (82.3cm) and minimum height was recorded in variety Chakwal 50. The more number of days to flowering were observed in variety Pirsabak 2005.The maximum days for physiological maturity (159.4) were taken by E-20. The Variety Fareed 2006 gave the maximum grain yield (2732kg/ha). The maximum straw yield was recorded in entry E-8 whereas minimum straw yield was recorded in E –20.

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Introduction

Wheat (*Triticum aestivum* L) is most important staple food of the people of Pakistan. It is grown both irrigated and rain fed areas of the country. It is grown on the area of 8693 million hectares with production 24231 million tons and the average yield is of 2787 kg /ha (Anonymous, 2013). Wheat flour is also the chief dietetic item of people of Gilgit Baltistan of Pakistan. The total food requirement of Gilgit Baltistan is 25 metric tons. Out of which 6.244 metric tons (25%) is locally produced while remaining quantity is being imported through food department Gilgit Baltistan from PASCO. By growing high yield varieties and adapting improved technologies these gap can be reduced. In Gilgit Baltistan Wheat is not only grown for grain but also for fodder. Because of long and harsh dry winter the livestock depends on hay, maize stalk and wheat straw. Hence the farmers prefer the varieties not only with high grain abut also with high straw yield. Due to this, wheat occupies a central position in the farming system of Gilgit Baltistan. Wherever, farmers grow low yielding local cultivars, these are susceptible to diseases like rusts and smuts and lodging therefore, have low yield potential. The region also has a unique agroecological condition that is totally different from the rest of country.

The bread wheat varieties that are bred for the other parts of country are hardly adapted in this particular agroecological condition. Thus the yield of wheat crop is very below (30%) as compare to other wheat growing areas of the countries(Anonymous, 2000). The cultivation of local low yielding varieties as well as the improved wheat varieties developed in down country is general practice in the region.

These improved varieties are usually not tested for adaptability in the region before general cultivation in farmers' fields. In addition the use of un-judiciary fertilizer, poor soil conditions and late sowing also affect yield of wheat crop. Cultivation of well adapted and high yielding varieties having desirable traits of economical interest is of paramount important to enhance yield of the region. Alam *et al*. (2006) also viewed that the cultivation of adaptable wheat varieties can increase wheat yield.

There is lot of variability among commercial wheat varieties for yield and its components (Akmal *et al*; 2000 and Nadeem, 2001). The varieties expressing better traits in unique environment can be selected and recommended for general cultivation in the region. The study was aimed to evaluate adaptability of improved bread wheat varieties in agro ecological conditions of Chilas Diamer and recommending the well adaptable varieties for the region.

Material and methods

The present study carried out in department of Mountain Agricultural Research Station of MARC Chilas District Diamer. The experiment was conducted on two-factor factorial RCBD Design. Six different commercial wheat varieties and two elite lines were tested.

The varieties/lines studied were Pirsabak 2005, Chakwal 50, AS 2002, Seher 2006, BARS 2009, Fareed 2006, E-8 and E-20. The wheat variety Chakwal 50 was used as check variety. The adapted wheat variety Chakwal 50 was used as check variety. The experiment was laid out in RCBD with three replications. The experiment was conducted during two consecutive years 2010-11 and 2011-12 cropping season. Plot size was 5 x 1.8m and row to row distance was 30 cm. The crop was shown on 14th December during both years.

The data were recorded for number of days taken to 50% heading, number of days taken to physiological maturity, plant height (cm), number of grains per spike, , grain yield (kg) per hectare and straw yield (kg) per hectare. Days for sowing to 50% heading and physical maturity was recorded. Ten plants were taken randomly from each treatment in each replication to record the data for plant height (cm) and number of grains per spike. Total grain and straw yield (kg) per plot was recorded to take grain and straw yield per hectare. The data were subjected to analysis of variance (Steel and Torrie, 1980). Variables showing significant differences among the

varieties were further tested for comparison of significance of means by using Duncan's Multiple Range Test (Duncan, 1955).

Results and discussion

Plant Height (cm)

The analysis of variance showed that effect of year x variety interaction on plant height was significant (Table 1).

Table 1. Mean square values from analysis of variance for different traits studied.

SOV	DF	PH	DH	DM	NGPS	GY	SY
Rep.	3	5.356	3.017	1.347	30.8962	811111	3779818
Year	1	2.852 Ns	808.521 **	475.021 **	1.3300 Ns	120000 Ns	1868352
Variety	7	130.075 **	18.237 Ns	21.946**	36.9834*	388449 *	192781
Year x Variety	7	32.718 Ns	11.664 Ns	4.592 Ns	4.1901 Ns	138976 Ns	84576
Error	29	13.480	8.263	2.412	14.3718	164800	439646
Total	47						

*significant, **highly significant, ns Non-significant, PH = Plant Height, DH = Days to 50% heading, DM = Days to physiological Maturity, NGPS = Number of Grains per Spike, GY = Grain Yield per hectare (kg) and SY = Straw yield per hectare (kg).

The variety BARS attained the maximum height (83.6 cm) on year 2010-11 whereas the variety Chakwal 50 had the least plant height (68.0cm) during the year 2011-12 (Fig. 1). The main affect of variety on plant height was highly significant while the main effect of year on the plant height was non-significant (Table 2). Duncan's Multiple Range Test revealed two groups of variety for plant height (Table 2).

Table 2. Mean values for different parameters studied.

Varieties	PH (cm)	DH	DM	NGPS	GY(kgha^{-1})	SY(kgha^{-1})
Pirsabak 2005	79.9a*	123.7a	156.7b	40.7a	2556 abc	4677a
Chakwal 50	70.1b	121.5 abc	156.2b	37.0abc	2115 c	4558a
AS 2002	73.1b	118.2 c	153.4c	34.0c	2082 c	4527a
Seher 2006	81.8a	120.0 bc	156.4b	38.8ab	2374 acc	4449a
BARS 2009	82.3a	121.3 abc	159.2a	33.9c	2691 ab	4334a
E-8	81.6a	119.2 bc	159.2a	35.0bc	2558 abc	4298a
Fareed 2006	80.2a	122.0 ab	157.9ab	37,4abc	2732 a	4238a
E-20	74.2b	121.8 ab	159.4 a	39.3ab	2230 bc	4140a

*The values sharing the same letters are non-significantly different from each other.

Group one includes the varieties BARS 2009, Seher 2006, E-8, Fareed 2006 and Pirsabak 2005 while the group two includes the E-20, AS 2002 and Chakwal 50. The varieties in each group did not differ significantly from each other. However, the maximum plant height was attained by the variety BARS 2009 (82.3 cm) and the minimum plant height was gained by variety Chakwal 50. Similar results have also been reported by Hussain (1986) and Qamar *et al.* (2007) under the unique agro-ecological condition of Gilgit Baltistan of Pakistan. They viewed that the wheat varieties had significant effect on plant height while environment did not affect the plant height. They also suggested that the suitable varieties that adapted well in these conditions can be selected.

Number of days taken to 50% heading

The interactive effect of years x variety effect variety

did not influence the number days to 50% heading (Table 1). This indicates that the test varieties/lines responded equally to the changed environment. Main effect of year on number of days to 50% heading was significant whereas the variety showed a highly significant effect on days to 50% heading (Table 1).

The variety Pirsabak 2005 took maximum day to flowering (123.7days) while the variety AS 2002 took minimum days (118.2.) to 50% heading (Table 2). The difference of days taken to 50% heading in 2nd year is generally more as compare to 1st year in all varieties (Table 3).

Table 3. Effect of year on different parameters.

Year	PH	DM	DM	NGPS	GY(kgha^{-1})	SY(kgha^{-1})
Year 1	78.1 a	125.1a	1260.2 a	37.1 a	2467 a	4600 a
Year 2	77.6 a	116.9b	154.2 b	36.8 b	2367 b	4205 ab

This data show those days to 50% heading of wheat crop is very sensitive to the environmental changes. Favorable environmental condition may enhance or delay the heading of wheat crops.

These findings are in line with those of Ahmad *et al.* (2009), Yaqub *et al.*, (2011) and Nizamuddin *et al.* (2014) who also fund genetic variability in different wheat genotypes for number of days to 50% heading. They also noticed the effect of environmental conditions on days to 50% heading of wheat crop.

Number of days taken to physiological maturity

Likewise Number of days taken to 50% heading the effect of year x variety interaction was also non significant on number of days to physiological maturity (Table 1).

The main effect of both the year and variety was highly significant on number of days to physiological maturity. The number of days taken to maturity ranges from 153.4 to 159.4 days (Table 2).

The maximum days has taken by E-20, E-8 and BARS 2009.

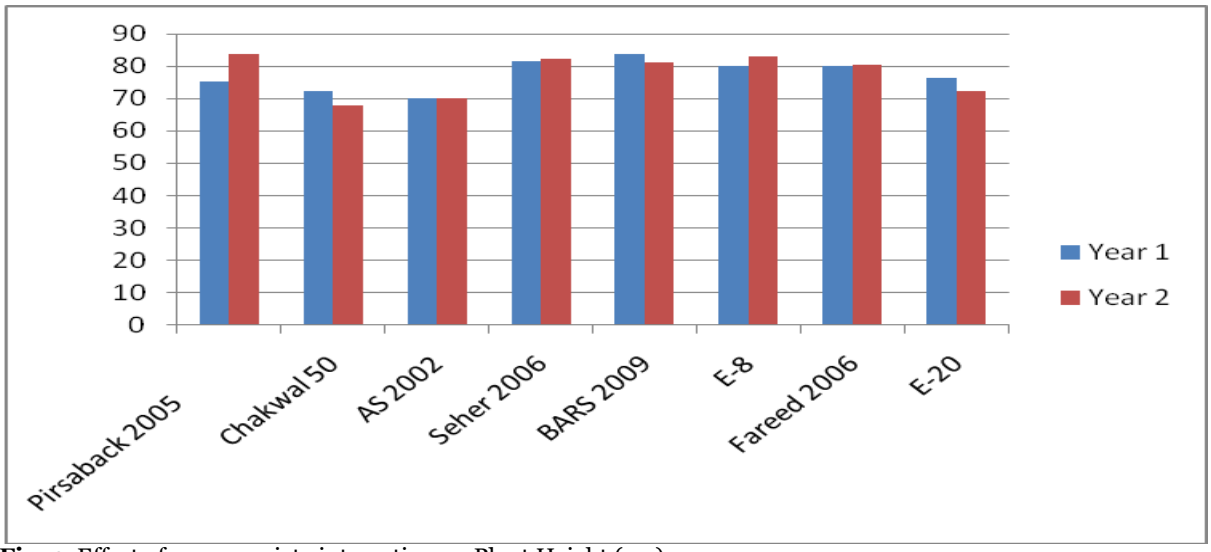

Fig. 1. Effect of year x variety interaction on Plant Height (cm).

The minimum number of day has taken by AS-2002 (153.4 days). Here again days to physiological maturity is also more in 2nd as compared to the 1st year (Table 3). In this research the test wheat varieties/lines did not show variable response to the change environment; however changed environment (year) had highly significant effect on enhancing or delaying the physiological maturity of wheat crops. Similarly, the test varieties/lines displayed great genetic variability for number of days to physiological

maturity. These findings also confirms the previous studies of Qamar *et al.* (2007), Ahmad *et al.* (2009), Yaqub *et al.*, (2011) and Sohail *et al.* (2014). They claimed that the number of days to philological of wheat crop is highly and equally affected by wheat genotypes and variable environmental conditions.

Number of grains per spike

Analysis of variance (Table 1) showed that interactive effect of year x variety and the main effect of year did not significant influence the number of grains per spike. These results are in contradiction to those of Matsumura *et al.* (1988), Waraich *et al.* (1982), and Gebeyehou *et al.* (1982) who reported positive relation-ship of favorable environment to the number of grains per spike. There was significant variation among the varieties/lines for the number of grains per spike. The maximum numbers of grains per spike were recorded in variety Pirsabak 2005 (40.7) whereas minimum number of grains per spike were produce by the BARS 2009 (33.9kg/ha) (Table 2). Similar findings have also been reported by Ibrahim *et al.* (1986), Ansari *et al.* (1989, Akmal *et al* (2000) Nadeem *et al* (2001), Ubaidullah *et al.* (2007) Akram *et al* (2009) who also observed significant difference among the wheat varieties for number of grain per spike. Number of grain per spike is an important factor for yield contributing. The number of grain per spike is directly co-related to yield production (Qamar *et al.*, 2004).

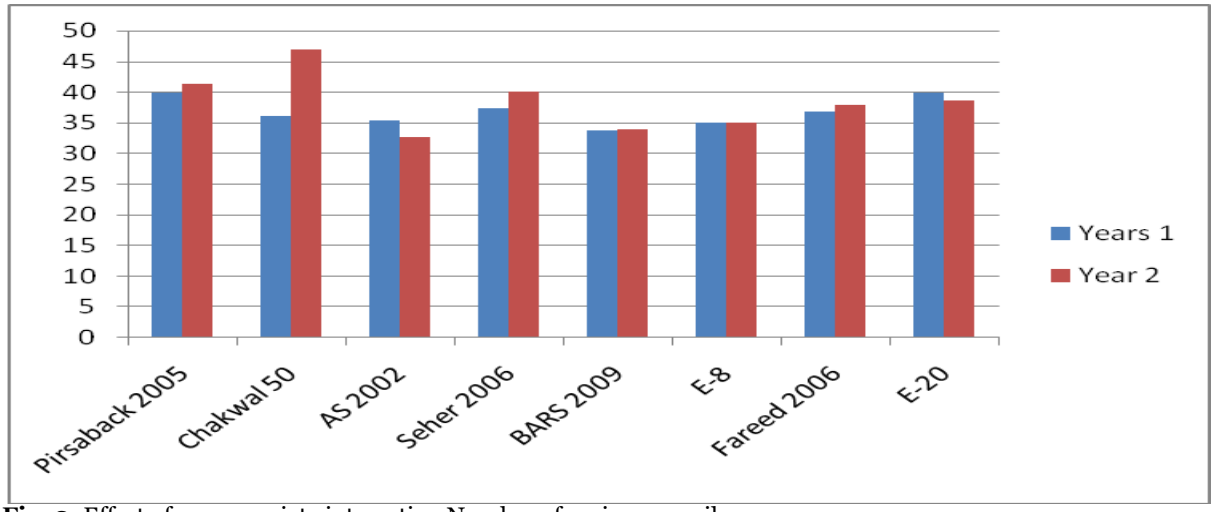

Fig. 2. Effect of year x variety interaction Number of grains per spike.

Straw yield (kg/ha)

In this study the straw yield of wheat varieties/lines was not affected either by interactive effect ion of year x variety or by main effect of both year and variety (Table 1). This might be the effect of shorter growing period because of each genotype needs a specific growing season to produce sufficient biomass. Hence, the terminal heat stress enhanced the developmental stages of crop and the wheat varieties/lines could not produce the potential straw yield (Qamer *at el;* 2007).

Grain yield (kg/ha)

The final grain yield is a function of the combined effect of individual yield components, which are likely to be influenced by the genetic as well as the environmental factors. However, in this study the interactive effect of year x variety and main effect of year also did not significantly influence grain yield per hectare (Table 1). These results indicated that the test wheat varieties/lines did nod showed differential response to changed environments. However, there was significant and continuous variation among the varieties/lines for grain yield. The maximum grain yield was gained by Fareed 2006 (2732 kg/ha) and the minimum grain yield was produced by check variety Chakwal 50 and AS 2002 (Table 2). However, these two varieties were statistically at par with Pirsabak 2005, Seher 2006, E-8 and E-20. The top yielder varieties Fareed 2006 and BARS 2009

produced significantly higher yield than Check variety Chakwal 50 and AS 2002. Baig *et al* (2008) also reported significant variation among wheat varieties at Chilas. Khan *et al.* (2014) also reported similar results. Qamar (2004) reported that the varieties adapted well in any environment will express higher yield than the poor adapted varieties. In this research the wheat variety Fareed 2007 gave 29% higher grain yield (2732 kg/ha) than check variety Chakwal 50 (2415 kg/ha), hence can be recommended for general cultivation under double cropping zone of Gilgit Baltistan.

From the above discussion it can be concluded that the wheat production can be enhance by selecting improved high yielding varieties through adaptive trails in the fascinating agro-ecological condition of Gilgit Baltistan. Through cultivation of recommended varieties the yield gap can be minimized at local and national level.

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