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Study of end-of-season drought stress effects on lengths of peduncles, lengths of extrusions and lengths of flag leaves of irrigated barley lines in moderate regions of Kermanshah province

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Key words: Irrigated barely lines, Drought stress , lengths of peduncles, lengths of extrusions ,lengths of flag leaves.

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Abstract

In 2009-10, a research was done in order to study the effects of late-season drought stress on yield and yield components of irrigated barely lines with 2 factors of genotype and drought stress in the form of split plot test in the format of complete random blocks with 3 repetition in Islamabad-e Gharb Station (Kermanshah province).For 9 levels of lines MBD-85-3 , MBD-85-6, MBD-85-8, MBD-85-14, MB-85-3, MB-85-5,MB-85-18 and 2 control cultivars Yosuf (D5) and Nosrat, drought stress and genotypes were considered as major and minor factors, respectively. Each plot was set at a 12-m² area (each ridge 60 cm). Plant density was set at 400 seeds/m² with 4-5 cm planting depth. Seeding was performed by winter Schneider test seeder with sprinkler irrigation. Soil test determined the amount and type of fertilizer to be used Results of variance analysis indicated that the differences between cultivars in terms of peduncle length and between irrigation levels were both significant at probability level of 1%, but cultivar x irrigation interactions were not significant at levels of 1% and 5%. Also, results showed that the differences between cultivars in terms of extrusion length and between irrigation levels were significant at level of 1%, but cultivar x irrigation interactions were not. For length of flag leaves, results of variance analysis showed that differences between cultivars in terms of the length of flag leaves and between irrigation levels were significant at level of 1%.

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Introduction

Barley *(Hordeumvulgare L.)* is an annual plant from cereal (Gramineae) family of genus Hordeum with 24 species including diploid , tetra ploid , and hexaploid and the basic chromosome number of which is x=7 . Farming barley is of species (H.Valgare L.) which includes both types of 2-rowed (H.V.disticum) and 6-rowed (H.V.hexasticum) barley although, in the past, they were classified into 2 separate species. During many centuries, barley has been paid attention to as a major cereal for following reasons (Rasmosen, 1985). Barley is an auto gamy plant with shallow fibrous roots. It has a cane knobby stalk, and narrow light green leaves with round ends. At connection place of leaf to talk, there are 2 large stipules and 1 long half-circle achromatic ligules. Barley is bisexual and has spike inflorescences (Bakero *et al.*, 1990). Like other plants, barley germination includes a series of events as a result of which germs undergo some metamorphosis changing from a dormant state into an actively generative metabolic one. This is reached after a period of dormancy caused by environmental (temperature, heat. Degree , oxeye , and light) , physiological (growth inhibitor substances , immature embryo) , and or morphological (seed coat) factors. Physiologically, termination is a process beginning with water uptake by dry seeds and terminating with emergence of primary root out of seed coat. Seeds of any species or variety have minimum, and maximum temperatures, which are 4°c, 22° c, and 36°c, temperatures, for barley germination. History of genesis and evolution of barley dates back to the beginning of agriculture so that its domestication time has been attributed to 5-7 thousand years B.C or more (Rasmosen , 1985).

Barley is a highly vast adaptive plant and one of the first plants dots domesticated by humans development and their basic food supply (Allarad *et al.*, 1964).For embryos absorbed water, oxygen requirement directly relates to increased temperature, but the amount of oxygen dissolved in water decreases as temperature increases. Germination is more dependent on moisture than on oxygen and dioxide carbon. For germination, barley and other cereal exhibit the least reaction to the light (Kouchaki *et al.*, 1988). Plant height increases as density increases. Under plant high-density conditions, shading results and stalks become etiolated. Probably, shade effect is caused by increased oxide and seems to be intensified at presence of gibberellins (Kouchaki & Sarmadnia , 1994) . The rate of barley production is estimated at 3.45 million tons in the country , 69.10% and 30.90% of which are harvested from irrigated lands and from dry farming, respectively (Agriculture Data sheet ,2009) Khorassan Razavi province holds the first place nationwide in terms of barley production at 16.68% , followed by Kermanshah , Hamadan, Isfahan, Golestan , and Tehran at the end to 6th places , respectably , producing 8.74% , 7.72% , 5.62% , 5.47% , 5.32% of total rate of barley production . Collectively, 6 mentioned provinces produce 49.55% of country barley while remaining 50.45% are produces by all other provinces of the country. The least rate of barley production is 0.07% by Hormozgan province (Agriculture Data sheet, 2009).

Materials and methods

In farming year of 2009-10, present research was done at research station of Islamabad-e Gharb, Kermanshah province. Research field is located 65 km of south Kermanshah at north 34°8′ latitude and east 47° 26′ longitude , elevated 1346 m from sea level having semiarid Mediterranean climate . Following results were obtained at agrology lab of soil & water research division from Kermanshah Agriculture Center by performing soil analysis operation on soil samples randomly taken from 0-125 cm depth of the soil of test field. Target region soil with 10.8% of sand, 56% of sill, and 33.2% of clay has a silly – clay –loam texture. During farming year of 2009-10 , at Islamabad-e Gharb station (Kermanshah province) this research was vane with 2 factors of cultivar and stress in the form of split plot design based on complete random blocks with 3 repetitions in order to study effects of late-season drought stress on morphological and physiological characteristics of different irrigated barley lines within temperate regions of Kermanshah province. Drought stress and normal conditions were regarded as major and

irrigated barley cultivars as minor factors; the latter at 9 levels (MBD-85-3 , MBD-85-6 , MBD-85-8 , MBD -85-14 , MB-85-3 , MB-85-5 , MB-85-18 , and 2 control cvs. Nosrat and yosuf). Each plot was of 1.2×10= 12 m^2 area (with ridges 60 cm apart), and plant density was 400 seeds m^{-2} . The amount and type of fertilizers to be used were determined on the basis of soil test as follows: potash, phosphorus, and nitrogenous fertilizer were used, respectably, from potash sulfate source; and urea source , in the form of basal and top-dressing fertilizers. Based on the soil analysis results, 150 kg of ammonium phosphate fertilizer was used at the time of planting , and a third of urea fertilizer was used at the time of planting and remaining amount was used as top-dressing fertilizer during 2 stages of elongation and grain-set. Also, in grain-filling stage, Integration pesticide was used to control wheat bug. In order to control smut, used seeds were disinfected by using Maukazeb fungicide. Other stages of crop management were performed routinely.

Measurement

Lengths of peduncles

The distance between flag leaf up to clusters, ten barely plants were measured in cm.

Lengths of extrusions

The distance between the end nodes up to the flower stalk random in cm were measured in ten plant and Averages for each treatment were used as the length of the extrusion.

Lengths of flag leaves

Ten stems were randomly assigned to flag leaf length was measured in cm.

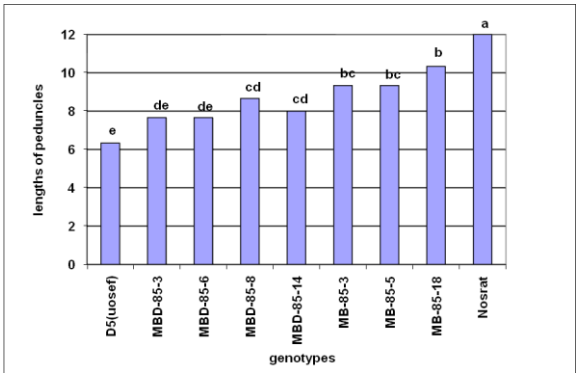
Statistical analysis

Variance analysis of data was performed on the basis of split plot design in the form of complete random blocks, and Duncken·s method was employed to compare means. MSTAT-C software and 3-D graph drawing were used to analyze data, and statistical SAS and SPSS software was used to analyze principal components and coefficients of simple correlation between attributes.

Results and discussion

Lengths of peduncles

Variance analysis results indicated that differences between cultivars in terms of peduncle lengths and between irrigation levels were significant at level of 1%, but cultivar x irrigation interactions were not significant at levels of 1% and 5%. The maximum (11.3cm) and minimum (6.3 cm) values of peduncle length belonged to cv.



(a)(b) significan-(ab) not significant

Fig. 1A. Means of peduncle length for different irrigated barley genotypes under normal conditions.

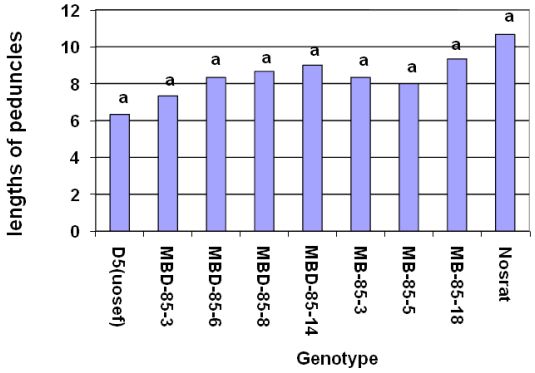


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Fig. 2A. Means of peduncle length for different irrigated barley genotypes under end-of-season drought stress conditions.

Nosrat and cv. Yusef (D5), respectively. In addition, among irrigation treatments, maximum (8.8 cm) and minimum (8.4 cm) values of peduncle length related to line MBD-85-3 and cv. yousef (D50, respectively. Because nutrients are taken up by plants in the from

of water-dissolved, limited water supply resulted in limitation of whole food supplies so plants were forced to lower vegetative growth and to finish it early and to start germinative stage, as a result of which growth, period was shortened and height, peduncle length were reduced (Sarmadnia & Kouchaki, 1987). Also, peduncle lengths were significantly different at level of 1% between irrigation treatments, maximum (12.0 cm)and minimum (6.3 cm) values of which belonged to cv.Nosrat and cv.yousef (D5), respectedly.

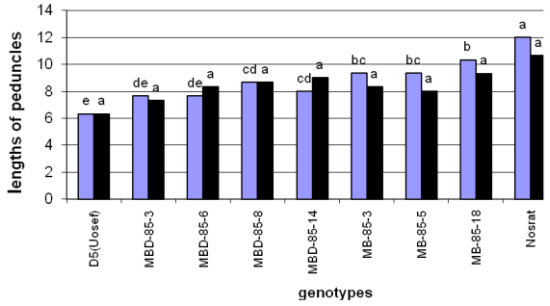

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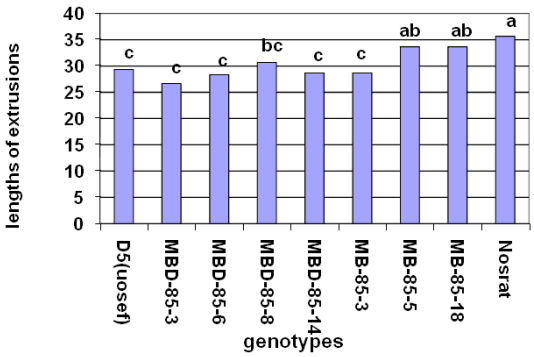
Fig. 3A. Drought stress x normal conditions interactions for peduncle lengths.



(a)(b) significan-(ab) not significant

Fig. 1B. Means of extrusion length for different irrigated barley genotypes under normal conditions.

There was no significant difference between and-of-season drought stress treatments in terms of peduncle lengths, maximum(10.7 cm) and minimum (6.3 cm) values of which belonged to cv.Nosrat and cv.Yousef, respectively. It can be concluded that each cultivars peduncle lengths depend on the plants genotypes, but they change under environmental impacts, on which, here, irrigation stress had no effects because stresses were exercised more in final stages of vegetative growth.

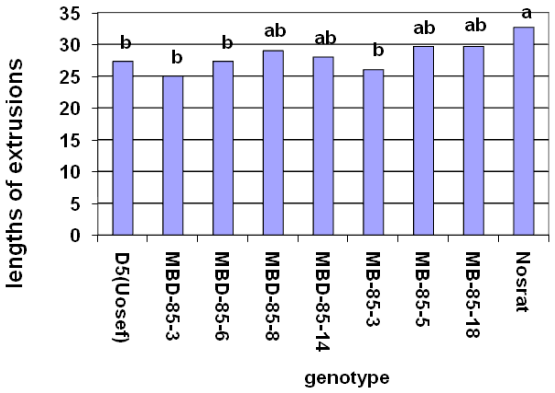


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Fig 2B. Means of extrusion length for different irrigated barley genotypes under end-of-season drought stress conditions.

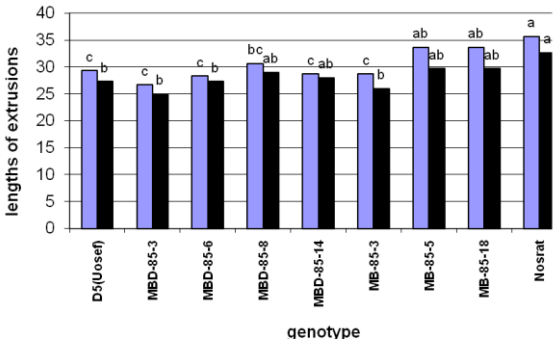

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Fig. 3B. Drought stress x normal conditions interactions for extrusion lengths.

Lengths of extrusions

Variance analysis results showed that at level of 1%, differences between cultivars in terms of extrusion lengths and between irrigation levels became significant, but cultivar x irrigation interactions did not. Maximum (34.2 cm) and minimum (25.8 cm) values of extrusion length related to cv.Nosrat and line MBD-85-3, respectedly. For irrigation treatments, maximum (30.6 cm) and minimum (28.3 cm) values of extrusion length were observed with line MBD-85-3 and cv.Yousef (D5), respectively. At level of 1%, extrusion lengths were significantly different between irrigation levels, maximum (35.7 cm) and minimum (26.7 cm) values of which belonged to cv. Nosrat and line MBD-85-3,

respectedly. For end-of-season drought stress treatments, extrusion lengths were significantly different at level of 1%, maximum(32.7 cm) and minimum(25.0 cm) values of which were obtained with cv. Nosrat and line MBD-85-3, respectively.

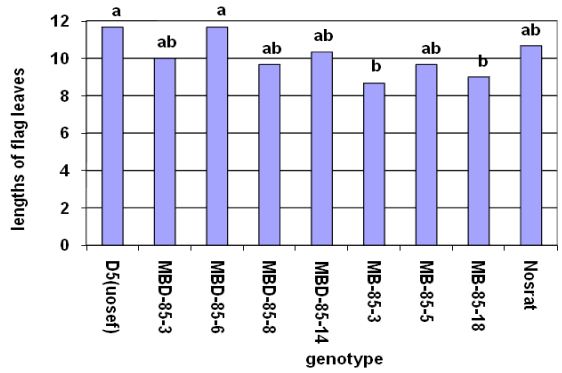

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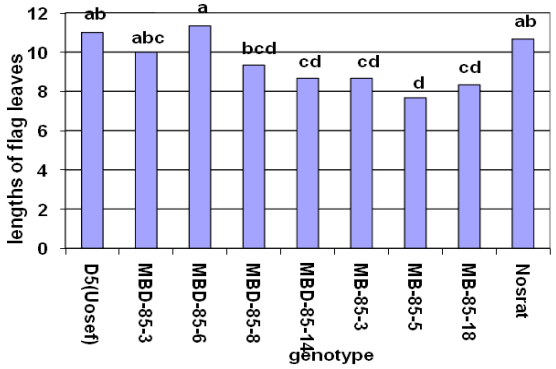
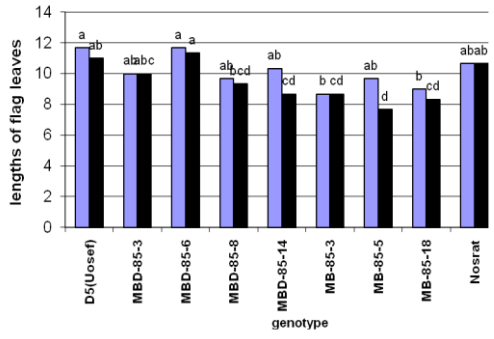
Fig. 1C. Means of flag leaf length for different irrigated barley genotypes under normal conditions.



((a)(b) significan-(ab) not significant

Fig. 2C. Means of flag leaf length for different irrigated barley genotypes under end-of-season drought stress conditions.



(a)(b) significan-(ab) not significant

Fig. 3C. Drought stress x normal conditions interactions for flag leaf length trait.

Given the effects of water stress on cultivars early maturity resulting in early stoppage of vegetative growth. It seems that , like plant heights, extrusion lengths are reduced. Results showed that each cultivars extrusion length depends on plant genotypes while being also influenced by the environment.

Lengths of flag leaves

Results of variance analysis showed that differences between cultivars in terms of flag leaf lengths and between irrigation levels became significant at level of 1%, but cultivar x irrigation interactions did not. Maximum (11.5 cm) and minimum(8.7 cm) values of flag leaf length related to line MBD-85-6 and line MBD-85-5, respectedly. For irrigation treatments, maximum (10.1 cm) minimum (9.5 cm) values of flag leaf length belonged to line MBD-85-3 and and cv. Yousef (D5), respectively. Another mechanism of tolerance considered by some scientists is assimilates translocation. For several species of grains, growth takes place partially through photosynthesis flowing in flag leaves and inflorescences and partially through translocation of substances stored in stalks in the stage prior to flowering. Hoving entered grain-filling stage, plants convert starchy substances into sugar being transferred into grains. Transfer of substances from the site in which they were stored previously to another site where they are used again is referred to as re-transfer (Fathi,2004) . In certain stages of development, photosynthetic substances are produced in an amount more than that consumed by growth and development processes . This excessive amount of substances can be converted into storage compounds. In following stages, for example, fruiting when photosynthesis is not able to supply needs of plant destination sites, stored compounds can be moved to active centers such as grains. There was also a significant difference (1%) between irrigation treatments in terms of flag leaf lengths, maximum 911.7 cm) and minimum (8.7 cm) values of which belonged to cv. Yousef (D5) and line MB-85-3, respectively . Values of flag leaf length were significantly different at level of 1% between end-of-season drought stress treatments, maximum (11.3 cm) ad minimum (7.7 cm) of which pertained to line

MBD-85-6 and line MB-85-5, RESPECTEDLY. Genotypes becoming significant can be attributed to their potential and conditions of growth because study cultivars are all different from each other in terms of crop types.

Conclusion

Results of variance analysis indicated that the differences between cultivars in terms of peduncle length and between irrigation levels were both significant at probability level of 1%, but cultivar x irrigation interactions were not significant at levels of 1% and 5%. Also, results showed that the differences between cultivars in terms of extrusion length and between irrigation levels were significant at level of 1%, but cultivar x irrigation interactions were not. For length of flag leaves, results of variance analysis showed that differences between cultivars in terms of the length of flag leaves and between irrigation levels were significant at level of 1%, but cultivar x irrigation interactions were not, therefore, the highest(11.5 cm) and lowest (8.7 cm) flag leaf length values were observed with line MBD-85-6 and line MB-85-5,respectively.

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