INTERNATIONAL JOURNAL OF AGRICULTURE & BIOLOGY
ISSN Print: 1560–8530; ISSN Online: 1814–9596
13–1060/2015/17–5–945–952
DOI: 10.17957/IJAB/15.0006
http://www.fspublishers.org

Full Length Article

Influence of Planting Dates on Grain Quality of Different Wheat Cultivars in Dual Purpose System

Fazal Munsif[1*], Muhammad Arif[1], Kawsar Ali[1], M.T. Jan[1] and M. Jamal Khan[2]
[1]*Department of Agronomy, The University of Agriculture Peshawar, Amir Muhammad Khan Campus Mardan -23200, Pakistan*
[2]*Departments of Soil and Environmental Sciences, The University of Agriculture Peshawar-25130, Pakistan*
[*]For correspondence: munsiffazal@yahoo.com

Abstract

Field experiments were conducted to determine the effect of wheat grain quality under optimal planting date suitable for dual purpose (DP) system and to compare and find out wheat cultivars with good quality parameters after recovered from cutting at stem elongation stage. The experiments were laid out in randomized complete block design with split plot arrangement having three replications during winter 2009–2010 and 2010–2011 at New Developmental Farm (NDF), Khyber Pakhtunkhwa Agricultural University Peshawar. Six wheat cultivars (Saleem-2000, Bathoor-2007, Fakhre-Sarhad 99 (FS-99), Uqab-2000, Siran-2008 and Ghaznavi-98), three planting dates (15th October, 30th October and 14th November) and two cutting treatments (cut and no-cut) were included in the experiments. Results indicated that planting in end of October and 14th November resulted in higher grain moisture, crude protein, wet and dry gluten content. Wheat cultivar Ghaznavi-98 and Siran-2008 were higher in ash content whereas higher crude protein content was recorded in wheat cultivars Bathoor-2007, Uqab-2000 and Siran-2008. Crude fiber and wet gluten were in similar range for all cultivars except Bathoor-2007 and FS-99 however higher dry glutens were found in Uqab-2000 and Saleem-2000. Cutting treatment had not significantly reduced all quality parameters except dry gluten. It was concluded from the study that cutting of wheat 70 days after planting had no adverse effect on the quality of wheat grain except gluten content planted either on 30th October or 14th November and thus wheat can be used as a dual purpose crop for forage early in the season with reduced gluten content than only for grain. Wheat cv. Bathoor-2007, Uqab-2000 and Siran-2008 can be planted for dual purpose wheat without any penalty on grain quality.

Keywords: Dual purpose wheat; Quality parameters; Cultivars; Crude protein; Fiber contents

Introduction

Wheat (*Triticum aestivum* L.) is commonly grown both as fodder and grain purpose crop for livestock due to its palatability, higher crude protein and digestibility compared to other fodder crops (Krenzer, 2000 Hossain *et al*., 2003). It helps to decrease production risk and increase profit margin by providing sufficient feed to the starving livestock in Pakistan with higher net income than wheat system where grown only for grain purpose; though at the cost of some decline in grain yield of dual-purpose wheat (Naveed *et al*., 2014). Nonetheless, the success of dual purpose wheat depends on the crop requirements for grain and fodder as well. Therefore, in case of high fodder value, the crop need to be grown earlier for increasing fodder and when the value of grain is higher than optimal planting should be preferred (Hossain *et al*., 2003). However, wheat grain harvested from a dual-purpose crop is often professed to have inferior quality compared with of a grain-only crop. Grain weight, size and protein content may be reduced in the dual-purpose system possibly due to reduced photosynthetic assimilation and in availability of nitrogen for redistribution and partitioning during grain filling after cutting for fodder (MacKown and Rao, 1998).

Wheat quality is influenced both by genotype and growth environment (Kent and Evers, 1994). Both protein quantity and quality are considered important in estimating the potential of flour for its end use quality. The grain moisture of wheat is critical for storage, milling industry, import and export. High grain moisture results in higher microbial activity and lower dry matter which are not desirable in wheat trade. The associated effects of cutting or grazing pressure on wheat grain quality are not formally documented. Several components of bread wheat quality that are central to domestic and international wheat trade are greatly affected by genotype as well environment (Marry *et al*., 2001; Zhu and Khan, 2001). Protein content and its composition are vital for several physical and nutritional characteristics of dough, which in turn influence bread volume and texture (Finney *et al*., 1987). Crude protein content increased with delayed sowing (Reents *et al*., 1997; Yadava and Singh, 2003) but grain size is lowered with

To cite this paper: Munsif, F., M. Arif, K. Ali, M.T. Jan and M.J. Khan, 2015. Influence of planting dates on grain quality of different wheat cultivars in dual purpose system. *Int. J. Agric. Biol.*, 17: 945–952

delayed sowing (Patil *et al*., 2000). Higher temperatures in the post-anthesis period of late sown wheat shorten the grain filling period and results in a smaller endosperms, lower grain weights and increased protein content (Ahmed *et al*., 1994; Farooq and Cheema, 2013).

In this paper, we described wheat quality parameters of the selective cultivars that might be influenced by planting dates after cutting at vegetative stage which is non-traditional practice in Pakistan. Thus, the study was therefore imperative to determine the influence of planting dates and cutting on quality parameters of the wheat cultivars and to compare the quality characteristics of dual purpose wheat with grain only.

Materials and Methods

Experimental Materials

The experiments were carried out at New Developmental Farm of Khyber Pakhtunkhwa Agricultural University Peshawar during winter 2009-2010 and 2010-2011. The treatments were consisted of three planting dates (D), six cultivars (Cv) and two cutting treatments (C). Three planting dates (15th October, 30th October and 14th November), six cultivars (Saleem-2000, Bathoor-2007, Fakhre sarhad-99, Uqab-2000, Siran-2008, and Ghaznavi-98) and two cutting treatments (cut and no-cut) were included in the experiment. Wheat cultivars were sown at three planting dates, starting from early to optimum and given a cut 70 days after sowing (Arif *et al*., 2006). The experiment was laid out in randomized complete block design with split plot arrangement having three replications. Treatment combinations of planting dates and cutting were kept in the main plots, while wheat cultivars were allotted to sub plots. A plot size of 4 m × 3 m with row-to-row distance of 30 cm was used. The soil was ploughed to 30 cm depth across the field twice and up and down twice by using common cultivator (tine plough) followed by planking to break the clods and level the field. The seed was sown at the rate of 120 kg ha^{-1} with the help of hand hoe in each sub plot. Nitrogen and phosphorus were applied at the rate of 120 and 100 kg ha^{-1} in the form of urea and DAP, respectively as basal doses. All phosphorus was applied at the time of sowing. Half nitrogen was applied with first irrigation about 30 days after sowing, while remaining half soon after cutting to each subplot. All agronomic practices were kept constant for all treatments. For each sowing date, cutting was imposed 70 days after sowing (stem elongation stage; Feekes and Zadoks scale 5 and 30, respectively) leaving about 4.0 cm stem portion above the ground. After the harvest of the crop during both the years, data were recorded on moisture, ash, crude protein, crude fiber, wet and dry gluten contents.

Procedure for Data Collection

For the estimation of moisture content, about 2 g grain samples from each treatment were taken in clean and pre-weighed crucibles in duplicate. The crucibles were then placed in laboratory oven at 105°C until a constant weight was obtained. The samples were then cooled in a desiccator for 30 min and re-weighed. Ash content was determined by taking grains samples from each treatment and was incinerated in a muffle furnace at 550°C for 6 h for the determination of ash content. After burning, the grains samples were cooled for 30 min in a desiccator and re-weighed. Ash percentage was calculated as under:

$$Ash(\%) = \frac{C - A x 100}{B - A}$$

A = weight of empty crucible, B = weight of crucible + grain sample (post drying), C = weight of crucible + ash.

Crude protein was determined by Kjeldhal method (AOAC, 1990). In this method, the grinded grain samples of each treatment were digested with concentrated sulphuric acid (H_2SO_4) and followed by distillation and titration. Samples (1 g) in duplicate were taken in the Tecator digestion tubes and added with 5 g of catalyst (K_2SO_4 93%, $CuSO_4$ 7%) and 10 mL concentrated sulfuric acid. Acetanilide (0.1 g) was processed as standard for recovery of nitrogen. The digestion tubes were heated in Tecator digestion block. The tubes were then allowed to cool at room temperature. About 15 mL distilled water was added in the tubes containing digested samples. After dispensing, required amount of sodium hydroxide (NaOH) solution (40% W/V) in the tubes to alkaline the sample and the contents were distilled for about seven minutes. The resulting ammonia was collected in conical flask containing 10 mL boric acid (2%) and 3-4 drops of methylene red indicator. The titration of distillate was carried out with 0.5 N sulfuric acid solution. To determine the blank values duplicate tubes containing 15 mL distilled water and 5 mL NaOH were also processed for distillation and titration. The percentage of nitrogen was calculated as under:

$$(N\%) = \frac{(V1 - V2)\, x 14.01 x 0.5 x 100}{(Sample\ (mg))}$$

V1= Titration reading of sample, V2= Titration reading of blank.

14.01= Atomic weight of Nitrogen (N), Crude protein was determined for feed sample, by multiplying the nitrogen content of the sample by 6.25.

Crude fiber are organic residues that remain after the digestion, first with weak solution of H_2SO_4 and then with a weak solution of sodium hydroxide. The residues collected after digestion is ignited and the loss in weight on burning is recorded as crude fiber. Moisture free sample (1 g) with dilute H_2SO_4 at rate of 200 mL was taken in a beaker and digested on crude fiber extraction apparatus for 30 min. The digest was filtered through glass buchner funnel with the help of suction air pump. The filtrate was then washed with hot water until it became acid free (15 mL filtrate was collected and 1 drop N/10 NaOH and 1 drop phenolphthalein indicator is added. Pink color was an indicator of being acid free). Transferred again to tall beaker and 200 mL boiling dilute NaOH was added. After 30 minutes digestion, the digest was filtered through glass buchner funnel with an aid of suction air pump. The filtrate was again washed with 10 mL hot dilute H_2SO_4 and then with hot water until it became acid free. The residues were transferred to a prepared gooch crucible and washed with 10 mL ethanol. Then the residues were dried in an oven at 135°C for 2 h. After cooling in desiccator for 30 min, the residues were weighed. Samples were further ignited in muffle furnace at 600°C for 30 min. Ignition residues were cooled in desiccator for 1 h and reweighed. The percentage of CF was calculated as under:

$$\%\text{CF (sample)} = \frac{(\text{crucible wt} + \text{dried residue}) - (\text{crucible wt.} + \text{ash residue}) \times 100}{(\text{Crucible wt.} + \text{sample}) - \text{empty crucible weight}}$$

Wet and dry gluten contents in wheat flour of each treatment were determined by hand wash method (AACC, 2000). From each treatment, about 25 g of wheat flour was mixed with 15 mL of water and dough was made in a bowl. The dough was allowed to stand for one hour and then pressed quietly in cold tap water, letting the washings passed through a fine sieve for the removal of all starch and soluble matter. Starch removal was tested by pressing a little water from the ball in to beaker and the cloudiness indicated that starch is still present. The ball was kept in cold water for an hour and water was squeezed with hands. Then the ball was placed in a tarred, flat-bottomed dish and weighed as moist gluten. For dry gluten estimation, the ball was dried in oven at temperature of 105°C until a constant weight.

Statistical Analysis

The data recorded were analyzed statistically combined over years using analysis of variance techniques appropriate for randomized complete block design with split plot arrangement. Means were compared using LSD test at 0.05 level of probability, when the F-values were significant (Jan *et al*., 2009). The statistical software GenStat release 8.1 was used for analysis of the data.

Results

Grain Moisture Content

Moisture content of wheat grains was significantly influenced by planting dates, whereas cutting did not affect moisture content of wheat grains. Wheat cultivars did not vary for moisture content of grains. The effect of year was significant. None of the interaction was found significant except D × V and D × C for grain moisture content (Table 1). Moisture content of grains was higher in 2009-10 as compared to 2009-2010. Moisture content in wheat grains increased with delay in planting. Higher moisture content was recorded for later planting in mid November, which was at par with 30th October planting, whereas lower moisture content was recorded in early planting in mid October. Interaction between D × V indicated that moisture content enhanced in wheat grains with delay in planting from mid October to mid November in all cultivars except Uqab-2000 and Ghaznavi-98 where there was no variation in moisture content in grains with delay in planting from 30th October to mid November (Fig. 1b). The D × C interaction indicated that moisture content in grains remained unchanged for mid October planting, whereas it was increased and decreased with cutting in 30th October and 14th November planting, respectively (Fig. 1a).

Grain Ash Content

Ash content of wheat grains were not significantly influenced by planting dates and cutting, whereas cultivars varied significantly for ash content in grains. The effect of year was also significant. None of the interaction was significant except D × V (Table 1). Ash content of grains was higher in 2010-2011 as compared to 2009-2010. Wheat cultivar Ghaznavi-98 resulted in higher ash content which was at par with Siran-2008, followed by each Saleem-2000, FS-99 and Uqab-2000 which was at par with each other. Wheat cultivar Bathoor-2007 resulted in lower ash content. The D × V interaction showed that ash content decreased with delay in sowing from mid October to mid November for all cultivars except Bathoor-2007 and FS-99 where ash content was higher in 30th October and 14th November planting, respectively (Fig. c).

Grain Crude Protein

Planting dates and cultivars significantly influenced crude protein in wheat grains, whereas cutting did not affect wheat grain crude protein (Table 1). The year effect was also not significant. Interactions between D × C, D × V and V × C were found significant for crude protein. Crude protein of grains was increased with delay in planting from mid October to mid November. Higher crude protein in grains were recorded later planting in mid November however it was similar to the 30th October planting, whereas lower crude protein was recorded for early planting in 15th October. Wheat cultivar Bathoor-2007 resulted in higher crude protein (13.95%), however it was at par with the protein content of Uqab-2000 and Siran-2008, whereas lower crude protein was recorded in Saleem-2000, which was also similar to FS-99 and Ghaznavi-98. Cutting did not reduced crude protein of wheat grains. Interaction (D × V) showed that early planting in mid October decreased crud protein in grains of all wheat cultivars except Uqab-2000, whereas it was almost similar to 30th October planting. Similarly, Saleem-2000, FS-99, Siran-2008 and Ghaznavi-98 resulted higher grain crud protein when they were sown late in mid November whereas sowing in mid October or delaying till 15th November resulted in higher crude protein

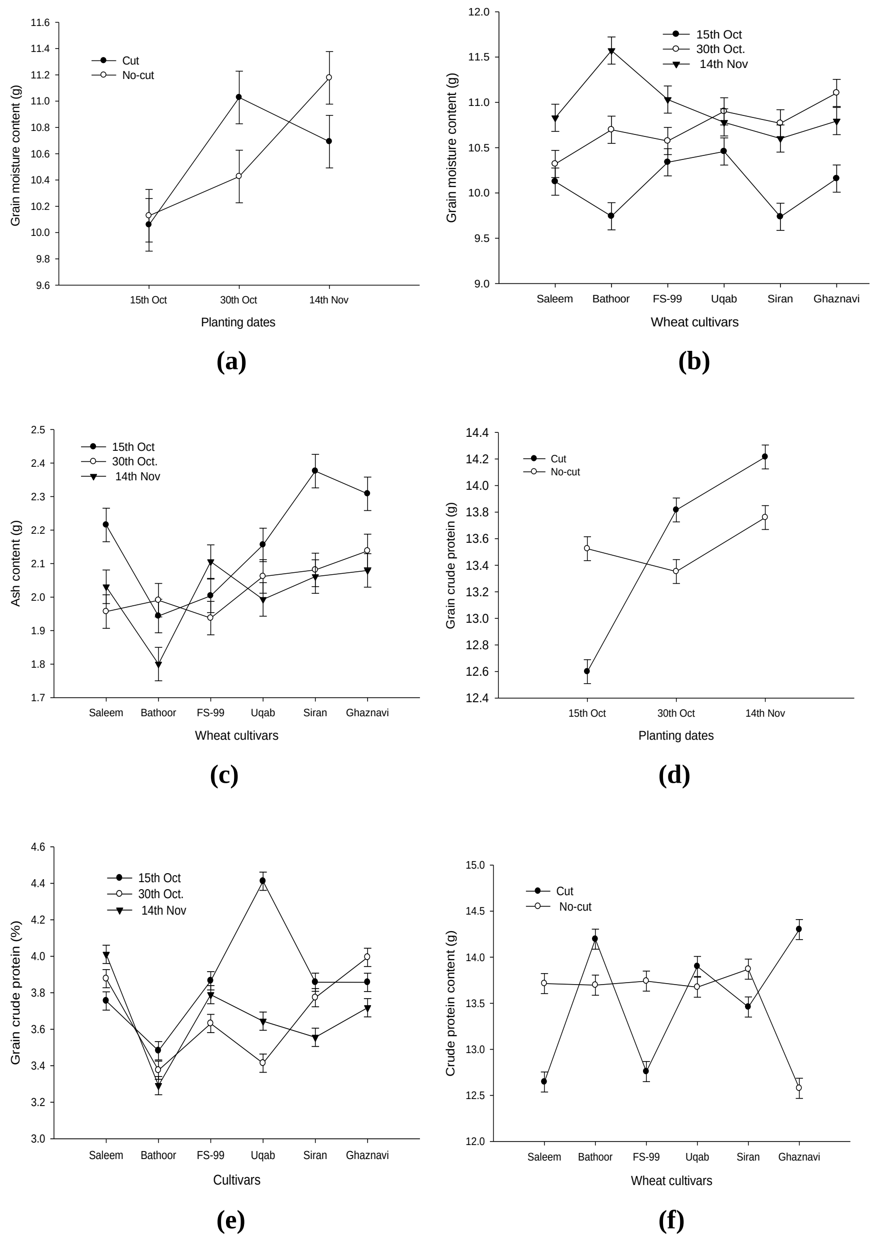

Fig. 1: interaction between (**a**) D x C for grain moisture content (**b**) D x V for grain moisture content (**c**) D x V for grain ash content (**d**) D x C for grain crude protein (**e**) D x V for crude protein and (**f**) V x C for grain crude protein of wheat crop. Vertical bars denote standard error

of grains. Wheat cultivar Bathoor-2007 and Uqab-2000 produced higher crude protein in grains with 30th October planting (Fig. 1e). V × C interaction exhibited that cutting reduced crude protein in grains of wheat cultivars FS-99 and Saleem-2000, whereas it was increased for Bathoor-2007, Uqab-2000 and Ghaznavi-98 (Fig. 1f). Interaction between D x C showed that crude protein was decreased for early sowing in mid October while it was increased for later planting in the end of October and mid November with the imposition of cutting treatment (Fig. 1d).

Grain Crude Fiber

Planting dates and cutting did not influence crude fiber in wheat grains but there was significant variation among wheat cultivars for crude fiber in grains. The year effect was also found significant. Interaction between D x V was found significant whereas all other interaction was found non-significant for crude fiber. Crude fiber in wheat grains was higher during 2010-2011 as compared to 2009-2010. Wheat cv. Ghaznavi-98 resulted in higher crude fiber; however, it was at similar with the crude fibers in grains of all wheat cultivars except Bathoor-2007. Interaction between D × V indicated FS-99 and Saleem-2000 resulted in higher crude fiber in grains when planted in end of October, whereas for the remaining cultivars, it was higher in early planting in mid October (Fig. 2a).

Wet Gluten

Gluten was significantly affected by planting dates and cultivars whereas cutting did not affect gluten content in wheat flour. The effect of year was also not significant. Interaction between D × C, D × V and V × C were found significant (Table 2). Greater wet gluten was found in later planting in mid November, which was statistically similar to 30th October planting, whereas it was lower for mid October planting. Among cultivars, higher wet gluten was found in Saleem-2000, which was similar to all cultivars except Bathoor-2007 and FS-99 with lower gluten content. Interaction between D × V showed that all cultivars resulted in higher wet gluten for later planting in mid November except Saleem-2000, which had opposite response (Fig. 1c). The interaction between V x C showed that cutting reduced wet gluten for all cultivars with cutting except Saleem-2000, FS-99 and Siran-2000 (Fig. 2d). The D × C interaction indicated that wet gluten was higher with cutting for later planting whereas it was reduced with cutting in early planting (Fig. 2b).

Dry Gluten

Planting dates, cultivars and cutting significantly influenced dry gluten in wheat flour. The effect of year was also found not significant. The interaction between D × V was found significant, whereas the remaining interactions were not significant. Greater dry gluten was found in later planting in mid November, which was statistically similar to end October planting. Lower gluten content was recorded in early planting in mid October. Among cultivars, higher dry gluten was found in Uqab-2000, which was similar to Saleem-2000, whereas the remaining cultivars were less in dry gluten with similar range (Table 2). The interaction between D × V showed that Uqab-2000, FS-99 and Bathoor-2007 resulted in higher dry gluten when planted later in mid November, whereas other cultivars were least affected the dry gluten with early or later planting (Fig. 2e).

Discussion

Significant variation was observed for grain moisture, crude protein, crude fiber, wet gluten and dry gluten contents by planting dates, whereas crude fiber and ash content did not differ in response to planting dates. Grain moisture, crude protein and gluten reduced in early planting. Grains moisture content of all wheat cultivars except Uqab-2000 and Ghaznavi-98 enhanced for later planting. On contrary, all cultivars except Bathoor-2007 and FS-99 declined in ash content with delay in sowing. Early planting in mid October decreased grain crude protein of Saleem-

Table 1: Grain moisture, ash and crude protein content of wheat cultivars as affected by planting dates and cutting

Planting dates		Moisture content (%)	Ash content (%)	Crude protein (%)
	15th Oct	10.09 b	2.17	13.06 b
	30th Oct	10.73 a	2.03	13.58 a
	14th Nov	11.00 a	2.01	13.99 a
	$LSD_{0.05}$	0.39	ns	0.48
Cultivars	Saleem-2000	10.46	2.07 a	13.18 c
	Bathoor-2007	10.67	1.91 c	13.95 a
	FS-99	10.69	2.02 b	13.25 bc
	Uqab-2000	10.70	2.07 b	13.74 ab
	Siran-2008	10.42	2.17 a	13.71 ab
	Ghaznavi-98	10.71	2.18 a	13.44 bc
	$LSD_{0.05}$	ns	0.10	0.51
Cutting	Cut	10.62	2.03	13.54
	No-cut	10.60	2.10	13.55
	Significance	ns	ns	ns
Year	2009-10	10.77	2.02	13.51
	2010-2011	10.45	2.12	13.58
	Significance	*	*	ns
Interactions	D x C	**	ns	*
	D x V	**	*	**
	V x C	ns	ns	**
	D x V x C	ns	ns	ns

Means for each category followed by different letters are significantly different from each other at 5% level of probability
** & *= significant at 1% and 5 % level of probability, respectively
ns = non-significant

Table 2: Grain crude fiber, wet and dry gluten content of wheat cultivars as affected by planting dates and cutting

Planting dates		Grain crude fiber (%)	Wet gluten (%)	Dry gluten (%)
	15th Oct	3.87	26.33 b	13.17 b
	30th Oct	3.68	29.37 a	13.53 ab
	14th Nov	3.67	30.99 a	14.17 a
	$LSD_{0.05}$	ns	2.01	0.71
Cultivars	Saleem-2000	3.88 a	30.58 a	13.87 ab
	Bathoor-2007	3.38 b	25.58 b	13.09 c
	FS-99	3.76 a	26.86 b	13.37 bc
	Uqab-2000	3.75 a	30.46 a	14.48 a
	Siran-2008	3.80 a	30.01 a	13.36 bc
	Ghaznavi-98	3.86 a	29.89 a	13.57 bc
	$LSD_{0.05}$	0.27	1.87	0.73
Cutting	Cut	3.66	28.74	13.25
	No-cut	3.82	29.05	14.00
	Significance	ns	ns	**
Year	2009-10	3.23	28.95	14.01
	2010-2011	4.25	28.85	13.24
	Significance	**	ns	ns
Interactions	D x C	ns	**	ns
	D x V	*	**	**
	V x C	ns	**	ns
	D x V x C	ns	ns	ns

Means for each category followed by different letters are significantly different from each other at 5% level of probability
** & *= significant at 1% and 5 % level of probability, respectively
ns = non-significant

2000 and FS-99 compared mid November. Wheat cultivars FS-99 and Saleem-2000 had higher grain crude fiber when planted at the end of October compared to other cultivars. Subedi and Xue (2007) reported higher grain nitrogen accumulation in late sown plots as compared to early planted wheat crop. Ehdaie and Waines (2001) also suggested that early planted crop removed more N from the soil than the optimum date thus N partitioning to grain was greater in the late planted crop. They further revealed that more N losses from anthesis to maturity at early than optimum planting date which could be due to the senescence of leaves and root than the later planted ones, thus had lower grain protein content.

The lower moisture content in saleem-2000 and Uqab-2000 and neither change in FS-99 compared to Ghaznavi-98 and Bathoor-2007 due to cutting might be due to the differential genetic potential of the cultivars. Cutting unlike gluten content did not reduce grain crude protein content of all cultivars except Saleem-2000 and FS-99. However, the crude protein content of Bathoor-2007 and Ghaznavi-98

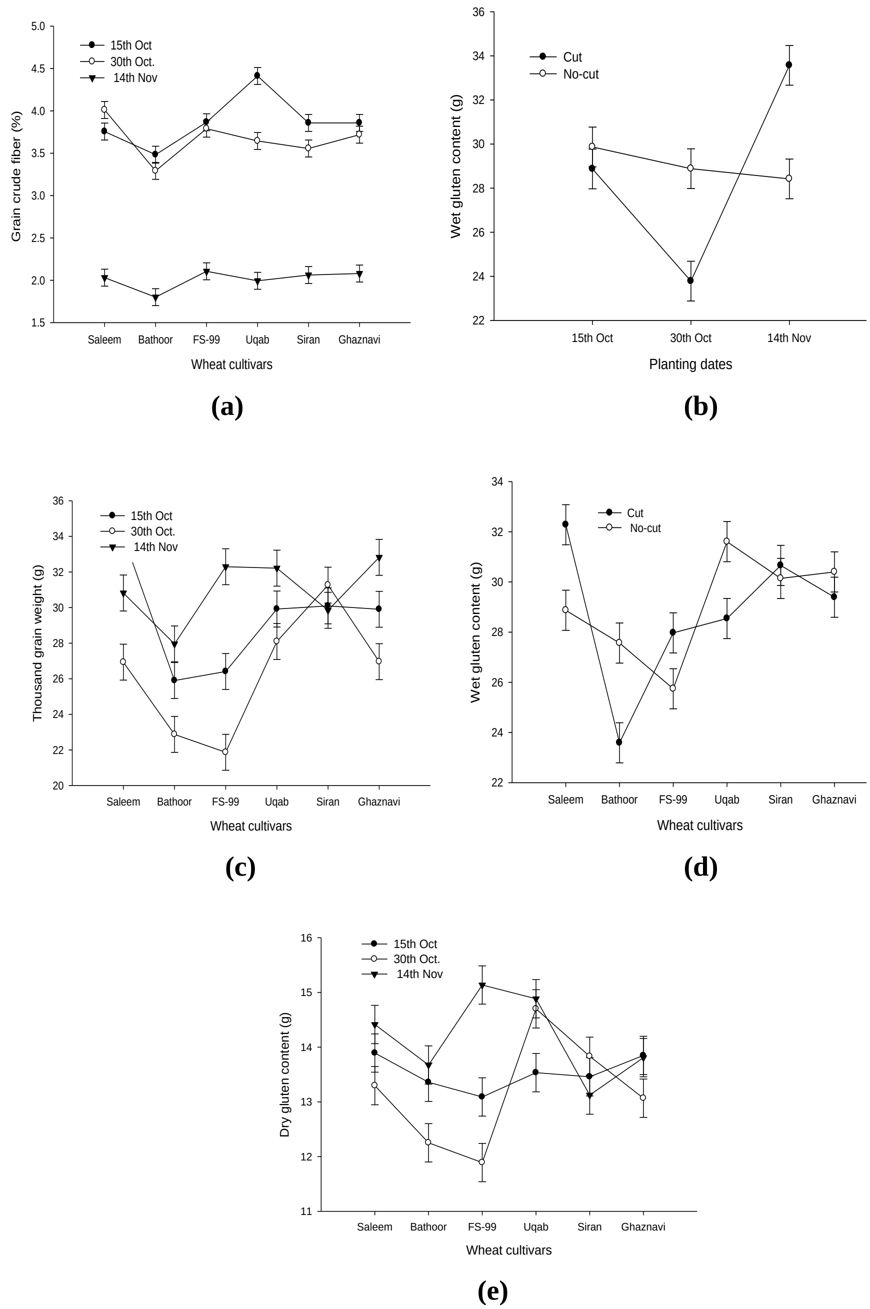

Fig. 2: Interaction between (**a**) D x V for grains crude fiber (%) (**b**) D x C for wet gluten (**c**) D x V for wet gluten (**d**) V x C for wet gluten (**e**) D x V for dry gluten of wheat. Vertical bars denote standard error

increased due to cutting. Thus, the cv. Saleem-2000 and FS-99 could be under estimated for dual purpose system in term of protein content. The higher wet gluten content obtained in cutting treatment under later planting compared to early planting favored mid November planting for wheat grain with higher amount of gluten content. In present study, the grain moisture of genotypes had the most desirable values as had been reported by Elgun *et al*. (2002) who found the moisture content in range of 10 to 11.5% among different genotypes. The higher temperature during the reproductive period shortened the grain filling duration of later sown wheat resulting in reduced grain weight consequently increased crude protein content. Ahmed *et al*. (1994) and Patil *et al*. (2000) also reported higher crude protein content with later sowing of wheat crop. The crude protein content in wheat grain enhanced under late sown wheat compared to wheat sown in October (Patil *et al*., 2000 and Yadava and Singh, 2003). Similarly, Seleiman *et al*. (2011) and Mahmoud (1992) also found greater percentages of crude protein, wet and dry gluten wheat grains when planted later in the season. However, Seleiman *et al*. (2011) found highest ash content for early planting than later plantings. Abdullah *et al*. (2007) found that planting dates significantly influenced bread quality differently for each wheat cultivar.

Wheat cultivars significantly varied for ash, crude protein, crude fiber, wet and dry gluten content in wheat grain, whereas moisture content was similar in all cultivars. Wheat cultivar Ghaznavi-98 and Siran-2008 were higher in ash content, followed by each Saleem-2000, FS-99 and Uqab-2000 with similar range, whereas Bathoor-2007 was the lowest in ash content, however, it was higher in crude protein. Likewise, crude protein content of Uqab-2000 and Siran-2008 was also higher. Lower crude protein was measured in Saleem-2000 and FS-99. Crude fiber remained unchanged for all cultivars except Bathoor-2007, where it was observed in lower amount. Similarly, all wheat cultivars produced wet gluten in equal range except Bathoor-2007 and FS-99, where the wet gluten was in lower content. Higher dry gluten was found in Uqab-2000 and Saleem-2000, while the remaining cultivars were less in dry gluten with similar range. Tayyar (2010) investigated that protein contents of the different wheat varieties varied from 12.78 to 10.85% and had positive relationship between the protein content and bread making quality. Johnson *et al*. (1985) and Tayyar and Gul (2008) pointed out that the protein content of wheat strongly dependent upon genotype. The significant differences in gluten content among different wheat varieties due to their genotypic variations were also reported by Tayyar (2010). Considerable variation in gluten content among different genotypes due to its genotypic disparity was also reported by Elgun *et al*. (2002).

The significant effect of year on moisture, ash and crude fiber and non-significant effect on crude protein, wet and dry gluten content of wheat grains could be presumably due environmental factors in the experimental conditions. As the varied weather conditions greatly influence the performance of wheat cultivars both for yield and quality (Wajid *et al*., 2004; Abdullah *et al*., 2007). The probable reason for no significant variation in grain crude protein and gluten content during both the years might be due to the similar prevailing environmental conditions. Tayyar (2010) found variation in wheat grain protein and gluten content with crop year due to the fluctuations both in temperature and rainfall during both the studied years. Tayyar (2010) reported that the grain protein content and wet gluten content significantly also varied among genotypes due to the differential genetic potential.

Cutting did not influence moisture, ash, crude protein, crude fiber, dry gluten, whereas wet gluten was considerably reduced with cutting. Miyan and Clune (2008) reported no considerable differences in the grain protein between grazed and un-grazed treatment for two cultivars, yet high intensive grazing increased grain protein. The grain protein content of wheat is a critical factor in bread making and high protein content of wheat is associated with good bread making characteristics (Branlard *et al*., 2001; Marinciu and Saulescu, 2008). It is genetically controlled but may vary widely depending upon the variety, climatic conditions and the complex interactions between these factors (Tayyar, 2010).

Conclusion

Imposition of cutting did not reduce grain quality of wheat except fresh gluten content. Wheat planting from end of October to mid November had higher crude protein and gluten content. With the exception of cultivars FS-99 and Saleem-2000, all other cultivars had no significant reduction in crude protein content or quality parameters and thus can be used as dual purpose wheat cultivars with no detrimental effect on grain quality.

References

AACC, 2000. *Approved Methods of the American Association of Cereal Chemists*, 10th edition. AACC International, St. Paul, Minnesota, USA

Abdullah, M., A. Rehman, N. Ahmad and I. Rasul, 2007. Planting time effect on grain and quality characteristics of wheat. *Pak. J. Agric. Sci*., 44: 200–202

Ahmed, M., M.A. Arain and K.A. Siddiqui, 1994. Effect of contemporary rotation simulation on the grain weight, protein and lysine content of bread wheat. *Pak. J. Bot.*, 26: 311–339

AOAC, 1990. *Official Methods of Analysis*, 15th edition, pp: 770–771. Association of Official Analytical Chemists, Inc., Virginia, USA

Arif, M., M.A. Khan, H. Akbar, Sajjad and S. Ali, 2006. Prospects of wheat as a dual purpose crop and its impact on weeds. *J. Weed Sci. Res*., 12: 13–17

Branlard, G., M. Dardevet, R. Saccomano, F. Lagoutte and J. Gourdon, 2001. Genetic diversity of wheat storage proteins and bread wheat quality. *Euphytica*, 119: 59–67

Ehdaie, B. and J.G. Waines, 2001. Sowing date and nitrogen effects on dry matter and nitrogen partitioning in bread wheat. *Field Crops Res*., 73: 47–61

Elgun, A., Z. Ertugay, M. Certel and H.G. Kotancilar, 2002. *Guide of Analytical Quality Control and Laboratory Practices in Cereals and their Products,* 3rd edition. Turkey No. 335. Atatürk Univ. Agric. Faculty, Erzurum, Turkey

Farooq, O. and Z.A. Cheema, 2013. Impact of planting time and seedbed conditions on little seed canary grass and lambsquarters dynamics in wheat (*Triticum aestivum*). *Int. J. Agric. Biol.*, 15: 1003–1007

Finney, K.F., W.T. Yamazaki, V.L. Youngs and G.L. Rubenthaler, 1987. Quality of hard, soft, and durum wheats. *In*: *Wheat and Wheat Improvement*, 2nd edition, pp: 677–748. Heyne, E.G. (ed.). Agron. Monogr. 13. ASA, CSSA, and SSSA, Madison, Wisconsin, USA

Hossain, F., M. Epplin and E.G. Krenzer, 2003. Planting dates influence on dual purpose winter wheat forage yield, grain yield and test weight. *Agron. J.*, 95: 1197–1188

Jan, M.T., P. Shah P.A. Hollington, M.J. Khan and Q. Sohail, 2009. *Agriculture Research: Design and Analysis a Monograph.* NWFP Agricultural Uni. Peshawar, Pakistan

Johnson, V.A., P.J. Mattern, C.T. Peterson and S.L. Kurh, 1985. Improvement of wheat protein by traditional breeding and genetic techniques. *Cereal Chem*., 62: 350–355

Kent, N.L. and A.D. Evers, 1994. *Technology of Cereals*, 4th edition. Pergamon press, Oxford, UK

Krenzer, E.G., 2000. Wheat as forage. *In*: *Wheat Management in Oklahoma*, pp: 27–30. Royer, T.A. and E.G. Krenzer (eds.). Oklahoma Coop. Ext. Serv. and Oklahoma Agric. Exp. Stn. E-831

MacKown, C.T. and S.C. Rao, 1998. *Source-Sink relations and grain quality of winter wheat used for forage and grain production*, p: 148. In Agronomy abstracts, ASA, Madison, Wisconsin, USA

Mahmoud, M.A., 1992. Effect of sowing date and time of nitrogen application on some wheat and barley varieties. *Ph. D. Thesis*, Faculty of Agric. Minia University, Egypt

Marinciu, C. and N.N. Saulescu, 2008. Cultivar effects on the relationship between grain protein concentration/and yield in winter wheat. *Roman. Agric. Res.*, 25: 19–27

Marry, J.G., J.C. Stark, K. Obrien and E. Souza, 2001. Relative sensitivity of spring wheat grain yield and quality to moisture deficit. *Crop Sci.*, 41: 327–335

Miyan, S. and S. Clune, 2008. Effects of grazing on wheat grain yield and quality in Western Australia. *Proceedings of 14th Agronomy Conference 2008*, 21–25 Sep. 2008, Adelaide, Australia

Naveed, K., M.A. Khan, M.S. Baloch, K. Ali, M.A. Nadim, E.A. khan, S. Shah and M. Arif, 2014. Effect of different seeding rates on yield attributes of dual purpose wheat. *Sarhad J. Agric*., 30: 83–89

Patil, K.S., D.V. Durge, B.N. Phadnawis, R.S. Shivankar and T.H. Rathod, 2000. Effect of sowing dates on biomass production of wheat cultivars. *Ann. Plant. Physiol.*, 14: 115–119

Reents, H.J., K. Moller and FX Maidle, 1997. *Use of Soil Nitrate through Differentiated Growing Strategies of Cereals Following Potatoes*, pp: 129–135. Contributions to the fourth scientific meeting on ecological agriculture, Bonn, Germany: CAB Abst. (1998/08–2000/07)

Seleiman, M. Mahmoud I.S.A. Aal and G. Zahran, 2011. Effect of sowing dates on productivity, technological and rheological characteristics of bread wheat. *J. Agron. Crop. Sci.*, 2: 1–6

Subedi, K.D., B.L. Ma and A.G. Xue, 2007. Planting date and nitrogen effects on grain yield and protein content of spring wheat. *Crop Sci.,* 47: 36–44

Tayyar, S. and M.K. Gul, 2008. Evaluation of 12 bread wheat varieties for seed yield and some chemical properties grown in Northwestern Turkey. *Asian J. Chem.,* 20: 3715–3725

Tayyar, S., 2010. Variation in grain yield and quality of romanian bread wheat varieties compared to local varieties in Northwestern Turkey. *Roman. Biotechnol. Lett.*, 15: 5189–5196

Wajid, A., A. Hussain, A. Ahmad, A.R. Goheer, M. Ibrahim and M. Mussaddique, 2004. Effect of sowing date and plant population on biomass, grain yield and yield components of wheat. *Int. J. Agric. Biol.,* 6: 1003–1005

Yadava, R. and T.B. Singh, 2003. Stability analysis in wheat for grain protein. *Ind. J. Gen. Plant. Breed.*, 63: 337–338

Zhu, J. and K. Khan, 2001. Effects of genotype and environment on glutenin polymers and bread making quality. *Cereal Chem*., 78: 125–130

(Received 16 August 2013; Accepted 09 January 2015)