International Journal of Farming and Allied Sciences
Available online at www.ijfas.com
©2017 IJFAS Journal-2017-6-4/109-119/ 31 Aug, 2017
ISSN 2322-4134 ©2017 IJFAS

Effect of planting date on growth periods, yield, and yield components of some bread wheat cultivars in Parsabad Moghan

Asgar Shirinzadeh[1], Hossein Heidari Sharif Abad[1*], Ghorban Nourmohammadi[1], Eslam Majidi Haravan[1], Hamid Madani[2]

1. Department of Agronomy, Science and Research Branch, Islamic Azad University, Tehran, Iran
2. Department of Agronomy, Arak Branch, Islamic Azad University, Arak, Iran

Corresponding author: Hossein Heidari Sharif Abad

ABSTRACT: The use of optimum planting dates plays an important role in achieving maximum yield in wheat. In order to evaluate the growth period, yield and some related qualities, a field experiment was conducted at Ardebil province's Moghan Research, Education and Resources Center using five varieties (Chamran, Shirodi, Gonbad, Morvarid, N80-19) in four cultivars (6th of November, 21th of November, 6th of December and 21th of December), which were cultivated in 2014-2015. This experiment was conducted as a factorial based research using randomized complete block design with three replications. The results of analysis of variance indicated that the traits were significant between planting dates and selected cultivars at the probability level of 1% and 5%. Comparison of mean planting dates showed that the highest and lowest grain yield were observed on 21 November (7322.50 kg /ha) and 21 December (5176.9 kg /ha), respectively. Higher yield was observed on 6 and 21 November due to the superiority of some traits, including 1000 grain weight, grain number, grain weight per spike, optimum density, harvest index and grain filling period. Comparison of mean yield among cultivars showed that Chamran cultivar with the yield of 6948.80 kg /ha and Morvarid cultivar with the highest yield of 5875.80 kg /ha had the highest and lowest yield respectively.

***Keywords*:** Wheat, planting date, yield, yield components, growth period

INTRODUCTION

Wheat (Triticum aestivum) is one of the most important food sources in the world for some reasons: (1). According to UN estimates, the world's population will reach 4.9 billion by 2050. Therefore, production capacity to feed 10 billion people over the next 40 to 50 years should increase more by yielding wheat (Cattivelli et al., 2008; Hirel et al., 2007). Increasing the yield of wheat to feed the growing population of the world is a necessity. 2. Wheat is one of the world's agricultural species that accounts for 53% and 85% of the human nutrition needs in developed and developing countries respectively. Pena, 2007; Denčić et al., 2011. In Iran, it has also been one of the most important crops , so that during the growing season of 1394-1951, approximately 14 million tons of wheat were produced .4. The wheat cultivars' quantity as grain yield id affected by environmental conditions (Zhang et al., 2006; Sharma et al., 2009; Paderewski et al., 2011), agronomy management and their interactions (Souza et al., 2004; Anderson, 2010; Annicchiarico et al., 2010).) One of the factors of agricultural management that should be controlled by farmers is the planting date, which is one of the most important factors in productivity ((Sun et al., 2007). Selection of appropriate planting dates, affects growth and development, germination percentage and viscosity and cold tolerance (Schwarte et al., 2006). Planting dates in different regions are affected by different growth conditions such as the maximum and minimum temperature, daily radiation of the sun, rainfall, growth period and genetic potential of wheat. Wheat is mainly a winter crop and needs temperature,and light for optimal growth (Dabre et al., 1993). Early planting of wheat increases the growth and sensitivity to frost, as well as the risk of disease and damage to pests including aphids (Paulitz and Steffenson, 2011). Early planting increases the growth and absorption of food due to high temperatures. More changes in the planting date of wheat changes wheat yield through the number of tillers and spikes, and spike growth (Bassu et al., 2010; Thiry et al., 2002; and number of seeds per unit area, grain weight Fischer, 1975 ; 1983; Sun et al., 2007. The number of seeds and spikes per square meter is the most important component of wheat yield, which in both early and late planting dates reduce the number of seeds per spike (Refay, 2011). Many physiological studies have shown that the number of grains in wheat has roughly a parallel role with increasing yield, and is strongly related to spike dry matter at flowering time. Slafer, 2003. After pollination in grains, the presence of seeds is most affected by the activity of the source and the reservoir for the accumulation of the estimates in the grains. In the period of seed filling, more of the transferred isolates are transferred to the seed through current photosynthesis (Arduini et al., 2006). In addition, one A significant portion of the dry matter can be recovered through the remobilization of accumulated amylates before the pollination stage that has been temporarily stored in the vegetative parts of the plant (Santiveri et al., 2004; Dordas, 2012). Late planting of wheat often shortens the pre-pollination period, causing early plant breeding, thereby reducing photosynthetic resources (Foulkes et al., 2004). The timely sowing date increases the germinated seeds, plant height, number of spikes, number of seeds per spike and grain weight in wheat (El-Mahdi et al., 2007). Finally, the grain yield depends on the amount and durability of each Plant growth phases, including grain filling period, are determined for dry matter accumulation immediately after flowering, and strongly depends on the formation of endospermic cells (Brocklehurst, 1977). The optimal planting date of the ideal growth conditions L provides for the plant and increases the tolerance of the plant to the cold during the tillering stage (Safdar et al., 2013). The low temperature caused by late planting produces The weaknesses are poor (Phadnawis and Saini, 1992). The agronomic system in Parsabad Moghan is more cereal-based and wheat is mainly cultivated after corn, in which the history of wheat cultivation is often delayed. High performance is difficult in these situations. Among the important goals in this study was the effect of management of planting date on the growth and yield period and the grain yield in 5 bread wheat cultivars in Parsabad Moghan region, so that we can find a solution for agronomic management in Increase wheat yield per unit area (decrease in yield gap).

Materials and methods

In order to investigate the effect of planting date on yield of different wheat cultivars in the research center, training and natural resources of Ardebil province (Moghan), 10 km in Parsabad city with 39 ° 39 'longitude and 47' longitude, Degree of 58 minutes at a height of 78 meters above sea level. The data on soil and meteorological analysis of the area during the experiment year are presented in Tables 1 and 2. In this research, four wheat cultivars (Chamran, Shiroudi, Morvarid and Gonbad) and N80-19 line were planted in four sowing dates (6 and 21 November, 6 and 21 December) in a randomized complete block design with factorial experiment in three replications Was investigated. Seed rate based on 400 seeds per square meter was calculated based on 1000-seed weight and planting operations were carried out on a field that was cultivated last year by seed grain specialist (Winter Spiker). The implementation of land preparation according to the logic convention including plowing, discs, loading and stacking, and fertilizer requirements based on the soil's lab experience, 200 kg of ammonium phosphate before planting, 250 kg of urea fertilizer, 50 kg before planting, and the rest as road in step Paw and stem were provided. Each plot was 6 square meters and consisted of 6 5-meter lines on two stacks and 20 cm apart. The chemical control of leafy and leafy weeds in the tillering stage was carried out by mixing granistar herbicides at a rate of 20 grams per hectare and tapic one litter per hectare using a dual spray motor. Irrigation of the plots according to the custom of the area, method of flooding and considering the climatic conditions and the needs of the plant were performed until the physiology was examined in 5 turns. Date of emergence of spike, maturity, grain filling period, number of spikes per square meter and plant height were taken. After harvesting, 1000 seed weight, grain number per spike, grain weight per spike, biological yield, grain yield and harvest index were recorded. Data were analyzed using SAS and EXCELL software. And for mean comparison, the mean difference test (LSD) was used.

Table 1. The average monthly temperature, rainfall and relative humidity during the experiment (2015-16)

month	2015-2016			
	Minimum temperature (^{0}C)	Maximum temperature (^{0}C)	rain(mm)	relative humidity
October	4.6	31	52.1	75
November	0.3	27.7	33.8	80
December	-3.3	24.6	30.5	77
January	-13.2	19.2	36.6	75
February	-12.3	21.8	37.2	80
March	-1.4	27	21.7	79
April	-1.2	26	33.2	77
May	1.8	31.6	25.7	75
June	11.9	34.7	27.3	65

Table 2. Physical and chemical characteristics of farm testing

Soil texture	Sand (%)	Clay (%)	Silt (%)	K(ppm)	P(ppm)	N(ppm)	PH	EC(ds/m)	OC (%)
Clay loam	17	41	42	488.8	11.2	0.1	7.9	0.81	0.2

Results and discussion

The results of the research project based on planting date and selected cultivars showed that planting date is one of the effective factors in reducing wheat yield in the Moghan region. The results of variance (Table 3) show that most of the studied traits are affected by the planting date and cultivar at a probability level of 1 or 5%. Grain yield was significant at the level of 1% and 5% between different planting dates as well as selected cultivars, respectively.

Table 3: Analysis of variance for experimental traits

Treatments	DF	MS grain Yield (kg ha-1)	1000 Seed weight (gr)	Seed number	Spike density	Plant height(cm)	Grain weight / spike(gr)	Harvest index (%)	Grain filling period(day)	Biological Yield(kg ha-1)
block	2	52632834.5	15.85	3.32	13773.07	299.97	5.00	0.16	2.32	2460326.6
a	3	14776054.9**	49.18**	49.47**	59985.8**	936.80**	5.12**	37.84**	536.77**	85543423.8**
b	4	1883505.6*	35.11**	329.6**	92967.83**	482.25**	0.63**	4.49**	22.32**	14318518.3**
a*b	1	1447507.8**	2.48ns	9.26*	3215.54*	100.44**	0.02**	3.48*	9.99*	5563969.1*
error	2	498173.9	8.29	4.23	1437.72	35.65	0.01	1.48	4.89	2373649.3
CV		10.86	6.90	5.61	7.94	6.10	5.37	3.40	5.45	9.34

ns, *: and **: Non significant and significant at the 5 and 1% levels of probability, respectively

Table 4. Mean comparisons of studies traits in wheat cultivars

Treatments	grain Yield (kg ha-1)	1000 Seed weight (gr)	Seed number	Spike density	Plant height(cm)	Grain weight / spike(gr)	Harvest index (%)	Grain filling period(day)	Biological Yield(kg ha-1)
Sowing									
dates	7200.7a	42.88a	34.33d	537.33a	105.35a	1.47c	39.84b	46.13a	17670.90a
6Nov	7322.5a	44.33b	38.73a	501.07b	102.79b	1.60a	40.52a	44.33b	17596.80a
21Nov	6294.3b	39.20c	37.07b	482.93c	96.00c	1.54b	39.46b	39.20c	16683.30b
6Dec	5176.9c	32.80d	36.53c	389.00d	87.68d	1.39d	36.91c	32.80d	12626.10c
21Dec	175.51	0.33	0.51	9.43	1.48	0.02	0.33	0.55	374.95
LSD									
Varieties	6948.80a	40.35b	31.33d	577.67a	90.31e	1.26d	39.69a	42.50a	17109.10a
Chamran	6690.00b	39.58b	31.34d	569.50a	93.31d	1.27d	39.87a	41.33b	16724.50a
Shiroodi	6473.20c	43.28a	41.42b	402.08c	101.93c	1.78a	38.38d	39.75a	16396.00b
Gonbad	5875.80d	42.96a	37.08c	423.67b	105.67a	1.56c	39.32b	39.00d	16201.80c
Morvarid	6507.70b	42.92a	42.17a	415.00b	103.12b	1.62b	38.86c	40.50c	14289.9c
N80-19	196.23	0.80	0.57	10.54	0.37	0.02	0.37	0.62	419.21
LSD									

The comparison of the mean grain yield showed that the highest grain yield was obtained in the second half of November and then the first half of November (respectively 7322.5 and 7200.7 kg, respectively). Also, the lowest yield was observed on the sowing date of the second half of December with an average yield of 5176.9 kg (Table 4 and Figure 1).

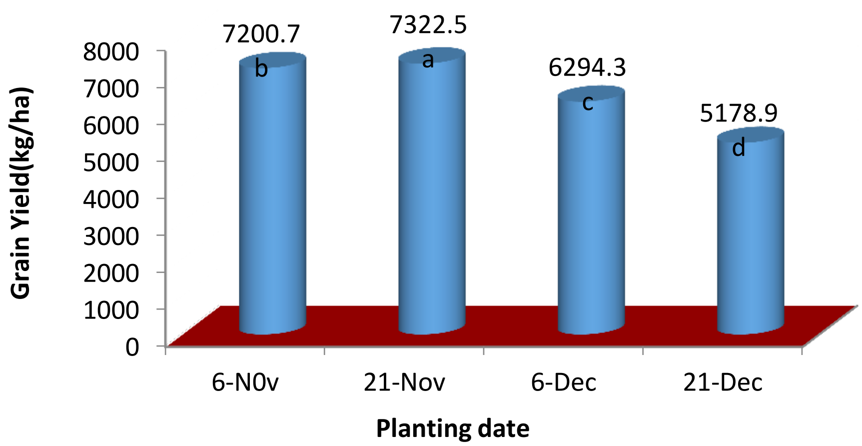

Figure 1. Comparison grain yield in wheat cultivars in different planting date

The grain yield variability (Table 4 and Figure 2) was also evident among the cultivars. So that the highest and lowest grain yield belonged to Chamran cultivar, with a mean yield of 6948.80 kg and Morvarid cultivar, with an average grain yield of 5875.8 kg. These results were consistent with the observations of many researchers.

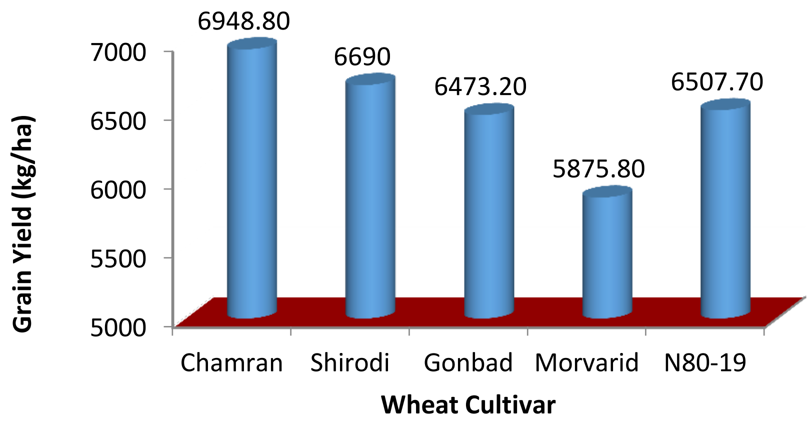

Figure 2. Comparison grain yield in wheat cultivars in different cultivars

They stated that the reduction in yield caused by the planting date could be due to the shortening of the grain filling period, the increase in temperature during the grain filling period, the reduction in the number of seeds, the weight of 1000 seeds, the reduction in density and other factors associated with grain yield (Kumar et al. 2013); Cassim (2008); Zia et al. (2014); Ibrahim et al. (1995); Kerr et al. (1992); Subdi et al. (1997).

1000-seed weight

The results of analysis of variance indicate that 1000 seed weight is significant at the probability level between sowing date and different cultivars (Table 3). According to table (4), the comparison of the average weight of 1000 seeds indicates that the mean of this trait is significant among experimental treatments. The highest 1000 kernel weight was observed in the first and second half of November (42.88 and 43.47 grams respectively). In late cultivation, due to reduced grain filling period and environmental temperature increase, the weight of 1000 seeds is also reduced, so that the least 1000 seed weight was obtained in late crop conditions in the second half of December. The weight of 1000 seeds was significant among the cultivars under test. The highest 1000-seed weight among the cultivars belonged to the N80-19 variety (Table 4).

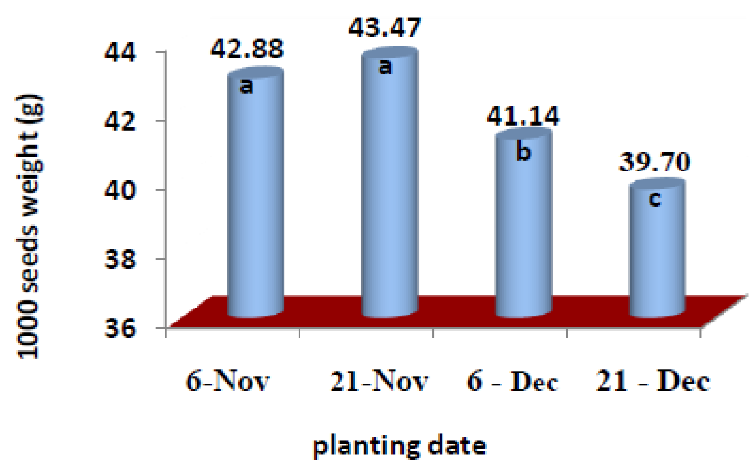

Figure 3. Comparison of wheat 1000-weight weight in different planting dates

Studies by Rashid et al. (2004), Gassim et al. (2008), Serrago et al. (2013) and Aslani et al. (2012) are fully consistent with the findings of this study. The variation in 1000-seed weight between planting dates and various cultivars is shown in Figures 3 and 4. Gebbing et al. (1991) concluded that grain weight was the amount of remobilization of dry matter produced during the interval between the stages of pollination and physiological processing and dry matter storage efficiency during the re-seeding phase. And the share of dry matter stored in grain weight (Przulj et al., 2014; Ericoli et al., 2006) varies in different plants.

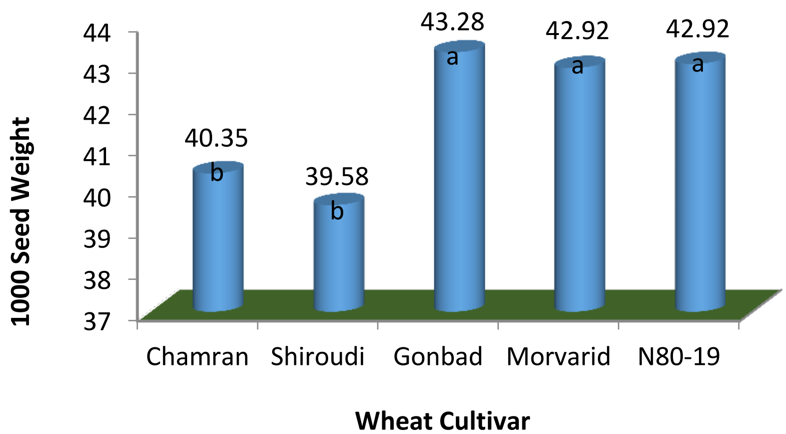

Figure 4. Comparison of 1000-seed weight of cultivars in different cultivars

Number of seeds per spike

The number of grain and harvestable spike are the determinant factors in grain yield. The analysis of the information on these attributes is presented in Tables (3) and (4). The highest number of seeds was observed in the second half of November and the lowest in the first half of November (Fig. 5). Line N80-19 had the highest number of grains (42.17) and Shiroudi cultivar with 31.33 seeds of the least amount among the cultivars (Table.4). Reducing the number of grains may be due to an increase in temperature during the grain filling period in late crop production. In this regard, a similar report was presented by Sarag et al. (2013) and Ishaq (1993), which identified the reduction in the number of seeds associated with the increase in temperature during the period of grain filling and the abortion of the floret and the reduction of the claw. Many physiological studies have shown that increasing the number of grains in wheat brings about increased yields. Increasing the number of seeds per spike strongly depends on spike dry matter (DM) during pollination (Slafer, 2006). Regarding the fact that spike growth is developed in a short time before the jejunum and mainly coincides with the stem elongation stage, it is suggested that the correction of the length of the stem stroke stage can be attributed to the improvement of the spike dry matter at the pollination stage and the number Grain is effective (Slafer et al., 2001). The role of length of stem elongation in the number of seeds is essentially related to the fate of the initial cells of the flower. A large part of the initial cells of the flower is destroyed, and 40% of these cells are developed and converted into fertile flies (Slafer et al., 2009; Kerbi, 1988). For example, the termal time for the stem stroke is shortened by increasing the photoperiod and causing the primary cells of the flowers to decrease due to the reduction in dry matter at the pollination stage (Bancal, 2008; Serrago et al., 2008; Gonzalez et al., 2003 and 2005). This evidence suggests that the role of the genesis gene is to improve the partitioning of the dry matter to the young spike and to reduce the degree of degeneration of the starter cells and increase the amount of fertilized flowers that can increase the seeds (Seddique et al. 1989; Miralles et al. 1998).

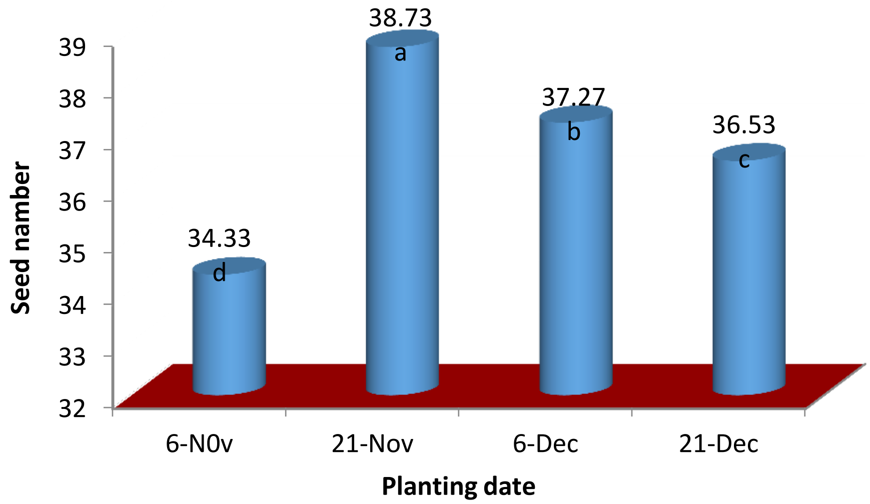

Figure 5. Comparison of the average number of seeds in different planting date

Spike density

Harvest plant and spike density are among the most effective traits in increasing grain yield. The results of this study showed that this trait was significant at the probability level of 1% between planting date and between different cultivars (Table 3). Therefore, the comparison of the mean of this trait in both treatments (Table 4 and Figure 6) showed that the highest and lowest perceived yields belonged to the first half of November (573.33) and the second half of December (389.00) is. Among different cultivars, Chamran cultivar with the highest spike density (577.67) and Gonbad cultivar with minimum spike density (402.08) were identified. This trait was also significant among the cultivars, and according to the mean comparison, a significant variation was observed among the cultivars (Table 4).

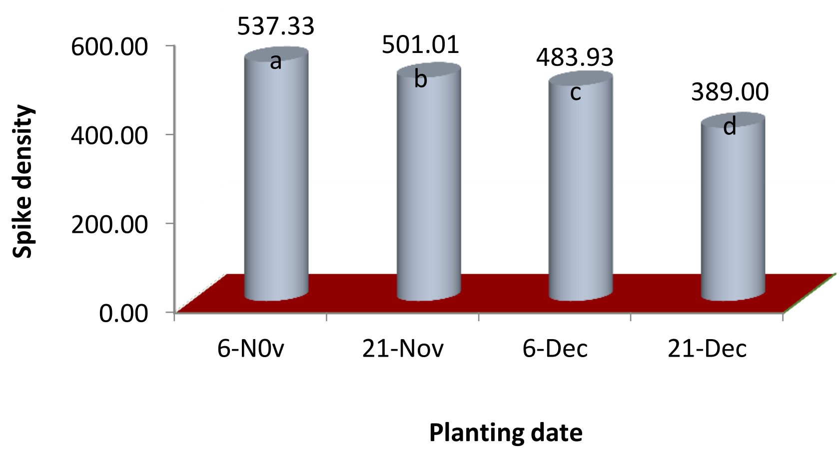

Figure 6. Comparison of average spike density in different planting date

Grain filling period

The grain filling period occurs between the flowering stages and the physiological examination of wheat filling more seeds slowly and for a longer time or more in a cool condition. The warm conditions make the grain fill up more quickly and in a shorter period of time. The high temperatures cause the grain to be small and the weight of a thousand seeds is reduced. The results of analysis of variance in this study showed that the grain filling period in both cultivars and sowing date was significant at 1% level (Table 3).

Comparison of mean (Table 4 and Figure 7) showed that the longest grain filling period in the first half of November (46.13 days) and the lowest grain filling period in the late afternoon cultivar (32.8 days) was observed It turned out These results indicate that the grain filling period is significantly reduced due to the delay in the fall wheat crop. Akkaya and Akten (1988) and Witt (1996) presented similar reports in this regard
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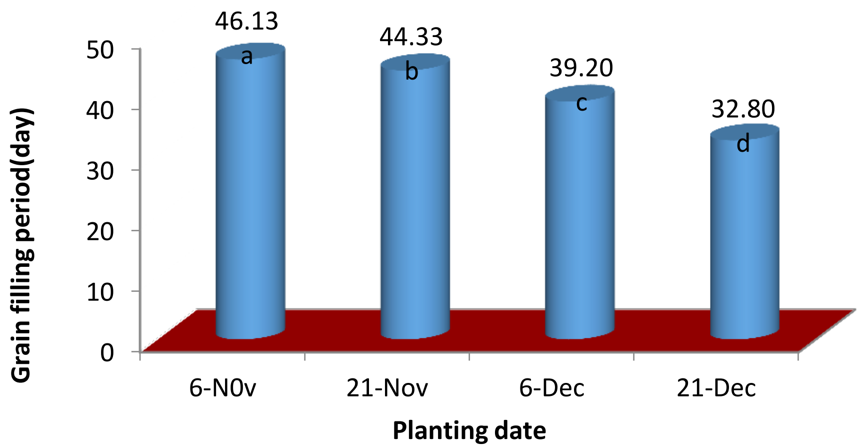

Figure 7. Comparison of mean wheat grain filling period in different planting date

Harvest index

Harvest index was also significant in terms of cultivars and cultivar (at 1% probability level) (Table 3). The lowest harvest index dates from the second half of December (36.19%) and the highest harvest index dates from the second half of December (40.52%) (Fig. 8). Also, this trait was significant among the cultivars, and the results are presented in Table (5). Beneficent and colleagues (2003) have stated that there is a significant difference between the wheat cultivars in terms of harvest index. And also Kamali and Sharifi (2010) observed different and significant harvest index among cultivars. Harvest index shows the efficiency of the distribution of photosynthetic materials between different plant organs. Rezaei (1996), with regard to the relationship between grain yield and harvest index, suggested it as a criterion for selecting high yielding lines in wheat. Mirosavljevic et al. (2015) showed grain yield correlation with harvest index and dry matter and remobilization of dry matter before pollination. They also concluded in their experiment that high healing and longer vegetative periods were the main factor in the accumulation and remobilization of dry matter and increased grain yield. In granular grains, genetic capability for accumulation, dry matter remobilization, and adaptation to climatic conditions (Koutroubas et al., 2012; Santiver et al., 2004) and the close correlation between biomass and vegetative period, are the factors that the accumulation and remobilization of matter Dry, and finally, the Harvest index affects
Mirosavljevic et al. (2015).

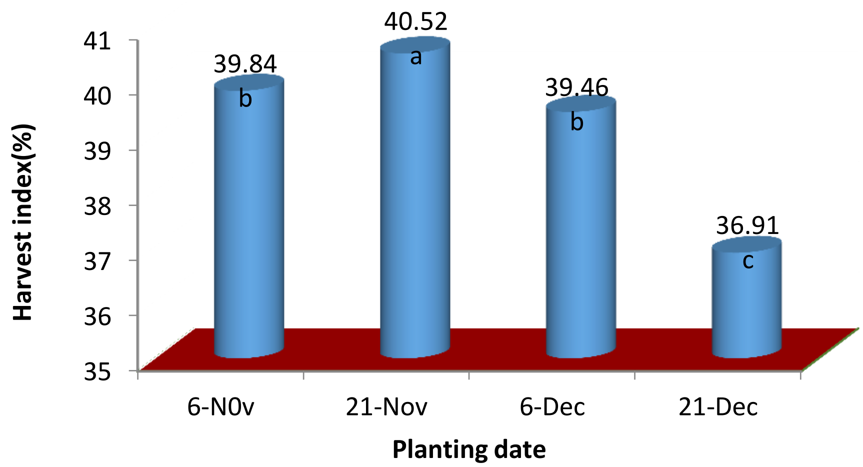

Figure 8. Comparison of average wheat harvest index in different planting date

Plant height

Plant height was also one of the variable traits among cultivars and different planting dates. The results of variance analysis indicate that this trait is significant at 1% probability level in both treatments (Table 3). The average comparison of this trait (Table 4 and Figure 9) showed that the highest and lowest values were observed in the first half of November (105.5 cm) and the second half of December (87.68 cm), respectively. The Morvarid cultivar was the highest with 105.67 cm and the Chamran cultivar was 90.31 cm with the lowest plant height. These findings are fully consistent with the results of Rashid et al. (2004) and al-gtayk (2010). Plant height is essentially influenced by the genetic makeup of a genotype and also by environmental factors (Shazad et al., 2007). The height of the plant was significantly affected by planting time (Blaoch et al., 2010), and in late crop cultivation, the reduction in wheat height (Iqbal et al., 2001) did not change much even with increasing seed consumption. This is most due to environmental and genetic conditions (Sulieman, 2010).

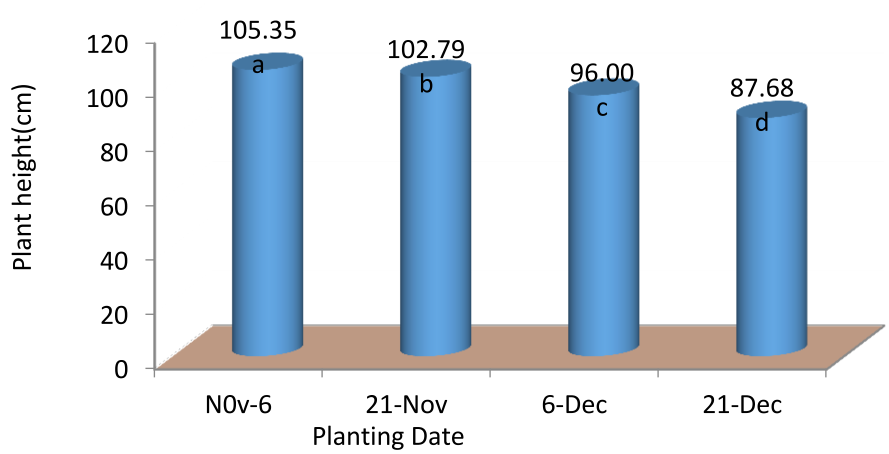

Figure 9. Comparison of average plant height in different planting date

Final conclusion

In this study, we concluded that yield and yield components of different wheat genotypes were significantly affected by the planting date. The delay in planting of wheat resulted in a sharp decrease in grain yield and yield. Comparison of simple mean wheat yield on different planting dates showed that the highest grain yield was obtained on sowing date (6 and 21 November). Delayed planting date (from Dec. 15) reduced seed yield, vegetative period (VP), day to maturity (DM), grain filling period (GFP), spike number, grain weight per spike, 1000 seed weight, number Grain per spike, plant height, spike length were observed. The highest and lowest grain yields were obtained on November 21 and December 21, respectively (with 7322.50 and 5176.90 kg ha -1, respectively). There is a significant variation in wheat genotype in the mean grain yield. It is recommended for wheat that the product should be planted on the good planting date from 6th of November to 6th of December. Chamran and Shiroudi genotype despite the susceptibility to disease, due to desirable traits such as compressibility and growth period, and more grain filling, and finally the optimum yield, in the absence of superior and resistant to disease and sprout variety, is currently recommended for the region to achieve high yield.

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