INTERNATIONAL JOURNAL OF PLANT, ANIMAL AND ENVIRONMENTAL SCIENCES
IJPAES
Volume-4, Issue-3, July-Sept-2014
ISSN 2231-4490

Coden : IJPAES www.ijpaes.com
Received: 30th March-2014 *Revised: 28th April-2014* *Accepted: 05th May-2014*
Research article

EFFECT OF CULTIVATION TIME AND WEED CONTROL ON WEED AND SOME CHARACTERISTICS OF BROAD BEAN (*VICIA FABA* L.)

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ABSTRACT: A field experiment was laid out in order to evaluate the effects of two cultivation time and six weed control methods on yield and some yield components of broad bean based on randomized complete block design with four replications. Results showed that lowest density and dry weight of weed obtained at night cultivation and application of Bentazon+once hand weeding treatments. Also, broad bean yield and some of it components was significantly higher in night cultivation and application of Bentazon+once hand weeding treatments.
Key words: Broad bean, Weed, control methods

INTRODUCTION

Broad bean (*Vicia faba L.*) has a long tradition of cultivation in old world agriculture, being among the most ancient plants in cultivation and also among the easiest to grow. This plant is very sensitive to weed competition. To avoid yield decrease, common bean crop should be kept weed-free 3 to 5 weeks after sowing [1 and 3]. Weed management is a critical component of any farming system. Some weed for example, Lambsquarter, Puncturevine and Broomrape are considered three of the most serious agricultural problem in Mediterranean countries and different parts of the world, causing severe damage to legume crops such as Broad bean, peas, lentils, vetch, grass peas and chickpea [9]. Management of Broomrape is difficult because of its close association with the host. Broomrapes are obligate holophrastic weed that cause severe damage to the most important vegetable and field crops in Mediterranean region and the Middle East. Annual food crop losses due to broomrape infestation amount to $ 1.3 to 2.6 billion. The lack of an effective way to control weed during the entire growing season for the crop Broad bean has led to the introduction of some herbicides. Suitable cultivation time may result in severe weed, insect and disease attack [16]. Mekky et al, [10] referred that suitable time sowing in faba bean decreased broomrape infestation by 92%, in association with increasing seed yield by 27.7%. Most success in controlling weed has been achieved with using herbicides. Application of herbicides two or three times at rate of 75 cm^3/fed gave 99.1 and 97.8% reduction of broomrape and increased seed yield by 149.5 and 141.5% as compared with the untreated plots in both of the seasons under investigation successively. Messiha et al, [11] reported that the post-emergence application of the low rate of herbicides substantially controlled broomrape parasitism in peas, by reducing the number, fresh and dry weight as compared with infected control. Therefore, this study was planned to evaluate the effects of cultivation time and weed control methods on control of some weed and evaluate of some yield components in Broad bean in Iran.

MATERIALS AND METHODS

This experiment was laid out in order to evaluation of effects of cultivation time (CT) and weed control methods(CM) treatments on control of some weed in Broad bean during the growing season of 2011–2012. Soil of the field experiment was loam (pH= 7.7) with organic matter content 0.57% , total P 8ppm, K 220ppm, N 0.04%, C 0.57%, Fe 5.2ppm, Mn 4ppm, Cu 0.68ppm and Zn 0.32ppm.

The experiment was a randomized complete block design with four replications. The experimental factors were cultivation time at day and night, weed control methods in six levels of (1)control (without weed control), (2)once hand weeding (H), (3)application of Treflan herbicide(T), (4)application of Bentazon herbicide(B), (5)application of Treflan + once hand weeding (H+T) and (6)application of Bentazon + once hand weeding (H+B). In each plot total weed in $1m^2$ were harvested, then individuation them in different families and species. Then dry matter of weed was determined. In maturity stage of Broad bean plant samples were taken with 15 plants from each plot and dry weight of pod, pod length and seed weight per pod determined. To determine of grain yield and pod harvest index plants were harvested from the middle of each plot. After that grain yield recorded on a dry weight basis. Yield was defined in terms of grams per square meter and quintals per hectare. The pod harvest index was calculated by the following equation:

HI = (grain yield / biomass yield of pods (seeds +pods weight) ×100

The data were subjected to analysis of variance using SAS (SAS Institute Inc., 2002).

RESULTS

Puncturevine: The effect of all treatments on number and dry weight of Puncturevine was significant (Table 1). The mean comparison of the number of Puncturevine showed that the highest (14.95 p/m^2) and lowest (12.83 p/m^2) number of Puncturevine were obtained by day and night cultivation respectively. Among the weed control methods treatments, there were the lowest (1.75 p/m^2) and highest (31.5 p/m^2) number of Puncturevine at application of Bentazon + once hand weeding (H+B) treatment and control treatment respectively (Table 2). Day cultivation treatment has the highest (17.70 g/m^2) Puncturevine dry weight and night cultivation treatment has the lowest Puncturevine dry weight (14.68 g/m^2) and the differences were significant (Table 2). Among the weed control methods treatments, the lowest Puncturevine dry weight (1.95 g/m^2) was belonged at application of Treflan + once hand weeding (H+B) treatment and the highest Puncturevine dry weight (42.53 g/m^2) was belonged at control treatment (Table 2).

Lambsquarter: The effect of all treatments on number and dry weight of Lambsquarter was significant (Table 1). The mean comparisons of the number of Lambsquarter showed that day cultivation treatment has the highest (4.5 p/m^2) number of Lambsquarter and night cultivation treatment has the lowest number of Lambsquarter (2.31 p/m^2) and the differences were significant (Table 2). Among the weed control methods treatments, the lowest number of Lambsquarter (0.71 p/m^2) was belonged at application of Bentazon + once hand weeding (H+B) treatment and the highest number of Lambsquarter (9.5 p/m^2) was belonged at control treatment (Table 2). The mean comparisons of the Lambsquarter dry weight showed that day cultivation treatment has the highest (5 g/m^2) Lambsquarter dry weight and night cultivation treatment has the lowest Lambsquarter dry weight (2.82 g/m^2) and the differences were significant (Table 2). Among the weed control methods treatments, the lowest Lambsquarter dry weight (0.56 g/m^2) was belonged at application of Bentazon + once hand weeding (H+B)treatment and the highest Lambsquarter dry weight (11.41 g/m^2) was belonged at control treatment (Table 2).

Table1. Analysis of variance (mean squares) for effects of time of cultivation and weed control methods on dry weight and number of different weed in Broad bean farm

		Lambsquarter		Puncturevine		Broomrape	
source	df	Dry weight	Number	Dry weight	Number	Dry weight	Number
R							
Time(T)	1	52.181**	62.531**	101.958**	88.187**	8.130**	5.896**
Ea	3	0.830	0.253	0.421	0.743	0.021	0.027
Control method (C)	5	99.943**	84.167**	1452.224**	1007.570**	5.783**	9.298**
T*C	5	8.395**	11.080**	16.505**	4.22*	2.861**	3.698**
Eb	30	0.554	0.322	2.55	2.02	0.017	0.011
CV		18.42	15.67	8.56	9.35	15.23	21.30

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

Broomrape: The effect of all treatments on number and dry weight of Broomrape was significant (Table 1). The mean comparisons of the number of Broomrape showed that day cultivation treatment has the highest (0.88 p/m^2) number of Broomrape and night cultivation treatment has the lowest number of Broomrape (0.25 p/m^2) and the differences were significant (Table 2).

Among the weed control methods treatments, the lowest number of Broomrape (0.0 p/m^2) was belonged at application of Bentazon + once hand weeding (H+B) and Treflan + once hand weeding (T+B) treatments and the highest number of Broomrape (2.62 p/m^2) was belonged at control treatment (Table 2). The mean comparisons of the Broomrape dry weight showed that day cultivation treatment has the highest (1.08 g/m^2) Broomrape dry weight and night cultivation treatment has the lowest Broomrape dry weight (0.31 g/m^2) and the differences were significant (Table 2). Among the weed control methods treatments, the lowest Broomrape dry weight (0.0 g/m^2) was belonged at application of Bentazon + once hand weeding (H+B) and Treflan + once hand weeding (T+B) treatments and the highest Broomrape dry weight (2.74 g/m^2) was belonged at control treatment (Table 2).

Broad bean treats

Plant height: The effect of control method treatment on plant height was significant and the other treatments were not significant on it (Table 1). The mean comparison of the plant height showed that, the highest plant height (80.93 cm) was belonged at application of Bentazon + once hand weeding (H+B) treatment and the lowest plant height (58.12 cm) was belonged at control treatment (Table 2).

Number of branch per plant: The effect of cultivation time and control method treatments on number of branches per plant were significant, but the effect of interaction between them on it was not significant (Table 1). The mean comparisons values of the number of branches per plant showed that night cultivation treatment has the highest (3.85) number of branches per plant and day treatment has the lowest number of branches per plant (3.14) and the differences were significant (Table 2). Among the weed control methods treatments, the highest number of branches per plant (4.42) was observed from application of Bentazon + once hand weeding (H+B) treatment and the lowest number of branches per plant (2.40) was belonged to control treatment (Table 2) and the differences were significant.

Table-2. Mean comparison for effects of time cultivation and weed control methods on dry weight and number of different weed in Broad bean farm.

Treatments	Lambsquarter		Puncturevine		Broomrape	
	Dry weight (g/m^2)	Number (p/m^2)	Dry weight (g/m^2)	Number (p/m^2)	Dry weight (g/m^2)	Number (p/m^2)
time						
day	5.00^a	4.50^a	17.70^a	14.95^a	1.08^a	0.88^a
night	2.82^b	2.31^b	14.68^b	12.83^b	0.31^b	0.25^b
Control method						
control	11.41^a	9.50^a	42.53^a	31.50^a	2.74^a	2.62^a
Once handing control (H)	3.54^c	3.62^b	13.89^c	14.25^c	0.15^c	0.12^{cd}
Treflan (T)	4.78^b	2.75^c	18.37^b	18.62^b	0.70^b	0.37^b
Bentazon (B)	1.91^d	2.25^c	17.66^b	15.37^c	0.57^b	0.29^{bc}
H+T	1.26^{de}	1.58^d	1.97^d	1.87^d	0.00^d	0.00^d
H+B	0.56^e	0.71^e	2.73^d	1.75^d	0.00^d	0.00^d

Means followed by the same letters in each column are statistically not significant different (Duncan's multiple range test, p≤0.05).

Table-3. Analysis of variance (mean squares) for effects of time of cultivation and weed control methods on some yield components of Broad bean

source	df	Plant height	Number of branch per plant	Number of pod per plant	Pod length	Pod dry weight	Grain yield
R							
Time(T)	1	365.093^{ns}	5.922*	83.529*	0.336^{ns}	83.925*	373041.99**
Ea	3	320.763	0.406	3.341	0.862	7.471	11522.05
Control method(C)	5	565.512**	3.595**	234.860**	0.329^{ns}	720.114**	5016177.74**
T*C	5	50.148^{ns}	0.1189^{ns}	4.821^{ns}	2.509^{ns}	2.349^{ns}	22127.71^{ns}
Eb	30	62.053	0.456	3.459	0.278	8.386	20855.08
CV		11.58	19.31	8.01	4.76	9.47	5.30

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

Nuumber of pod per plant: The effect of all treatments on number of pod per plant was significant excluding interaction between them (Table 3). The comparison of the mean values of the number of pod per plant showed that night cultivation treatment has the highest (24.51) number of pod per plant and day treatment has the lowest number of pod per plant (21.87) and the differences were significant (Table 4). Among the weed control methods treatments, the highest number of pod per plant (28.89) was belonged at application of Bentazon + once hand weeding control (H+B) treatment and the lowest number of pod per plant (13.08) was belonged at control treatment (Table 2).

Table-4. Mean comparisons for effects of time cultivation and weed control methods on some yield components of Broad bean

traitments	Plant height (cm)	Number of branch per plant	Number of pod per plant	Pod length (cm)	Pod dry weight (g)	Grain yield (kg/ha)
time						
day	70.77^{a}	3.14^{b}	21.87^{b}	10.97^{a}	29.25^{b}	2633.17^{b}
night	65.25^{a}	3.85^{a}	24.51^{a}	11.14^{a}	31.90^{a}	2809.48^{a}
Control method						
control	58.12^{d}	2.40^{c}	13.08^{e}	11.09^{a}	15.06^{e}	1274.72^{e}
Once handing control (H)	61.47^{cd}	3.56^{b}	23.82^{cd}	11.16^{a}	28.01^{d}	2626.29^{d}
Treflan (T)	67.27^{cb}	3.86^{ab}	25.18^{bc}	11.00^{a}	28.39^{cd}	2690.48^{d}
Bentazon (B)	74.40^{ab}	3.41^{b}	25.83^{b}	10.95^{a}	38.45^{b}	2915.76^{c}
H+T	65.88^{cd}	3.32^{b}	22.36^{d}	11.00^{a}	31.32^{c}	3260.12^{b}
H+B	80.93^{a}	4.42^{a}	28.89^{a}	11.16^{a}	42.22^{a}	3560.59^{a}

Means followed by the same letters in each column are statistically not significant different (Duncan's multiple range test, $p \leq 0.05$).

Pod length and Pod dry weight: All of treatments hadn't any effects on pod length significantly (Table 1). Although there were significant effect of cultivation time and control method treatments on pod dry weight, but the effect of interaction between them on it was not significant (Table 1). The mean comparisons of the pod dry weight showed that night cultivation treatment has the highest (31.9 g) pod dry weight and day has the lowest pod dry weight (21.25 g) and the differences were significant (Table 2). Among the weed control methods treatments, the highest pod dry weight (42.22 g) was belonged to application of Bentazon + once hand weeding (H+B)treatment and the lowest pod dry weight (15.06 g) was belonged to control treatment (Table 2).

Grain yield: The effects of time of cultivation and control method treatments on grain yield were significant, but the effect of interaction between them on grain yield was not significant (Table 3). The mean comparisons values of the grain yield showed that night cultivation treatment has the highest (2809.48kg/ha) grain yield and day treatment has the lowest grain yield (2633.17kg/ha) and the differences were significant (Table 4). Among the weed control methods treatments, the highest grain yield (3560.59kg/ha) was belonged at application of Bentazon + once handing weed control (H+B) treatment and the lowest grain yield (1274.72kg/ha) was belonged to control treatment (Table 4).

DISCUSSION

This study revealed that the chemical control of weed in Broad bean can be achieved by using the herbicide Treflan and Bentazon. These treatments with hand weeding treatment were adequately enough to govern the number of broomrape, lambsquarter and puncturevine in Broad bean fields. Similar findings were reported by [6 and 10]. The most effective was the mechanical-chemical method, which significantly reduced both the number of weed and their dry weight. This method is gaining in importance due to the promotion of integrated agriculture and efforts to restrict the use of chemicals [15]. This trend diminished over time, and in day cultivation, the total number of weed in the day treatments had caught up to those in the night treatments. However, in day cultivation treatment there were significantly more large weed in the day treatment than the night treatment, which supports the inference that there were early differences between the night and day treatments, at least for the cultivated plots. Slight reduction in weed may be possible by cultivating at night, though weed numbers would still necessitate post-emergence control measures. This study revealed that the chemical control of weed on Broad bean can be achieved by using the herbicide Bentazon and Treflan. Chemical treatments were adequately enough to govern the number of weed emerging in Broad bean fields, but application of herbicides with handing weed control has a better effects on weed control on this fields. EL-Metwally [4] indicated that the number and dry weight of broomrape were significantly affected by the different time of sowing. Spraying herbicide was very effective in controlling broomrape [4].

EL-Metwally [4] showed that, a decrease in number and dry weight of broomrape spikes was recorded as compared with unweedy control plots. There is a strong negative correlation between faba bean seed yield and the number of Orobanche infestation/m^2. Broad bean and its attributes were significantly affected by the different time of cultivation and weed control methods. The best results recorded for the different characters (including the plant height, number of branches per plant, number of pod per plant, pod length, pod dry weight and grain yield) were for cultivation at night. This verifies that Bentazon herbicide is more effective when applied at early growth stages that weed are more sensitive. Motley et al, [13] also concluded that growth stage greatly affects the efficiency of herbicide. Application of a suitable herbicide at the early growth stages controls weed efficiently and makes crop the winner of competition [14]. Broad bean yield was significantly higher in night cultivation condition. Analysis of data revealed that cultivation time and weed control treatment interaction significantly affected seed yield kg/ha. Maximum seed yield was obtained with cultivation at night with the application of Bentazon+once handing weed control (H+B) treatment. This explains the integrated role of both cultivation time of Broad bean and Bentazone herbicides in weed control. However, these results showed that application of Bentazon with once handing weed control method was very effective in controlling of weed, which lead to maximum grain yield.

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