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A Study Food Security and Evaluation the Phenological Traits and Potential yield in various Wheat Cultivars during Two Years in Ardabil Region

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ABSTRACT

In order to Study Food Security and evaluation the Phenological Traits and Potential yield in Various Cultivars of Wheat in Ardabil region, an experiment was carried out in a randomized complete block design with three replications in Ardabil islamic Azad University Agricultural Research Station in two agricultural years of 2014-2015 and 2015-2016. The studied cultivars included Pishgam, Gascogen, Gaspard, Siosson and MV17. Results from ANOVA for traits of number of days from planting to flowering and number of days from planting to maturity suggested that there is a significant difference between cultivars and years at one percent, and also, in addition to cultivars and years, the interaction of year for the trait of number of days from planting to spike emergence is significant at one percent. Data mean comparison indicated that among the studied wheat cultivars, the cultivar of Pishgam with a mean of 225.33 days had the highest number of days from planting to flowering and the cultivar of Gascogen with a mean of 221.17 days, had the lowest number of days from planting to flowering. For the trait of number of days from planting to spike emergence, the cultivar of Pishgam with a mean of 221.67 days had the highest rate and the lowest number of days with a mean of 218 days was related to the cultivar of Gasgogen. The highest number of days from planting to end flowering (273.83 days) was related to the cultivar of Pishgam and the lowest number of days from planting to end flowering was related to the cultivar of Gaspard with a mean of 267.67 days. There was a significant difference between the studied cultivars on seed yield at one percent. Also, results showed that there was no significant difference found between the years and the interaction of the year on cultivar. Data mean comparison results indicated that Siosson with the mean of 6,627.7 kg per hectare had the highest seed yield and MV17 with the mean of 5,498.5 kg per hectare had the lowest seed yield.

Keywords: *Food Security, Potential yield, phenological traits, wheat.*

INTRODUCTION

Wheat as an export good at the rate of 134 million tons (2008-2010), which includes 20% of the global production, is widely being traded (FAOSTATS, 2013). The issue of food security and the need to provide food for the people in the world, which is estimated to reach 10.4 billion by 2050 (Jaggard and Ober, 2010), are important issues, since it is predicted that the need for crop production increases by 60-110 percent (FAO, 2012).

During the crop year of 2013-2014 in Iran, around 74.7 million tons of crops was produced and among which grains with 23.70 percent (17.55 million tons), legumes 0.83 percent, industrial crops 16.02 percent, vegetables 21.87 percent, cucurbits 12.50

percent, forage plants 24.89 percent and other crops 0.19 percent, and the highest rate of production was related to wheat with 14.28 percent (Ahmadi et al., 2015). Cassman (1999) has expressed that in many fertile agricultural lands in the world, the yield of crop plants reaches the assumed potentials. Future studies have suggested that half of the increase in crop yield is due to the plant breeding and the other half is related to the improvements in agricultural operations, and both these factors are interrelated (Miflin, 2000).

Assessing the future situation of grain production and especially wheat, due to its importance in the world population feeding, has drawn a lot of attention from researchers and planners in agricultures. Estimations suggest that in a global scale, the production of this crop must be increased for 44% in 2020, comparing to 2000, in order to fulfill the need for wheat (FAO, 2006). Increase in received radiation during the time before pollination in order to increase the number of grains in square meter should be mainly conducted through increasing the period of received radiation, since received radiation has reached its maximum during the spike rapid growth phase in modern cultivars (Folks et al., 2001). It has been reported in many restudies that increase in the duration of stem elongation period leads to increase in biomass during the pollination time and improvement of processed materials distribution for the spike and as a result increase in the number of the grains per square meter (Reynolds et al., 2005; Sluffer et al., 2005). Hence, increase in stem growth period is recommended as a solution for increasing the yield potential in wheat. Increase in the stem growth duration leads to increase in spike biomass, increase in soluble carbohydrates of the stem and higher biomass of the root in flowering time. There has been a significant correlation reported between stem growth duration length and stem reserves and grain yield.

Through assessing various traits such as number of days to spike emergence, height of the bush, maturity time, number of grain per spike, number of fertile tillers, harvest index, weight of thousand grains, grain yield, Ja'farzade (2009) reported a significant difference between 25 studied genotypes at 1%.

Through studying the ANOVA for the traits of number of days to spike emergence, height of the bush, maturity time, number of grain per spike, weight of thousand grains, grain yield, Amini (2003) reported a significant difference between studied genotypes at 1%.

MATERIALS AND METHODS

In order to Study Food Security and evaluation the Phenological Traits and Potential yield in Various Cultivars of Wheat in Ardabil region, an experiment was carried out in a randomized complete block design with three replications in Ardabil islamic Azad University Agricultural Research Station in two agricultural years of 2014-2015 and 2015-2016. The studied cultivars included Pishgam, Gascogen, Gaspard, Siosson and MV17.

Wheat genotypes were planted in controlled condition (without water limitation, nutrient elements limitation, pests and diseases) during 2014-2015 and 2015-2016 in a randomized complete block design with three replications. Each experiment plot was planted based on 500 seeds per square meter, with a length of 6 meters and in 6 rows with a distance of 20 cm. the seeds were planted in October 2014 and the irrigation was carried out according to the norms of the region, two times of irrigation in fall and three times of irrigation in spring.

Fertilizer Amount According to the results from laboratory analysis of the research department, soil, water, and phosphorus fertilizer from ammonium phosphate source in basal application and nitrogen fertilizer from urea source in two stages of basal and topdressing applications. Also, control of broadleaf and grass weeds was done through application of by Topic and Granstar herbicides and also by hand weeding. In both agricultural years several samples were chosen from each experiment unit after taking out the marginal effects and all desired characteristics were studied on chosen bushes and ultimately, at harvest, after taking out the margins, yield of each plot was estimated and transformed into hectare. During the research, traits of number of days from planting to flowering, number of days from planting to spike emergence and number of days from planting to end flowering were calculated. Before conducting statistical analysis, data was tested for its normality. After reassuring the normality of the data distribution, data was analyzed through statistical methods such as analysis of variance and mean comparison by Duncan test at 5 percent. To carry out the statistical calculation, SPSS software was used. Also, for drawing the diagrams, Excel was used.

RESULTS AND DISCUSSION

Number of Days from Planting to Flowering

Results from ANOVA of number of days from planting to flowering among the studied cultivars and years indicated that there is a significant difference between cultivars and years at one percent (Table 1). Data mean comparison indicated that among the studied wheat cultivars, the cultivar of Pishgam with a mean of 225.33 days had the highest number of days from planting to flowering and the cultivar of Gascogen with a mean of 221.17 days, had the lowest number of days from planting to flowering (Diagram 1). Also, results showed that among the years, the second year had a higher number of days from planting to flowering (Diagram 2).

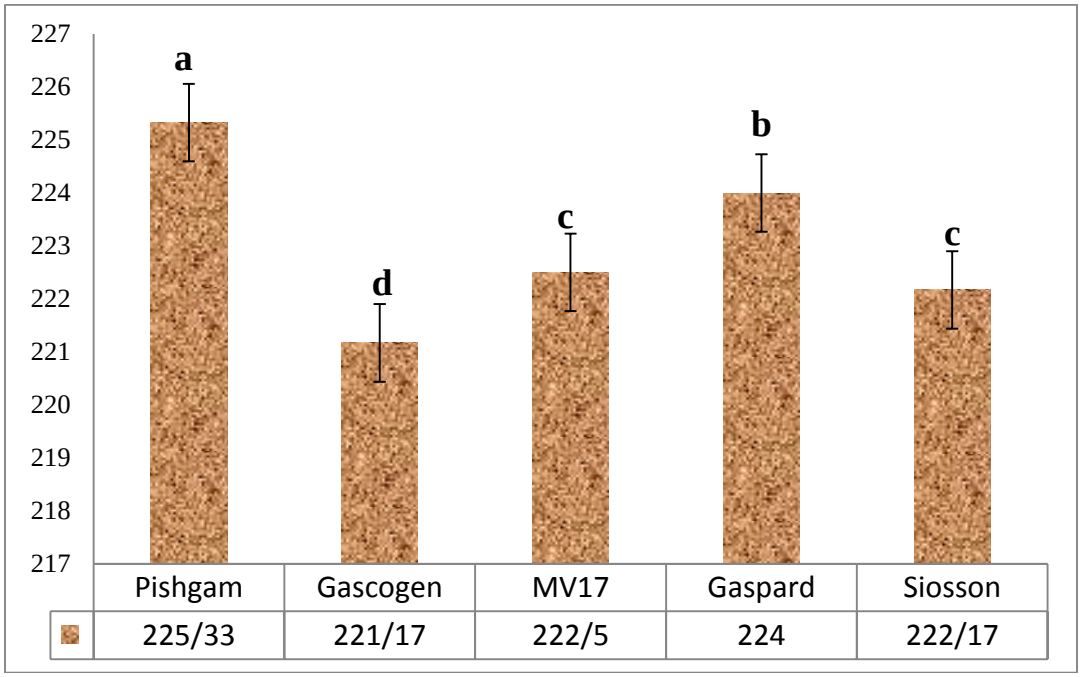

Diagram 1. Mean of Days from Planting to Flowering in various Wheat Cultivars

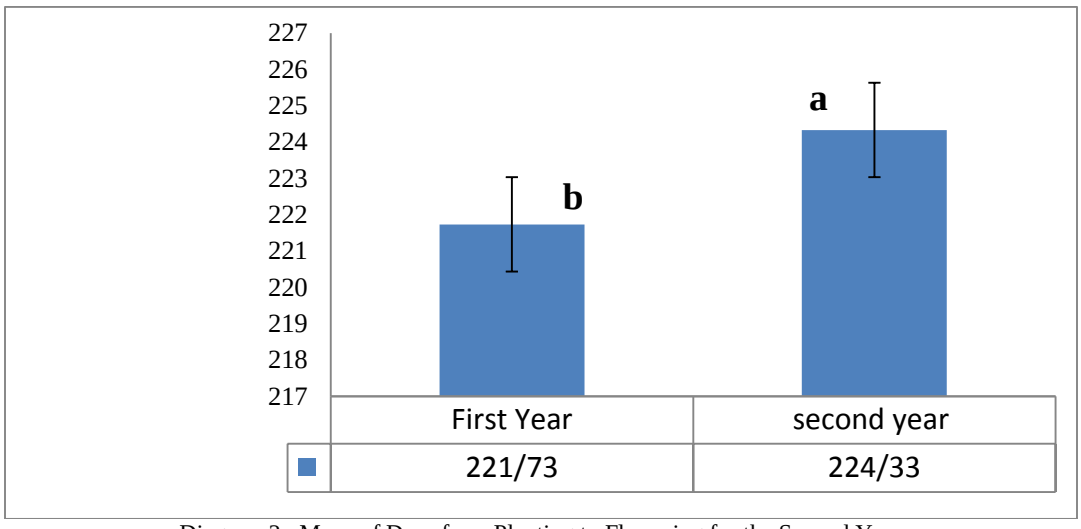

Diagram 2. Mean of Days from Planting to Flowering for the Second Year

Number of Days from Planting to Spike Emergence

ANOVA results suggested that there was a significant difference between various wheat cultivars and the interaction of year in cultivar based on this trait at one percent (Table 1), so that the cultivar of Pishgam with a mean of 221.67 days had the highest rate and the lowest number of days with a mean of 218 days was related to the cultivar of Gasgogen (Diagram 3).

Also, results indicated that the second year, comparing to the first year, had 2.2 days more of days from planting to spike emergence (Diagram 4). Mean comparison results for the interaction of year in cultivar showed that cultivars of Pishgam and Gaspard had a higher number of days from planting to spike emergence in the second year and were put in one statrsitical group, while the cultivar of MV17 with the mean of 217.3 days had the lowest number of days from planting to spike emergence in the first year (Diagram 5).

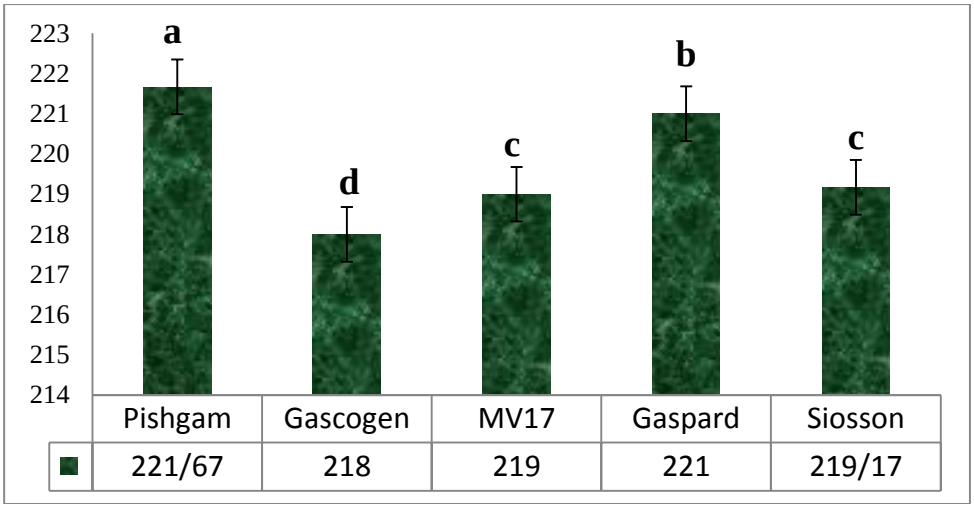

Diagram 3. Mean of Days from Planting to Spike Emergence of various Wheat Cultivars

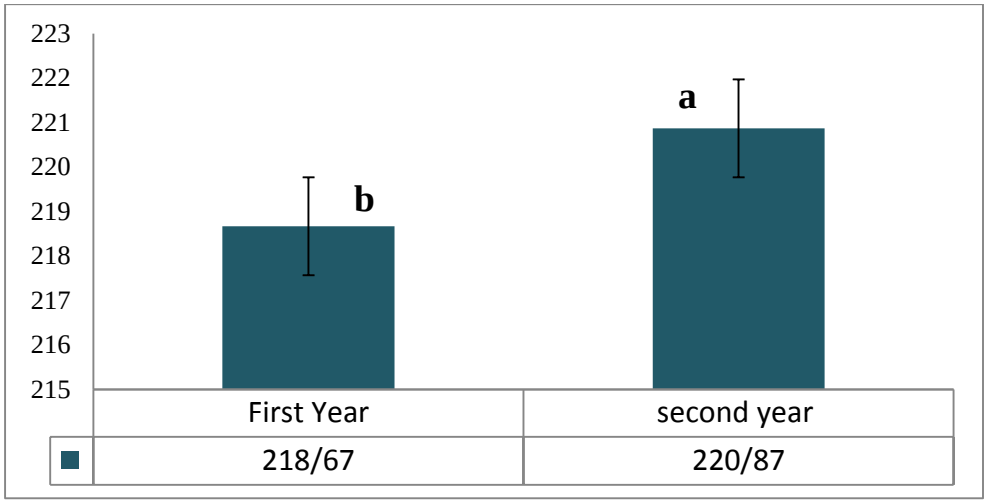

Diagram 4. Mean of Days from Planting to Spike Emergence for the Two Years

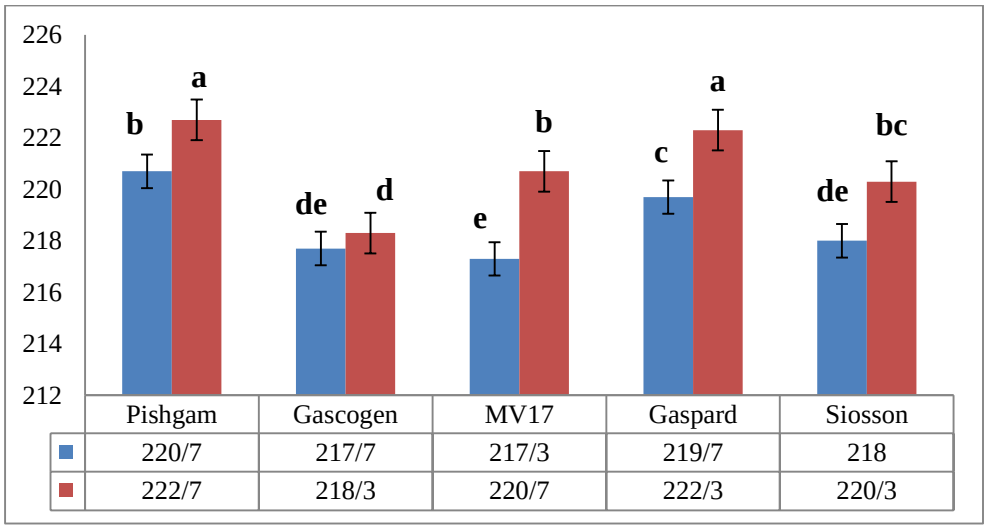

Diagram 5. Mean of Days from Planting to Spike Emergence for the Interaction of Year in Cultivar

Number of Days from Planting to Maturity

Data ANOVA showed the different impact of treatments on this trait and the studied wheat cultivars and years showed a significant difference on number of days from planting to maturity at one percent (Table 1), so that the highest number of days from planting to maturity (273.83 days) was related to the cultivar of Pishgam and the lowest number of days from planting to end flowering was related to the cultivar of Gaspard with a mean of 267.67 days (Diagram 6).Also, results showed that the second year with 3.66 days had higher number days from planting to maturity, comparing to the first year (Diagram 7).

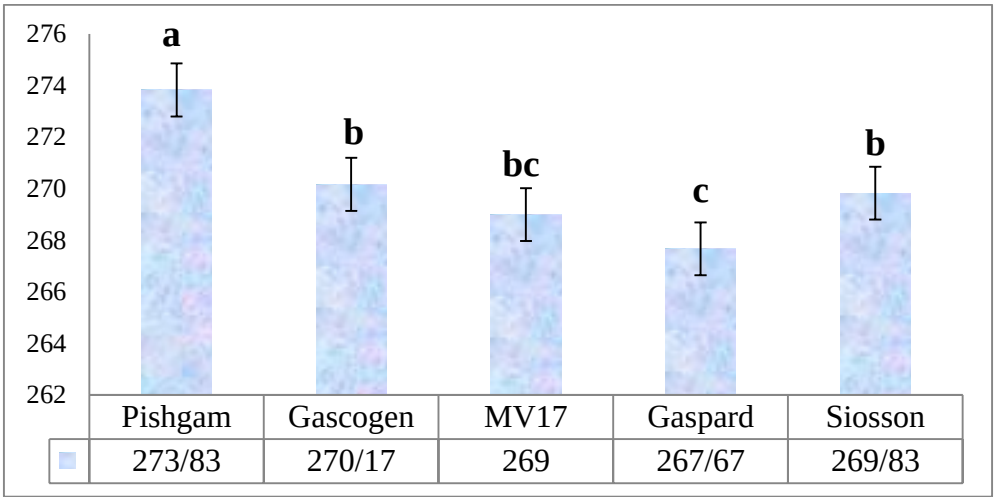

Diagram 6. Mean of Days from Planting to Maturity for various Wheat Cultivars

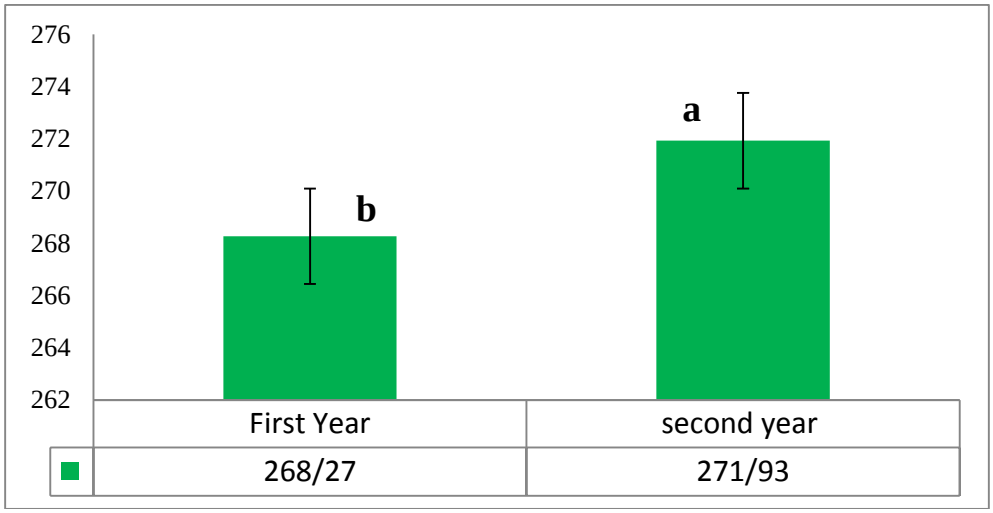

Diagram 7. Mean of Days from Planting to Maturity for the Two Years

By studying 300 durum wheat genotypes, Golabadi and Arzani (2003) showed that there is a considerable diversity for traits of grain yield, harvest index, number of spikes per area unit and number of grains per spike, and the grain yield has a positive and significant correlation with traits of harvest index, biologic yield, number of days to maturity, number of grains per spike and weight of grain per spike.

Abbit ey al. (1998) observed that in the studied six cultivars of wheat, there was no difference between plant growth speed. In the conducted studies, the relationship between plant growth rate and area of leaf has always been positive, while its relationship with photosynthesis was negative (Evans, 1993). Although the majority of derived results show that the total growth rate or growth rate before pollination in high and low yielding cultivars were significant, there is evidence that plant growth rate has a correlation with grain yield after flowering (Gardener et al., 1990; Karimi and Sediqgu, 1991). For instance, Karimi and Sediqgu observed that plant growth rate has a significant relationship with grain yield from spike emergence to harvest time. Also, in corn Gardner et al. (1990) observed that the spike growth rate and reproductive growth rate had a higher correlation with grain yield, comparing to rate of vegetative growth.

Seed Yield

Results from analysis of variance suggested that there was a significant difference in seed yield between various cultivars of wheat at one percent, and this could be due to the high genetic diversity among the studied cultivars (Table 1). Also, results indicated that there was no significant difference between the years and the year × cultivar interactions (Table 1). Results from mean comparison showed that the cultivar of Siosson with the mean of 6,627.7 kg per hectare had the highest seed yield and the lowest yield means were for cultivars of Gaspard and MV17, which were in the same statistical level and ranked last (Diagram 8).

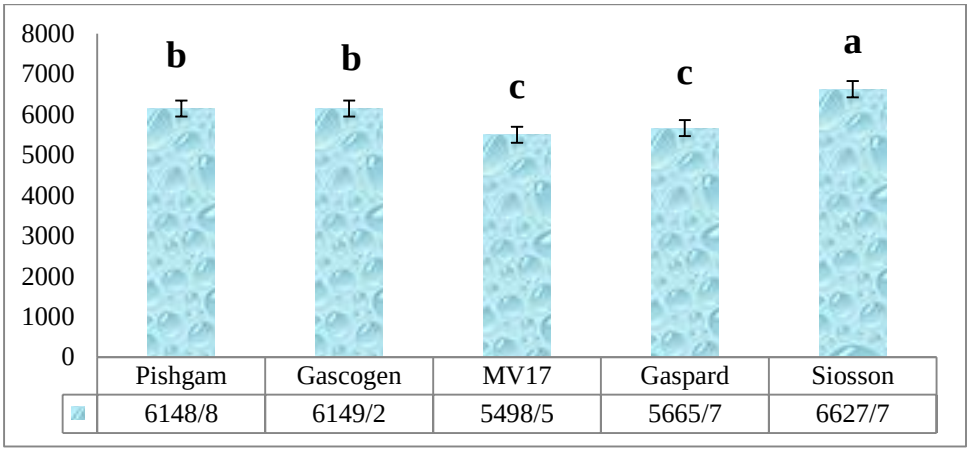

Diagram 8. Mean of Seed Yield in various Wheat Cultivars at the Research Center

Emergence of characteristics such as seed yield in plants is due to the impact of genetics and environmental factors and their interactions. Various genotypes might react differently to the environmental factors such as climate and planting date based on crop production and quality (Adugnd and Labuschagne, 2003).

Wheat seed yield is the result of simple and interaction effects of its yield such as the number of ears per unit, number of grains in ear and grain weight, plant growth environment, plant adaptation with the environment and the efficiency of using effective environmental factors on production and intra- and inter-plant competitions (Kiniry, 1993).

Mackay et al. (2010) expressed that the condition in perennial experiments in various cultivars is different, since yield increase is not retained through cultivar breeding only, but better crop improvement has a role as well (and any positive interaction), for it is an index of progress, as potential yield rate experiment is determined in the experiment year, and not the cultivar release year.

Actual yield in a certain region, in addition to physical factors such as climate and soil, is affected by managerial factors such as access to irrigation, consumption of inputs (chemical fertilizers and pesticides) and also substitution of older cultivars with new and yielding cultivars (Kropff et al., 1994).

In studying the cultivars, Zhou et al. (2007) observed that increase in seed yield in China during 1970 and 2000 was around 0.54. in a research in Spain to increase seed yield of Spanish and Italian cultivars released between1945 and 2000, Ruyu et al. (2007) observed that yield increase for Spanish and Italian cultivars were 0.36 percent and 0.44 percent, respectively.

Table 1. Analysis of Variance of Evaluated Characteristics for various Wheat Cultivars

S.O.V	df	Mean Square			
		Seed Yield	Number of Days from Planting to Flowering	Number of Days from Planting to Spike Emergence	Number of Days from Planting to Maturity
Replication	2	1425503.33	0.43	0.53	51.30
Cultivar	4	1200051.78**	16.12**	13.80**	31.72**
Year	1	45864.30 ^{ns}	50.70**	36.30**	100.83**
Y * C	4	1583.55 ^{ns}	0.62 ^{ns}	1.47**	0.58 ^{ns}
Error	18	120061.70	0.58	0.27	2.89
CV (%)		5.76	0.34	0.24	0.63

* and ** Significantly at p < 0.05 and < 0.01, respectively.

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