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Research Article

THE RESPONSE OF PHONOLOGICAL TRAITS (VEGETATIVE DURATION AND GENERATIVE DURATION) OF FABA BEAN TO CULTIVAR, PLANT DENSITY AND WEED CONTROL IN CLIMATIC CONDITIONS OF KHUZESTAN

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ABSTRACT
An experiment was performed in Mian-Ab Region of Shushtar,13th km, Ahwaz-Shushtar Road, for one year in agricultural year of 2011-2012 in order to investigate the effect of plant density and cultivar on weed control in faba bean fields in climatic conditions of Shushtar. In this experiment a complete randomized block design in a factorial-split arrangement with four repetitions was used, in which three cultivars of faba bean considered (Barekat,V1; Saraziri,V2; and Mahalli,V3), density at three levels (7,11 and 14 Plants per square meter; D1, D2 and D3 respectively) and weed population of %0, %50 and %100 (R3, R2 and R1 respectively). The results showed that all the studied phonological traits were affected by cultivar and plant density. Moreover, vegetative duration was influenced by weeds; however, generative duration was not affected by interactions. That the longest vegetative duration was obtained for cultivar Barakat in two conditions of %50 and %100 weed control; however, in condition in which weed was not controlled Mahalli mass exhibited the longest vegetative duration, which means Mahalli cultivar in condition of weed presence was more susceptible than the other two cultivars and which its phonological phases would be affected more in condition of competition with weeds. The shortest vegetative duration was observed for cultivar Saraziri in condition of not controlling weeds. Of course it should be mentioned that this cultivar exhibited the shortest vegetative duration at the other two levels of weed control than the other two cultivars.

Keywords: *Generative Duration, Plant Density, Percentage of Weed Control, Phonological Traits Vegetative Duration*

INTRODUCTION
Continuous change in plant's form and activity is called growth. The analysis of agricultural plant growth is simplified based on the study of distinctive growth events, i.e. growth phases, such as seedling appearance, flower initiation and flower appearance. The rate of plant's development and growth in each of the phonological phases (i.e. phonophases) determines growth rate, and the study of plant growth rate in relation to environmental conditions is called phonology (Mousavi *et al.,* 2010). The study of occurrence of different growth phases based on time calender and termal units allows easier analysis of plant's phonology, especially under hard conditions (Loomis and Connor, 1992). Russel *et al.*, (1984) reported that the rate of approaching each phase of growth is explicitly under the direct effect of temperature and that there is a close relation between temperature and crop growth. James *et al.*, (2000) reported that weeds not controlled for 4 weeks after corn germination, reduced crop yield significantly. The ratio of agricultural plant height to weed height is one of the factors of superiority of plants to each other. Because weed and agricultural plant are not different in height in the early season; however, this difference becomes more prominent over time and causes superiority between weed and agricultural plant (Ya,ghoubi *et al.*, 2009; Fernandez *et al.*, 2002).
Selecting suitable cultivar adaptable to climatic conditions and determining plant density and proper planting date are of important factors to achieve environmental favorable conditions and high yield. Agricultural plants and even an agricultural species have a of ideal plant density special to their own to

produce the maximum yield depending on their own genotypic and phenotypic capabilities to response to change in plant density and potential of competition with other plants (Dwyer *et al.*,1991). In addition to the above-mentioned factors, climatic conditions affect the yield rate different cultivars of agricultural plants (Aryan-Nia *et al.*, 2012; Gholi-zadeh *et al.*, 2013). Ideal plant density is one by which environmental factors (water, air, sunlight and soil) are applied completely while intra- and extra-plant competition is at the minimum level so that the maximum yield can be achieved with a desirable quality. Alternatively, that density must provide adequate space for maintenance and harvest operations (Khajeh-pour, 2008; Sharafi-Zadeh *et al.*, 2012). Mathew *et al.*, (2008) believe that plant density is the most determining factor for plant growth and matter accumulation. Ideal density depends on various factors the most important of which are: plant,s properties, vegetative duration, date and method of planting, soil,s productivity, plant size, available humidity, solar radiation, planting pattern and weed condition (Shirtlif and Johnson, 2002).

In this way, Jahansooz *et al.*, (2006) found out that there was significantly a negative correlation between yield and trait of the number of days until the appearance of the first flower. Also characteristic of the number of days until complete ripeness was positively and negatively significant in relation to the traits of the number of days until appearance of the first flower and plant,s form respectively. From the initial stage of growth to the initiation of flowering, faba bean is sensitive to competition with weeds (Agenehoo and Hai, 2006; Casto and Pakanoksi, 2007) such that when investigating the effect of time of weed removal on yield and yield components of faba bean, it was determined that weed control from 25 to 75 days after planting led to higher yield than plots having weeds (Tawaha and Turk, 2001). When sorghum's weed was removed 30 days after planting, no reduction was observed in final yield of sorghum plant, in spite of reduction in plant growth due to the presence of weeds. That shows that in weed control condition on the 30th day of planting, in some cases the plant affected by weeds continues to have yield potential similar to that in non-weed condition (Ayeneh-Band, 2006).

MATERIALS AND METHODS

This experiment was conducted in field located on 13th km, Shushtar-Ahwaz Road, for one year in agricultural year of 2010-2011. This field with a height of 67 m above sea level and 32º 3′ north latitude and 48º 50′ east longitude is locate in the southwestern part of Iran. On the whole, all the south coastal lands of the country whose height is less than 100 meters have desert climate. Therefore, whole the plain of Khuzestan to the feet of Lodestones Mountains have the properties of this kind of climate. There is an intense warm all over this region (the absolute maximum temperature recorded for this region is 53º related to Ahwaz). Average rainfall in this region is low and at the same time irregular. All the rainfall almost happens in winter, and 7 months of the year lacks rainfall (kuchaki *et al.*, 1995).

This experiment used a complete randomized block density in a factorial-split arrangement with four repititions in which cultivar of faba bean was considered at three levels (Barakat, V1; Saraziri, V2; Mahalli, V3), density at three levels (7, 11, and 14 plants per square meter; D3, D2 and D1 respectively) and population of weed of %0, %50 and %100 R1, R2 and R3 respectively). For weed which was considered at three levels of %0, %50 and %100, R1, R2 and R3 respectively, at %0 level weeds were removed until the end of growth period. At % 50 levels, 50 percent of weeds were controlled. Their control was performed in the manner of removing them from between 1 and 2, 3 and 4, and 5 and 6 lines. From the time of growth of weeds fighting against them started and continued until the end of plant growth such that weeds on the one side of the hill were removed and weeds on the other side were not. In other words, weeds of one ditch were removed and weeds of the next one were not (weed control of every other ditch). At level R3, weeds existed until the end of growth period. Final harvest was performed at time of ripeness from line 4. The entire length of line (6m long) was harvested by using method after removing upper and downer 0/5-mere margins.

Obtained data were inserted into tables of spreadsheet of Excel after conclusion and classification. Raw data were variance analyzed by SAS statistical program, and means comparison was performed using Duncan test method. Diagrams were depicted by using Excel Software.

RESULTS AND DISCUSSION

Results

Vegetative Duration

Vegetative duration was very significantly affected by cultivar (table1) such that the longest vegetative duration with a mean of 65 days belonged to cultivar Barakat, whereas the shortest duration with a mean of 63.5 was observed for cultivar Saraziri. Moreover, this characteristic was very significantly influenced by plant density (table 1). As table of means comparison of main effects displays, the longest vegetative duration was obtained in condition of 14 plants per m2; in other words, in this experiment the highest studied density was gained with a mean of 65.5 days, whereas the shortest duration was observed in condition of 11 plants per m2 with a mean of 63 days. This trait was not affected by weeds (table 1). Interaction of cultivar and plant density: vegetative duration was statistically influenced by interaction of cultivar and plant density at %1 probability level (table 1). Figure (1) shows that the longest vegetative duration was obtained for cultivar Barakat in condition of the highest plant density, i.e. density of 14 plants per square meter; the shortest vegetative duration was obtained for cultivar Saraziri in condition of middle density, i.e. 11 plant per square meter. Cultivars exhibited various responses in different densities such that in density of 7 plants per m2 Mahalli mass displayed the longest vegetative duration; in density of 11 plants per square meter two cultivars Mahalli and Barakat and in density of 14 plants per square meter cultivar Barakat exhibited the longest vegetative duration. Interaction of cultivar and weed control: analysis of variance showed that vegetative duration was affected by interaction of cultivar and weed control at %5 probability level (table 1). Figure (2) indicates that the longest vegetative duration was obtained for cultivar Barakat in two conditions of %50 and %100 weed control; however, in condition in which weed was not controlled Mahalli mass exhibited the longest vegetative duration, which means Mahalli cultivar in condition of weed presence was more susceptible than the other two cultivars and which its phonological phases would be affected more in condition of competition with weeds. The shortest vegetative duration was observed for cultivar Saraziri in condition of not controlling weeds. Of course it should be mentioned that this cultivar exhibited the shortest vegetative duration at the other two levels of weed control than the other two cultivars.

Table 1: Analysis of variance (mean squares) Phonological characteristics

S. O. V	df	mean squares	
		Length of Vegetative Course	Generative Duration
R	3	0/8889 ns	0/0000
Cultivar	2	21/0000**	334/0358
Cultivar × R	6	0/8518	0/0000
Density	2	58/0000**	0/0000
weed control	2	6/3333*	0/0000
Density × Cultivar	4	25/5000**	0/0000
weed control × Cultivar	4	2/8333*	0/0000
weed control × Density	4	13/8333**	0/0000
Cultivar × Density × weed control	8	24/5833**	0/0000
Error	72	1/8086	0/0000
CV (%)	-	2/09	0/00

ns: non significant, ,** : respectively significant (p≤0.05) and highly significant (p≤0.01)*

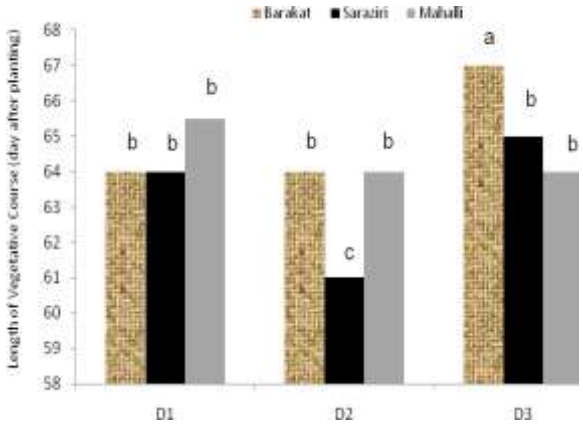

Figure 1: effect of density and Cultivar in Length of Vegetative Course

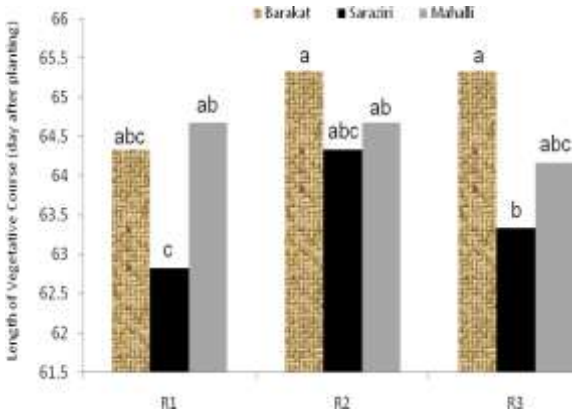

Figure 2: effect of weed control and Cultivar in Length of Vegetative Course

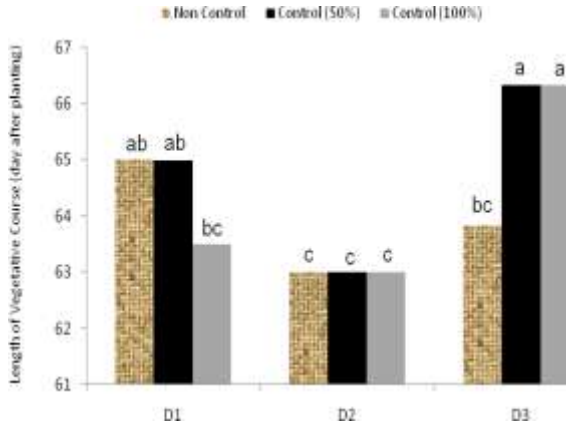

Figure 3: effect of weed control and density in Length of Vegetative Course

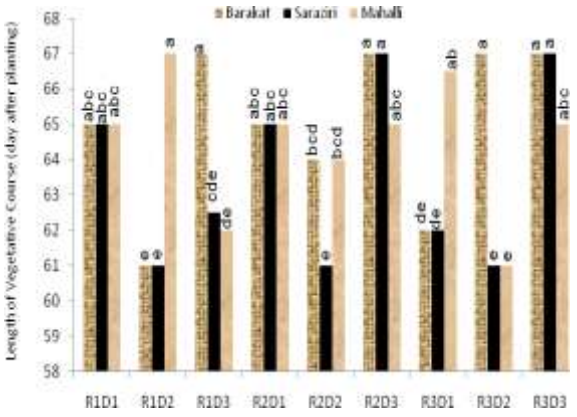

Figure 4: effect of weed control, density and Cultivar in Length of Vegetative Course

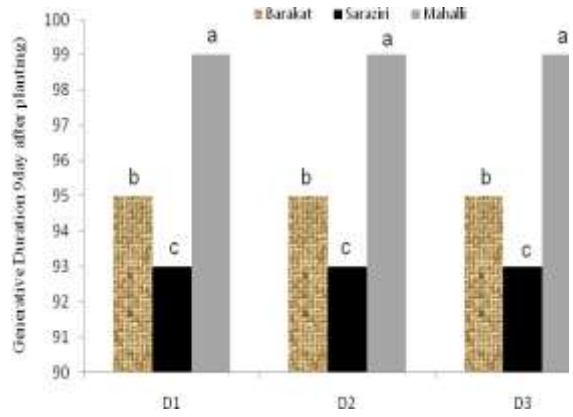

Figure 5: effect of density and Cultivar in Generative Duration

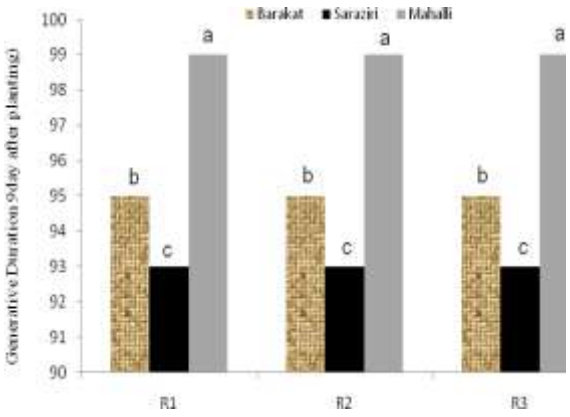

Figure 6: effect of weed control and Cultivar in Generative Duration

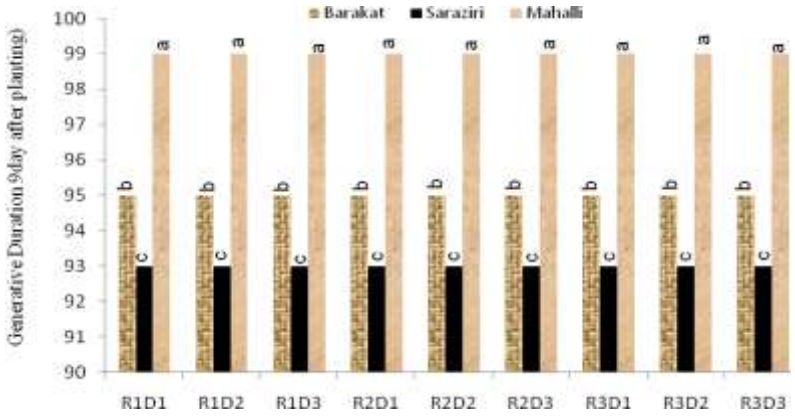

Figure 7: effect of weed control, density and Cultivar in Generative Duration

Interaction of plant density and weed control: the results indicated that vegetative duration was significantly affected by interaction of plant density and weed control (table 1). Figure (3) indicates that the longest vegetative duration was obtained in condition of the highest density, i.e. 14 plants per square meter, at two levels of %50 and % 100 weed controls. Interestingly, the shortest vegetative duration was observed for density of 11 plants per m2, and it was obtained equally at the three levels of weed control. Since shortness of vegetative duration leads generally to increase in generative duration, density of 11 plants per square meter seems to have been able to affect vegetative duration more than different levels of weed control. Triadic interaction of cultivar, plant density and weed control: vegetative duration was extremely significantly influenced by triadic interaction of cultivar, plant density and weed control (table 1). Figure (4) indicates that the three of cultivars had the same vegetative duration in condition of density of 7 plants per square meter at two levels of not controlling weeds and % 50 weed controls. Generally, cultivar Barakat had the longest vegetative duration in all conditions, except in condition of density of 7 plants per square meter at level of %100 weed control. Mahalli mass exhibited its shortest vegetative duration in density condition of 11 plants per square meter at level of %100 weed control, whereas its longest vegetative duration was observed in condition of 11 plants per square meter at level of not controlling weeds. Cultivar Saraziri like cultivar Barakat displayed its shortest vegetative duration in condition of density of 11 plants per m2 at level of %100 weed control; its longest vegetative duration occurred in condition of density of 14 plants per square meter at level of %50 weed control.

Generative Duration

The results obtained from analysis of variance indicated that generative duration was affected by cultivar and plant density; however. It was not affected by weed control (table 1). Means comparison of main effects showed the longest generative duration was obtained for Mahalli cultivar and the shortest duration was gained for Saraziri cultivar with means of 99 and 93 days respectively. Similarly, means comparison of main effects showed that out of different levels of plant density the longest generative duration was observed in the case of density of 14 plants per square meter with an average of 95.74. The results indicated that interaction of cultivar and plant density on generative duration was significant. Figure (5) shows that generative duration was noticeably longer for cultivar Mahalli at the three levels of density compared to the other two cultivars. Interaction of cultivar and weed control on generative duration was significant. As it is observed in figure (6), cultivar Mahalli exhibited a longer generative duration in comparison to the other two cultivars at the three treatment levels of weed control. The results from analysis of variance showed generative duration were not influenced by interaction of density and weed control; however, this trait was affected by triadic interaction of cultivar, plant density and weed control. Figure (7) indicates that cultivar Mahalli displayed a longer generative duration in all conditions of experiment, i.e. in different densities and at different levels of weed control.

Conclusion

The results showed all the studied phonological traits were influenced by cultivar and plant density. Also, vegetative duration and pod appearance was affected by weed control; however, germination percentage and generative duration were not influenced by different levels of weed control. In addition, phonological traits were under the influence of interaction. Cultivar Barakat held the highest germination percentage at all the three levels of weed control. In this way, this cultivar was statistically placed in the same group at two %0 and %50 levels of weed control; Mahalli mass had the lowest germination percentage at the three levels of weed control; however, germination percentage of this cultivar was higher at %100 level of weed control compared to the other two levels. That is to say that this cultivar had higher germination in non-weed condition; in other words, in condition of weed presence it was affected more in comparison to the other two cultivars and its germination percentage lowered. Aryan-Nia *et al.*, (2011) reported that cultivars had no effects on duration of germination, 6-leaf and 12-leaf, and that two cultivars had passed the same days to reach the desired phonological phases, whereas in studying two hybrids of corn, Hamidi and Dabbgh (2001) pointed out that there was a significant difference between hybrids Single cross 604 and 601. These differences can be associated with difference in plant size and type of plant or cultivar. In regard to the used in this study it can be said that the three cultivars were not structurally different.

REFERENCES

Agegnehu G and Fessehaie R (2006). Response of Faba Bean to Phosphate Fertilizer and Weed Control on Nitisols of Ethiopian Highlands. *The Italian Journal of Agronomy / Rivista di Agronomia* **1** 281-291.

Aryan-Nia N, **ENayat Gholi-Zadeh MR**, **Sharafi-Zadeh M and Mousavi SH (2012).** Response of yield and yield Components of Black-Eyed Pea to Plant Density and Planting Date in Safi-abad Region. *Scientific Research Journal of Agricultural Plants.* The special edition of 2012.

Aryannia N, Enayatgholizadeh MR and Sharafizadeh M (2011). Morphological characteristics affected by hybrid and plant density on Corn competition with natural weeds population. *Advances in Environmental Biology* **5**(11) 3444-3449.

Ayeneh-Band A (2006). To Study the Effect of Previous Plant Type and Weeding Time on Weed Communities in Forage Sorghum. *Scientific-Agricultural Journal of Ahwaz* **29**(3) 51-60.

Dwyer LM, Tollenar M and Stwart DW (1991). Changes in plant density dependence of leaf photosynthesis of maize (*Zea mays*) hybrids. *Canadian Journal of Plant Science* **71** 1-11.

EnayatGholizadeh MR, Gharineh MH, Bakhshandeh AM, Alami Saeid KH and Siadat SA (2013). Response of the seedling characters of New Hybrid seeds of corn in laboratory conditions using standard Germination Test. *Advances in Environmental Biology* **7**(1) 141-146, 2013.

Fernandez ON, Vignolio OR and Requsesns EC (2002). Competition betweencorn (Zea mays) and bermudagrass (*Cynodon dactylon*) in relation to the cropplant arrangement. *Agronomie* **22** 293-305.

Hamidi A and Dabagh Mohammadi Nasab A (2001). To Study the Effects of Plant Density and Different Levels of Nitrogen on Phonology of Two Medium-Maturity Corn Hybrids. *Iranian Journal of Agricultural Sciences* **32** 857-74.

Jahansooz MR, Naghavie MR and Tale,ie AR (2006). To Determine Relationships of Different Characteristics in Cultivars of Black- Eyed Pea. *Journal of Agricultural Sciences* **12**(1) 143-49.

James KT, Rahman A and Mellsop J (2000). Weed competition in maize crop under different timing for post – emergence weed control. New control. *New Zealand Plant Protect* **53** 269-272.

Khajeh-Pour MR (2008). *Principles and Basics of Agronomy* (Jahad Daneshgahi Publications Center of Industrial Branch of Isfahan) 412.

Kostov T and Pacanoski Z (2007). Weeds with major economic impact on agriculture in republic of Macedonia. *Pakistan Journal of Weed Science Research* **13**(3-4) 227-239.

Kuchaki A and Nasiri Mahallati M (1995). *Ecology of Agricultural Plants* (Jahad Daneshgahi Publications of Mashad) 378.

Mathews PW, Armstrong EL, Lisle CJ, Menz ID, Shephard PL and Armstrong BC (2008). The effect of faba bean plant population on yield, seed quality and plant architecture under irrigation in

southern NSW. *Proceeding of the 14th Australian Agronomy Conference, September, Adelaide South Australia.* Available: www.Agronomy.Org.au.

Mousavi SH, Siadat A, Moshtata A and Inayat Gholi-Zadeh MR (2010). The Effects of Distance between and on planting rows on Yield and Yield Components of Faba Bean in Ahwaz Region. *Scientific Research of Crop Improvement* **2**(4) 1-7.

Russell MP, Wilhelm WW, Olson RA and Power JF (1984). Growth analysis based on degree dry. *Crop Science* **14** 28-32.

Sharafizadeh M, Enayat Gholizadeh MR, Aryannia N and Razaz M (2012). Effect of planting date and planting pattern on quality and quantity yield of canola hybrid seed (Hayola 401). *Advances in Environmental Biology* **6**(7) 2184-2189.

Shirtlif SJ and Johnston AM (2002). Yield density relationships and optimum plant populations in two cultivars of solid-seeding dry bean grown in Saskatchewan. *Canadian Journal of Plant Science* **82** 521-529.

Tawaha AM and Turk MA (2001). Crop – weed competition studies in faba bean (*Vicia faba L.*)under rainfed conditions. *Acta Agronomica Hungarica* **49**(3) 299-303.

Ya,ghoubi SR, Pirdashti HA, Habibi Savad Kuhi HM and Ghadamyari S (2009). The effects of weed Control Rounds on Structure and Distribution of Leaf Surface in Different Layers of Plant Coverage of Corn. *Iranian Agriculture Journal* **11**(1) 15-24.