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Effect of planting date on ecophysiological and morphological characteristics of lines and varieties of barley in different regions of Kermanshah

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Abstract

Obtaining high performance from barley needs to conform vegetative and reproductive growth stages to suitable weather conditions through suitable planting date. The present research carried out to study the effect of planting date on ecophysiological and morphological traits of ten lines and varieties of barley in different regions of Kermanshah by using split plats in randomized complete block design (RCBD) with three replications in the Research Farm of Islam Abad Gharb, Kermanshah province during cropping years 2011-2012. The treatments of planting date were consisting of 3levels October 7th, October 22th and November 6th as main factors and irrigated barley variety as sub – factors in 10 levels MBD–88–19, MBD–88, MBD–88–13, MBD–88–16, MBD–88–5, MBD–88–2 and D10 along with control genotypes of Nosrat, Yousof, and Nik. The results of analysis of variance (ANOVA) indicated that effects of planting date on seed performance, number of spikes per square meter, number of seed per spike, 1000-seed weight, biological performance and HI at the level of 1% probability were significant. The comparison of mean effect of planting date on economical performance showed that planting date of October 22th with 4736 kg per hectare has the most economical performance and November 6th with 4033 kg per hectare has the least performance.

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Introduction

Barley is the first plant that has been domesticated by human. It has an important role in progress of human and providing the main food of them (Alarad *et al*., 1984). The late planting of wheat and barley cause the pollination, absorption of materials, and grain filling are postponed in spring season and rapid increasing of temperature causes pollen cannot germinate on stigma. As a result, it causes some florets become sterilized and decrease the weight of seed and aggregation. All of these cases reduce the performance (Rad Mehr, 2010). Sharma *et al.* (2000) also reported that delay on planting decreases the seed performance. Sinclaie and Jamiesen (2006) also proved that seed performance and number of seed because of providing resources during growth season districted strongly. Ogarte *et al.* (2007) also studied the response of barley to temperature treatments has happened because of the effects of temperature on number of seed. Peltonen–Sainio *et al.* (2006) showed that reparative effect of number of seed and weight of seed depends on species, variety and environmental dominant conditions. Sharifi (2006) and Zolfaghari (2003) reported that with delay on planting, filling time of grains decreases. The main purposes of this investigation were to determine the most suitable planting date and introducing the best barley variety in the Kermanshah region.

Materials and methods

Plant materials and experimental conditions

This experiment carried out in the cropping years 2011-2012 at the Research Farm of Islam Abad Gharb at 65 km away from south of Kermanshah, Iran (47° 20′ N latitude, 34° 20′ E longitude and 1351m altitude). The experiment carried out in split plat based on random complete blocks in three replications. Three levels of planting date (October 7th, October 22th, November 6th) are considered to main plats, and ten varieties of (MBD – 88 – 19, MB – 88 – 15, MBD – 88 – 13, MB – 88 – 16, MB – 88 – 5, MB – 88 – 2, D10 and control varieties of Nosrat, Yousof, and Nik) are considered as sub – factors. Dimensions of each plat is 1.2 × 10=12 m^2 (distance of ridges is 60cm) and bush density is 400 seeds in square meter. Bushes harvested in specific area and obtained grains weighted, then seed performance calculated. Number of spikes calculated in one square meter. 10 spikes are selected randomly to calculate the number of spikes per plot and grain number in spike. Mean 1000-seed weight obtained after selecting 1000 seeds that are weighted and selected randomly from 10 samples with 100 grains.

Statistical analysis of data

The measurement data of the studied traits across all conditions were analyzed by the statistical methods including descriptive statistics, analysis of variance (ANOVA), compare means and simple correlation coefficients using MSTAT-C soft ware.

Results and discussion

Number of spikes per square meter

The results of analysis of variance (ANOVA) showed that effects of planting date on 1000-seed weight, economical performance and HI are significant at 1% level. Effects of genotype on 1000-seed weight, economical performance and HI are significant. Also interaction effects of planting date and genotype on 1000-seed weight are significant. With delay at planting, number of spikes decreases in square meter as at planting date of October 22th and November 6th with 304.66 and 207 grains in square meter have the most number of spikes per square meter, respectively. Planting date of October 22th has 47.17% increase more than planting date of November 6th. In studying the effect of planting date and amount of grain on performance and performance components of native barley without capsule, Salehi and Yousofi (2011) showed that with delay at planting, the seed performance, number of spikes per square meter, and 1000-seed weight decrease while number of seed in spikes remains fixed. The results of interaction effects of planting date and variety on number of spikes in square meter show that planting date of October 22th and MB –88 –2 genotype with 335 grains has the most spikes in square meter, and planting date of November 6th and D10 variety with 175 grains has the

least spikes in square meter (Table 1). We conclude that on time planting expands root systems and make plant to show more resistance to dry at the end of the season, and increases the number of spikes in square meter.

Table 1. Analysis of variance (ANOVA) for measured traits.

S.O.V.	D.F.	Harvest index (%)	Biological performance	Economical performance	1000-seed weight	Number of spikes per square meter	Number of seed per spike
Rep	2	12.04ns	121531165	5706283**	0.88ns	544.34**	7.63**
Planting date (A)	2	246.78*	161069590**	4244311**	254.61**	72235.27**	1.3
Rep × A	4	81.96.*	97221054.1**	2870713**	3.41ns	112.06	0.93
Genotype (B)	9	78.63*	80584947.8**	1060817	20.88**	4581.16**	50.51**
A × B	18	31.75	13389895.5	794047	10.28**	301.05**	1.26**
Suspicion	54	29.35	15313240	735487	4.34	107.04	0.54
Coefficient of Variation (CV)		18.7	16.49	19.21	5.53	14	8.13

* and ** : Significant at 5% and 1% levels, respectively.

Earlier planting also may face plant with long period of heat at the beginning of growth season and then aphids activated and increases yellow stunting virus disorder of barley. If barley cultivate with delay, period of tillering decreases. Because of chilling, fertile stems decrease in square meter, therefore, field is thinning and number of spikes decrease in square meter, and it is conform to results of Emam (1985) and Rasmusson (2004).

Seed number per spike

The results showed that effect of genotype and planting date on grain number per spike is significant at 1% level. Also interaction effect of planting date and genotype on above characteristics is significant at 1% level. The results of mean effect of genotype on grain number per spike showed that MB–88 –2 genotype with 37.88 grains in spike has the most grain number in October 22th. D10 variety with 3.66 grains in spike has the least grains number in November 6th. MB – 88 – 2 genotype showed 23.54% increasing more than D10 variety. In evaluation of morpho-physiological indices that influence the performance of spring wheat varieties, Ahmadi *et al.* (2010) reported that in terms of grain number in spike, growth speed of products and total dried materials, different varieties have high changes. Generally, we can say that planting date results in vegetative and reproductive growth, qualitative and quantitative performance of products and finally grain number in spike and even increasing the performance through conformity of growth stages of plant with thermal conditions and temperature of soil and weather, photoperiod, evaporation and transpiration potential, rainfall, humidity, and other weather characteristics, outbreak of disease and weed.

The results of ANOVA showed that only effect of planting date on economical performance is significant at 1% level (Table 1). The results of mean effect of planting date on economical performance show that sample of October 22th with 4736.4 kg in a hectare has the most economical performance and sample of November 6th with 4033.9 kg in a hectare has the least economical performance. Late planting in November 6th showed 17.41% reduction than sample of October 22th (Table 2). Sharma *et al.* (2000) reported that cultivating wheat and barley with delay decreases the seed performance. Planting date must be select in a way that all growth stages of plant keep from all. Environmental factors and different stages of growth conform to suitable conditions (Khaie – Pour, 2001). Increasing the germination speed and putting seed in the farm can increase the acceleration of seedlings to absorb water and nutrients and use sun light more. And about products that are cultivated in autumn they increase

the degree of clod tolerance before glacial (Finch Savage *et al.*, 2004). In the third planting date (November 6th) sudden cold of autumn chill the bushes especially at early planting date (October 7th) and late planting date (November 6th). And yellow planting date of October 7th, and login of final meristem to reproductive phase caused the damage of cold on bashes become more than two second and third date, and plant has less food reserve during vegetative and reproductive season. We can say that because of cold and reduction of ATP synthesis, in many.... Compositions such as cytokinins and many Amino acid and some vitamins that are conducted in the root synthesis, reduce and transform to with less speed. This difference restricts the stem growth and reduces the synthesis of hormones and performance.

Table 2. Mean values of measured traits in different planting dates.

Planting date	Harvest index (%)	Biological performance (kg/h)	Economical performance (kg/h)	1000-seed weight (g)	Number of spikes per square meter	Number of seed per spike
October 7th	32.26a	22513b	4618.2b	36.84b	264.16B	34.56A
October 22th	27.09b	26395a	4736.4a	40.92a	304.66A	64.66A
November 6th	27.52b	22262b	4033.9b	35.28c	207C	34.69A

Similar letters in each column indicate no significant difference between the mean values is assessed.

1000-seed weight

The results of analysis of variance (Table 3) show that effect of planting date on 1000-seed weight is significant at 1% level. Also effect of genotype and interaction effect of planting date on weight of one thousand seeds are significant at 1% level (Table 1). The results of mean comparison of effect of planting date on 1000-seed weight showed that samples of October 22th and November 6th with 40.92gr and 35.28gr ate the most and the least weight of seed, respectively. Sample of October 22th is 11.07% more than October 7th and it is 15.98% more than November 6th. Meanwhile, mean comparison of effect of genotype on 1000-seed weight showed that MB – 88 – 5 and MD–88–13 genotypes with average of 38.7 g and 38.71 g have the most 1000-seed weight, respectively. And D10 variety with 36.2 g has the least 1000-seed weight. We can conclude that with delay at planting, filling time of seeds reduces. To plant at unsuitable time including late or early, have many undesirable effects. To plant the grains at desirable time results in high percentage of germination, good tillering, on time phonological growth and producing strong plants with firm root system, reduction of loading, increasing the 1000-seed weight for all growth varieties and plant survival that conform to results of Habibi *et al.* (2006), Bakhshandeh *et al.* (2003) and Heyne (1977).

Table 3. Mean values of the barley genotypes in measured traits.

Genotype	Harvest index (%)	Biological performance (kg/h)	Economical performance (kg/h)	1000-seed weight (g)	Number of spikes per square meter	Number of seed per spike
Uo	26.31cd	27811ab	4845.1a	37.77bcd	239.66C	32.88E
MB-88-2	29.53abc	20777cd	4103.8ab	35.88d	284.22A	37.88A
MB-88-5	29.32abc	22299cd	4179ab	36.4d	276.44A	37B
MB-88-16	23.24d	28196a	4291.7ab	37.44bcd	275.77A	36.44Bc
MB-88-13	29.02bc	24266bc	4666.6ab	38.71bc	263.77B	36.11Cd
MB-88-15	34.03a	19727d	4181.3ab	36.75cd	278A	35.55D
MB-88-19	29.89abc	24391bc	4840.4a	36.24d	273.55Ab	35.66D
Nik	28.83bc	21217cd	3989.5b	39.31ab	239.55C	33.11E
Nosrat	32.02ab	22089cd	4713ab	37.57bcd	231.77Cd	32F
D10	27.39bcd	26462ab	4817.8a	40.73a	223.33D	3066G

Similar letters in each column indicate no significant difference between the mean values is assessed.

Harvest index (HI)

The results of ANOVA showed that effect of planting date on HI is significant at 1% level, planting date of October 7th with average of 32.26% has the most HI, and planting date of October 22th and November 6th with average of 27.09% and 27.52% have the least HI. Also the mean comparison of effect of genotype on HI showed that MB – 88 – 15 genotype with 34.03% has the most HI and MB – 88 – 16 genotype with 23.24% has the least HI. The effect of planting date and density on performance, performance components and phonology of maize single cross 704 in Gorgan, Moeini Rad *et al.* (2013) observed that seed performance, biological performance, 1000-seed weight, HI number of ears without seed and HI of ears are affected by planting date and they are significant at 1% level. Unaffected of HI under the effect of planting date belong to how seed performance and biological performance change. In the present research we observed that planting with delay decreases biological performance. And in comparison with seed performance more changes happened. As a result, reduction of biological At the second planting date in which seed performance is more, HI is maximum too. In fact, changes of HI shows that change of biological performance may not come with seed performance. On the whole, growth conditions specially planting date changes General conclusion.

On the whole, selecting the suitable genotype of each region with regard to weather conditions, available potential and also selecting the suitable planting date can improve the production and prevent from dealing stages of plant growth with environmental unsuitable conditions such as chilling and harmful effect of high temperature in reproductive stages of plant. The research showed that the best planting date of barley in moderate region of Kermanshah province and its similar region in other parts of the country are October 22th and MBD–88–2 variety in which plant has good growth by using environmental suitable conditions such as light and suitable temperature. And with good posture and making conditions that adapted with environment, it has sufficient autumn growth and by passing winter in the strong stage, it has good growth situation in spring and finally flowering and grading and grain filling happen in suitable temperature and increase the performance. The most performance of seed belong to planting date of October 22th and MBD – 88 – 2 variety with 4845 kg and the least seed performance belong to planting date of November 6th Nik variety with 3989 kg.

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