Egypt. J. Agric. Res., 80 (2), 2002.

PERFORMANCE OF *OROBANCHE* CONTROL TREATMENTS IN FABA BEAN CROP

FAYED, M. T. B.[1], A. HAMDI[2],
SAMIA, A. MAHMOUD[2] AND M. SHAABAN[2]

1 Agronomy Dept, Faculty of Agric., Ain-Shams Univ.
2 Food Legume Res. Program, Field Crops Res. Institute, Agric. Res. Centre.

(Manuscript received Aug. 2001)

Abstract

Evaluation of ten treatments for the control of *Orobanche* of faba bean was made in two field experiments carried out at Sids Agricultural Research Station, Beni-Suef Governorate. The results indicate that the variety Giza 2 had the highest number of *Orobanche* plants (53.3 spikes/m^2). In contrast, late sowing, glyphosate application, integrated control, non- chemical integrated control and Giza 429 (*Orobanche* tolerant var.) had the lowest number of *Orobanche*, which ranged from 5.3 to 10.3 spikes/m^2. These five treatments showed areduction in number of *Orobanche*/m^2 relative to Giza 2, of 90, 81, 88, 87 and 87%, respectively. The results indicate also that non- chemical integrated control treatment gave the highest faba bean seed yield of 1046 kg/fed (6.8 ardab/fed) followed by integrated control treatment (995 kg/fed, i.e 6.4 ardab/fed) with no significant difference. Both treatments produced seed yield 50 and 48 times greater than Giza 2, respectively. Late sowing ranked as the third highest yield treatment with seed yield of 648 kg/fed (4.9 ardab/fed) that was 37 times the yield of Giza 2, while Giza 429 was the fourth highest yielding treatment. These treatments in general, and the two integrated control treatments in particular, had also the highest yield component characters.

INTRODUCTION

Faba bean (*Vicia faba* L.) is considered the most important food legume crop in Egypt. Broomrape (*Orobanche* sp.) is one of the main constraints to faba bean production, in Egypt, and several other regions in the world. Therefore, broomrape control is a major objective world wide.

Orobanche crenata infestation significantly decreases faba bean plant height, leaf number and branches number, plant internode number, number of leaves, flowers and green pods/plant, as well as root and shoot dry weight of faba bean plants. The parasite also reduces number of seeds and pods/plant and seeds/pod and causes significant yield reduction. The yield losses in infected faba bean were 5-33% in Egypt, 50-100% in Malta, 12-63% in Morocco, 5.4% in Spain and 30-70% in Turkey (Sauerborn and Saxena, 1986).

Broomrape control methods which include cultural (sowing date and soil flooding), physical (solarization) and chemical methods (glyphosate) as well as integrated control have been studied individually. High soil moisture content and /or waterlogging inhibited emergence of *Orobanche* seeds and reduced broomrape infestation. Keeping of *Orobanche* seeds in wet soil for more than 8 weeks before crop sowing, markedly decreased the infestation of faba bean (Pieterse and Verkleij, 1994). Delayed planting of faba bean from Nov. 28 to Dec. 19 reduced number of *Orobanche* shoots from 14.8 to $6.4/4m^2$ under rainfed conditions in north Syria (Kukula *et al.*, 1983). Nassib *et al.* (1985) observed lower *Orobanche* shoots/m^2 when faba bean sown early in Oct. 15, and its seed yield increased by 19.6% comparing with late sowing of Nov. 15.

Sauerborn and Saxena (1987) in Syria reported that soil solarization for 40 days led to 90% reduction of emerging *Orobanche crenata* spikes and caused 50% increase in yield of faba bean. Seed germination ability of *Orobanche cernua* seeds decreased gradually as the period of solarization increased, and it was completely lost by 7 days of solarization (Krishna-Murty *et al.*, 1994). On the other hand solar heating increased number and fresh and dry weights of root nodules in faba bean and other legumes (Fayed *et al.*, 1992).

Several researchers indicated that using glyphosate either at high rate (64 g a.i/ ha) or reduced rate (34 g a.i./ha) is the most effective method for controlling *Orobanche crenata* and increasing the dry weight of faba bean plants (Hussein *et al.*, 1994).

Several broomrape tolerant faba bean cultivars show a high level of tolerance to *Orobanche* and exceeded local checks in seed yield, such as Giza 402 (Nassib *et al.*, 1982), and Giza 429, Giza 674 and Giza 843 (Saber *et al.*, 1998). Using integrated packages to control *Orobanche,* which included *Orobanche* resistant cultivar Giza 402, no-tillage system, delayed sowing, high plant population density and fertilizers with or without glyphosate spray gave the best *Orobanche* control and high faba bean seed yield (Nassib *et al.*, 1985).

Therefore, the present study, evaluates single *Orobanche* control methods in faba bean in addition to testing the efficiency of using integrated control treatments. Faba bean yield losses due to *Orobanche* infection and yield gained by using the different control methods were also evaluated.

MATERIALS AND METHODS

Field practices and treatments

Two field experiments were carried out at Sids Agricultural Research Station, Beni-Suef governorate during two successive winter seasons of 1996/97 and 1997/98. Soil type in the experimental site was clayloam of medium fertility.

The following treatments were applied to control broomrape in faba bean: (T1) Flooding: soil was water flooded continuously for three weeks before planting, (T2) Soil solarization: plots were irrigated to stimulate the germination of weed seeds. One week later, these plots were completely covered with transparent polyethylene (0.2 mm thickness) for 6 weeks before faba bean planting, and irrigated at 3-4 weeks after mulching. The polyethylene sheets were removed at planting, (T3) Late planting: sowing was delayed for one month after planting of other treatments (planting date was on November 22 instead of October 22 in both seasons), (T4) Chemical broomrape control by using glyphosate herbicide (Round up) 36.4% liquid: N- phosphonomethyl glycine at the rate of 75 cm^3/feddan using CP_3 knapsac sprayer with 200 l water. Two sprays were applied at the beginning of flowering and two weeks after the first spray, (T5) Integrated control: a package including flooding, late sowing, a broomrape tolerant variety "Giza 674" (hybrid between Giza 402 and BPL 561), and one spray of glyphosate at 75cm/feddan with 200 l water at beginning of faba bean flowering. (T6) Non–chemical integrated control: same as T5 but without chemical control, (T7) Rhizobium inoculation: faba bean seeds were inoculated with rhizobium as recommended, (T8) planting the *Orobanche* tolerant cultivar Giza 674 (hybrid line between Giza 402 and BPL 561), (T9) planting the *Orobanche* tolerant cultivar Giza 429 (selection from the *Orobanche* tolerant old cultivar Giza 402), and (T10) Control treatment: using the conventional Giza 2 cultivar without any broomrape control treatment. The *Orobanche* susceptible variety Giza 2 was used in all treatments, except in T5, T6, T8 and T9.

The treatments were arranged in a randomized complete block design with four replications. Planting was on October 22 in both growing seasons, in 4m-long 60 cm wide ridges, on both sides of the ridge, with intra row spacing of 20cm and 30cm between rows (33 plants/m^2). Each plot consisted of 10 ridges (20 rows). Fertilizer at 30 kg P2O5/fed, and 15kg N/fed was added to the soil prior to planting in both seasons. An sowing irrigation was given immediately after planting; then five irrigations were applied monthly starting November 19 in both seasons.

Data recording

Broomrape spikes in the central 2m of the central 2 ridges (4 rows, 2.4m^2) in each plot were counted before harvesting the faba bean plants, and number of broomrape spikes/m^2 was determined. The following criteria were recorded on faba bean throughout the growing season: (1) seedling emergence (%) at 21 days after sowing, (2) plant height (cm) at the late vegetative growth stage (30 days after planting), during flowering stage (60 days after planting) and at harvest, (3), days to 50% flowering, (4) number of branches/plant, and (5) days to 90% maturity.

At harvest, faba bean plants in the central 2m of each of the central 8 rows (4.8 m^2) in each plot were harvested together and the remaining plants were discarded to avoid the border effects. Harvested faba bean plants were field dried and then thrashed. The following yield and yield components criteria were estimated on 10 individual plants selected at random from each plot: Number of pods/ plant, number of seeds/pod, number of seeds/plant, seed yield (g)/plant and 100-seed weight (g). Seed yield per plot was estimated and transformed to seed yield (kg.) per feddan.

Statistical analysis

The plot mean for each character was used for statistical analysis. Data for each season was statistically analyzed separately. Then the combined data of both seasons were analyzed together according to the procedures suggested by Gomez and Gomez (1984). Simple correlation for all studied characters were calculated according to Gomez and Gomez (1984).

RESULTS AND DISCUSSION

The individual statistical analysis of variance for each season showed significant differences among treatments for all characters, except for seedling emergence, number of branches/plant and number of seeds/pod in the second season. The combined analysis of variance of the two seasons indicated significant differences among treatments, for all characters except seedling emergence.

Effect of broomrape control treatment on number and dry weight of orobanche

Number of *Orobanche* spikes/m^2 Table (1) shows that seasonal and treatment effects as well as their interaction were highly significant. The overall means of number of *Orobanche* in 1996/97 and 1997/98 were 27.7 and 19.1, respectively, indicating high *Orobanche* infestation severity in the first experimental season than the second one. Variation of number of *Orobanche*/ m^2 between years was also reported by many researchers. The average number of *Orobanche*/ m^2 observed in the present study is considered enough to cause considerable damage to faba bean plants. In this respect, Lopez-Granados and Garica-Torres (1991) reported that the mean of infestation severity of *Orobanche crenata* in faba bean was 14 spikes/m^2.

The combined data (Table 1) show that, the check treatment (Giza 2) had significantly the highest number of *Orobanche*/ m^2 compared to other treatments except rhizobium inoculation treatment. The high number of *Orobanche*/ m^2 found in rhizobium inoculation reflected the relation between the presence of soil bacteria and *Orobanche* infection. Cezard (1973) stated that presence of bacteria is necessary for the germination of seeds of several *Orobanche* species. Rhizobium bacteria seem to be essential for *Orobanche* attack on faba bean. They may open the door for *Orobanche*.

Late planting (T3), glyphosate (T4), integrated control (T5), non-chemical integrated control (T6) and the tolerant Giza 429 cultivar showed the lowest mean number of *Orobanche*/ m^2 of 5.27, 10.32, 6.20, 7.09 and 7.09 spikes/m^2, respectively with no significant differences between them. The percentage reductions in number of *Orobanche*/ m^2 gained by the previous treatments over the susceptible check Giza 2 were 90, 80.7, 88.4, 86.7 and 86.7%, respectively, indicating their superiority to control *Or-*

obanche in faba bean.

The positive effect of late planting for *Orobanche* control may be attributed mainly to the stunting effect of low temperature on seed germination and establishment of *Orobanche* as reported by Kasasian (1973). He found that the lower and upper limit for *Orobanche* seed germination was about 8°C and 30°C, respectively, while the optimum was about 20°C or slightly higher. Seeds of *Orobanche crenata* always germinate one week before flowering of faba bean, and the release of the germination stimulant occurs just before and during flowering of faba bean (Zahran, 1982). In the present study, when faba bean was grown in normal planting date of October 20, flowering started about November 20. The average minimum temperature in November was 11.4 and 11.5°C in the first and the second season, respectively (Table 2). These temperatures were above the lower limit for *Orobanche* germination as indicated by Kasasian (1973). While, when planting was delayed to November 20, the flowering began on December 20, when the average minimum temperature was 7.5 and 6.8°C, in the first and the second season, respectively, and ranged from 3.5 to 7.0°C during the period from 17 to 25 December in 1997 (Table 2). Therefore, these low temperatures may negatively affect *Orobanche* germination and hence, reduce its infection on faba bean plants.

An alternative explanation to this fact is that root exudates, which stimulate germination of *Orobanche* seed, diffuse from the host roots into the soil, but their activity is restricted to a distance of 10mm. The distance which the procaulome can cover is limited to 3-4mm (Salle *et al.,* 1984). Hence, at a certain seed density the number of seedlings that may possibly attach the host root is determined by the extension of the root system. Therefore, low temperature may not only reduce the attack by decreasing the number of germinating *Orobanche*, but it may also affect the host, because the position and the growth of the root system is influenced.

The superior effect of late planting on *Orobanche* control obtained in the present study is in agreement with Kukula *et al.*(1983).

Effect of broomrape control treatments on growth of faba bean

Faba bean plants emerged very well in all treatments (Table 3). There were significant differences between treatments in plant height at all stages, (30, 60 days after planting and at harvesting). For example, late sowing gave the shortest plants at all stages compared with other treatments (Table 3). This effect may be due to the short growth season of faba bean in late planting. The results indicated also that plant height increased with reducing *Orobanche* infestation. The data of number of branches/plant (Table 3) show that faba bean plants of the following treatments: late planting, glyphosate, integrated control, non-chemical integrated control, Giza 674 and Giza 429 manifested the highest number of branches/plant. Meantime, these treatments attained also the most effective broomrape control values. These treatments also showed high plant height. Therefore, the results clearly indicate that the treatments which had less *Orobanche* infestation showed better growth patterns. These results are in agreement with previous work showing that *Orobanche* spikes compete with faba bean plants for water, nutrients, assimilates and other growth substances.

The overall average of days to 50% flowering was 42 (Table 3). The data of time to flowering show that late planting as in T3, T5 and T6 treatments delayed 50% flowering by 20 days for T3 comparing with Giza 2 and by 17.5 and 18.2 days for T5 and T6, respectively comparing with Giza 674. Regarding days to 90% maturity, the data in Table 3 show that the three treatments, late sowing (T3), integrated control (T5) and non-chemical integrated control (T6), which were sown late, matured at about 133 days. These treatments matured earlier than other treatments by about 20 days. That means they had shorter growing season than other treatments applied. Number of days from planting to 90% maturity for the remaining treatments ranged from 151.6 to 154.4 days. This narrow range of days to 90% maturity, suggestes that all applied treatments, except late sowing, had little effect on days to maturity. Similar results obtained in previous studies where delayed sowing, delayed the time to flower, but at the same time the period between bud formation and pod development was reduced. That means development was quicker when sowing had been delayed.

Effect of broomrape control treatments on faba bean yield and yield components

The results of number of pods/plant show that Giza 2 gave the lowest pods/ plant of 3.67 followed by soil flooding (Table 4). Non chemical integrated control along with Giza 429 and integrated control treatments gave the highest number of pods/ plant. The data of number of seeds/plant, indicated similar trend to number of pods/ plant. Soil flooding, late planting and glyphosate significantly increased number of seeds/pod than the control (Giza 2). Meanwhile, seeds/pod was not significantly affected by each of integrated control (T5) and non-chemical integrated control (T6) treatments comparing with Giza 674.

Data indicated that Giza 2 had the lowest 100-seed weight value (51.63 g/100 seeds). Other treatments had various values of 100-seed weight. (80.4 g for non-chemical integrated control to 68.0 g for soil flooding). However, the treatments T6, T5, T9, T8, T3 and T4 also had the highest 100-seed weight values, followed by rhizobium inoculation. Seed yield/plant was significantly affected by *Orobanche* infestation. Seed yield/plant of all applied *Orobanche* control treatments exceeded seed yield/plant of Giza 2 with different extents (Table 4). Non-chemical integrated control along with integrated control attained the highest values of seed yield/plant and exceeded Giza 674 by 36.4 and 24.6%, respectively. In contrast, these two treatments exceeded seed yied/plant of Giza 2 by 300 and 280%.

Tabulated data (Table 4) show that the maximum seed yield in this investigation was obtained from the two integrated *Orobanche* control treatments (T5 and T6) with no significant difference between them. Both treatments dramatically increased seed yield to reach 50 and 48 times the yield of Giza 2, respectively. These two treatments had also high yield components, as number of pods/plant, number of seeds/plant, and 100-seed weight as indicated above. Also, both treatments had low *Orobanche* infection as indicated by low number of *Orobanche*/ m^2 as shown in Fig. (1).

Moreover, the superiority of T5 and T6 in seed yield was due to that these treatments combined the successfull agronomic practices such as late sowing, glyphosate spray and soil flooding with using the tolerant variety Giza 674. When each of these practices were applied individually, they gave considerable increase in seed yield over

Giza 2. Therefore when all these practices are combined together as a package, they maximized yield increase, and gave the greatest seed yields as indicated.

On the other hand, Giza 2 cultivar achieved the lowest value of seed yield. This conspicuous reduction was mainly attributed to the severe infestation of the broomrape parasite which widthdraws water, carbohydrates and nutrients from the host. Therefore, the heavier the broomrape infestation, the greater the decline befell in faba bean seed yield as shown in Fig. (1).

Correlation between faba bean seed yield and some of the studied characters

Data in Table 5 reveal that seed yield (kg/fed) showed a strong negative correlation with number of *Orobanche*/ m^2 (r= -0.689**) as confirmed by Zaitoun *et al.*, (1991). Seed yield was positively correlated with the growth characters of faba bean. These results confirm the results obtained above, as the treatments which had low *Orobanche* infestation had good growth patterns and hence showed high seed yield. The correlation between seed yield and each of days to flowering (*r* = 0.789**) and maturity (*r* =-0.634**) were highly significant and high in magnitude. These relationships confirm the results that the highest yielding treatments; late sowing, integrated control and non-chemical integrated control, which sown late, flowered later and matured earlier than other treatments as shown before. Seed yield was correlated positively and significantly with all yield component characters, i.e. number of pods (*r* = 0.587**), and seeds/plant (*r* = 0.647**), number of seeds/pod (*r* = 0.264*), 100-seed weight (*r* = 0.604**) and seed yield/plant (*r* = 0.565**), indicating that increasing seed yield was due to the increase of all yield components.

Table 1. Effect of *Orobanche* control treatments on number of *Orobanche*/ m^2 in 1996/97 and 1997/98 seasons and their combined analysis.

No.	*Orobanche* control treatment	No. of *Orobanche*/ m^2		
		96/97	97/98	Comb.
1	Soil flooding	54.38	29.07	41.73
2	Soil solarization	34.90	27.29	31.10
3	Late planting	5.42	5.11	5.27
4	Glyphosate herbicide	8.75	11.88	10.32
5	Integrated control	1.46	10.94	6.20
6	Non chemical integrated control	5.73	8.44	7.09
7	Rhizobium	67.51	26.77	47.14
8	Giza 674 (tolerant)	23.44	25.94	24.69
9	Giza 429 (tolerant)	4.27	9.90	7.09
10	Giza 2 (control)	71.05	35.63	53.34
	Average	27.69	19.10	23.40
L.S.D.5%:	Treatment	13.623	8.896	7.946
	Treatment x season			11.23s7

Table 2. Monthly average maximum and minimum air temperature during August – July in 1996-97 and 1997- 98 seasons.

Month	1996/1997		1997/1998	
	Max.	Min.	Max.	Min.
August	36.5	20.2	34.6	20.2
September	34.3	18.3	32.5	18.4
October	31.7	15.7	31.3	15.4
November	26.7	11.5	25.5	11.4
December	22.1	7.5	19.6	6.8
January	16.6	4.0	19.1	5.5
February	17.0	3.9	20.4	7.5
March	20.1	6.0	21.5	7.2
April	24.4	9.8	30.0	12.3
May	32.0	14.8	34.0	17.1
June	34.5	18.6	35.7	19.4
July	35.8	20.9	37.3	20.7

Source: Bulletin of Meteorological data, 1996-1998, Ministry of Agriculture

Table 3. Effect of *Orobanche* control treatments on faba bean seedling emergence, plant height at 30 and 60 days after planting and at harvest, no. of branches/ plant and days from planting to 50% flowering and to 90% maturity (combined analysis of 1996/97 and 1997/98 seasons).

No.	*Orobanche* control treatment	Seedling emergence	Plant height (cm) at 30 days	Plant height (cm) at 60 days	Plant height (cm) at harvest	No.of branches /plant	Days from planting to 50% flowering	Days from planting to 90% maturity
1	Soil flooding	97.7	24.2	75.9	100.7	2.44	35.00	153.38
2	Soil solarization	97.9	24.8	78.2	95.5	2.94	34.25	154.38
3	Late planting	98.5	17.7	53.3	95.1	3.12	56.38	133.38
4	Glyphosate herbicide	98.6	23.0	72.3	107.0	3.17	36.63	153.63
5	Integrated control	98.3	19.2	60.8	107.2	3.68	57.25	133.63
6	Non chemical integrated control	98.9	20.0	61.9	112.5	3.37	58.00	133.00
7	Rhizobium	97.7	24.3	70.7	98.6	2.79	37.00	151.63
8	Giza 674 (tolerant)	98.1	26.3	89.3	139.7	3.43	39.75	153.88
9	Giza 429 (tolerant)	99.0	25.4	95.5	133.9	3.63	41.38	154.00
10	Giza 2 (control)	98.5	23.4	77.8	90.1	2.47	36.38	152.63
	Average	98.32	22.83	73.57	108.03	3.10	43.20	147.35
L.S.D.5%:	Treatment	N.S	1.239	5.455	6.052	0.472	1.470	0.747
	Treatment x season	2.043	1.752	7.714	8.559	N.S	2.075	N.S

Table 4. Effect of *Orobanche* control treatments on no. of pods/plant, no. of seeds/plant, no. of seeds/pod, 100-seed/weight, seed yield/plant and seed yield (kg/fed) for faba bean (combined analysis of 1996/97 and 1997/98 seasons).

No.	*Orobanche control treatment*	No. of pods/plant	No. of seeds/plant	No. of seeds/pod	100-seed /weight (g)	Seed yield/plant (g)	Seed yield (kg/fed)
1	Soil flooding	3.96	11.71	2.91	68.00	6.94	118.81
2	Soil solarization	5.49	14.28	2.63	68.75	11.03	235.45
3	Late planting	6.67	19.68	2.98	74.75	13.37	764.77
4	Glyphosate herbicide	6.13	17.75	2.91	74.13	12.88	634.19
5	Integrated control	7.13	20.65	2.90	77.25	14.82	994.95
6	Non chemical integrated control	7.92	22.53	2.86	80.38	16.22	1045.4
7	Rhizobium	6.44	15.54	2.47	71.75	11.68	139.97
8	Giza 674 (tolerant)	6.79	19.08	2.83	76.75	11.89	411.22
9	Giza 429 (tolerant)	7.42	19.76	2.67	77.25	12.90	681.38
10	Giza 2 (control)	3.67	8.34	2.31	51.63	5.24	20.62
Average		6.16	16.93	2.75	72.06	11.70	504.68
L.S.D.5%: Treatment		0.878	2.688	0.385	2.351	3.383	92.979
Treatment x season		1.242	3.802	0.545	3.324	3.370	131.492

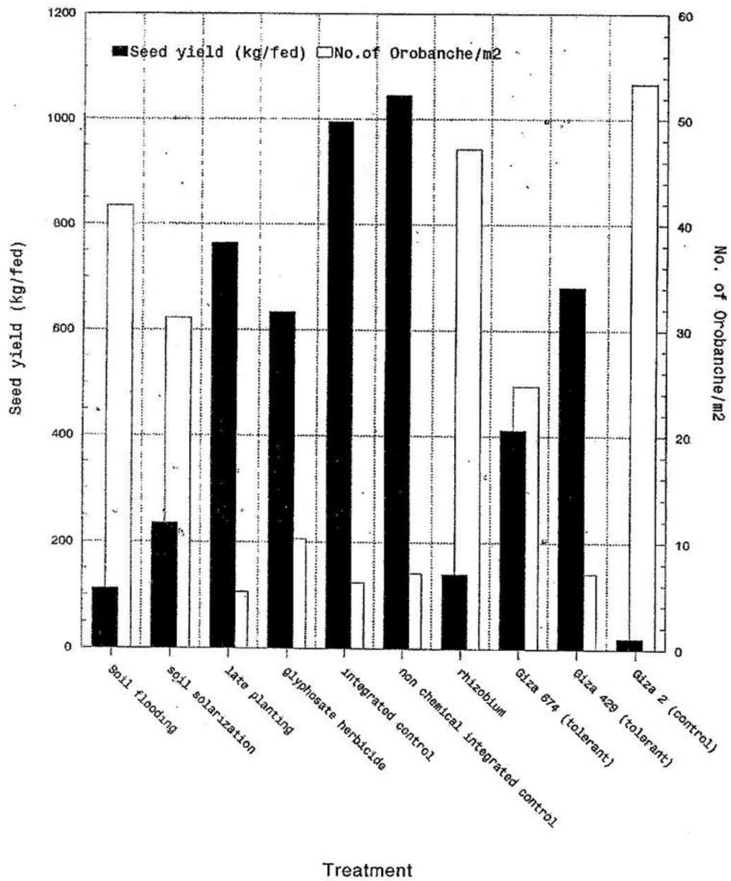
Table 5. Correlation coefficient ($r^{\dagger}$) values between seed yield (kg/fed) and some studied characters in faba bean.

Character	*r*
Number of *Orobanche* /m^2	-0.689**
Plant height at harvest	0.343**
Number of branches/plant	0.582**
Days from planting to 50 flowering	0.789**
Days from planting to 90 maturity	-0.634**
Number of pods/plant	0.587**
Number of seeds/plant	0.647**
Number of seeds/pod	0.264*
100-seed weight	0.604**
Seed yield/plant (g)	0.565**

*,** Significant at 0.05 and 0.01 probability levels, respectively.

† df = 78

Figure 1. Seed yield (kg/fed.) and number of Orobanche stems/m2 as affected by applied control treatments.



REFERENCES

1. Cezard, P. 1973. Quelques aspects particuliers de la biologie des orobanches. Proceeding of Workshop of Biology and Control of *Orobanche.* Parasitic Weeds Research Group Wageningen, The Netherlands: 55-67.

2. Fayed, M. T.; S. M. El-Nagar. and H. Fawzy. 1992. Performance of several weed control programs in peanut (*Arachis hypogaea* L.). II- Weed density, growth and nodulation of peanut plants. Proc. 5th Conf. Agron., Zagazig Univ., 2: 1061-1071.

3. Gomez, K. A. and A. A. Gomez. 1984. Statistical Procedures for Agricultural Research. 2nd Ed., USA, John Wiley and Sons, NewYork.

4. Hussein, A. H. A.; M. A. El-Deeb.; M. M. El-Morsy and S. R. Saleib. 1994. Performance of some chemical herbicides in controlling *Orobanche* in faba bean fields. J. Agric. Sci. Mansoura Univ., 19(2): 439-445.

5. Kasasian, L. 1973. Miscellaneous observation on the biology of *Orobanche crenata* and *Orobanche aegyptiaca.* Proceeding 1st Symposium on Parasitic Weeds. The European Weed Research Council, Parasitic Weeds Research Group, Wagningen, The Netherlands: 68-75.

6. Krishna-Murty, G. V. G.; C. A. Raju and G. V. G. K. Murty. 1994. Effect of Solarization on the germinability of broomrape seeds (microplot study). Proceeding of the 3rd International Workshop on *Orobanche* and Related *Striga* Research. Royal Tropical Institute. Amsterdam, The Netherlands: 493-495.

7. Kukula, S.; A. Haddad and H. Masri. 1983. Weed control in lentils, faba bean and chickpeas. Proceeding of the International Workshop on Faba bean, Kabuli Chickpeas, and Lentils in the 1980s, ICARDA, Aleppo, Syria: 169-177.

8. Lopez-Granados, F., and L. Garcia-Torres. 1991. Eight years study on population evaluation of *Orobanche crenata* in *Vicia faba* L. Proceeding of the International Symposium of Parasitic Weeds. Nairobi, Kenya: 352-355.

9. Nassib, A. A.; A. A. Ibrahim and S. A. Khalil. 1982. Breeding for resistance to *Orobanche*. Faba bean Improvement. Matinus Nijhaff publishers, The Hague, The Netherlands: 199-206.

10. Nassib, A. M.; A. H. A. Hussein and F. M. El-Rayes. 1985. Effect of variety, chemical control, sowing date and tillage on *Orobanche* spp. infestation and faba bean yield. The 10th International Cong. for Statistical Computer Sci., Social and Demographic Res., Ain Shams Univ., Cairo, Egypt: 247-263.

11. Pieterse, A. H. and J. A. C. Verkleij. 1994. Germination ecology of *Striga* and *Orobanche* an overview. Proceedings of the 3rd international Workshop on *Orobanche* and Related *Striga* Research. Royal Tropical Institute, Amsterdam, The Netherlands: 36-48.

12. Saber, H. A.; M. M. El-hady.; M. A. Omar.; Samia. A. Mahmoud; M. A. El-Deeb and M. M. Radi. 1998. A new Egyptian source for *Orobanche* resistance in faba bean. The 4th International Workshop on *Orobanche*. Institute for Wheat and Sunflower, Dobroudja, Bulgaria: 287-290.

13. Salle, G.; M. Aber and S. Lecoz. 1984. Comparative histo-physiological study of the germination and establishment of three major parasites: *Viscum, Orobanche* and *Cuscuta*. Proceeding 3rd International Symposium of Parasitic Weeds, Aleppo, Syria, ICARDA Aleppo, Syria: 10-21.

14. Sauerborn, J. and M. C. Saxena. 1986. A review on agronomy in relation to *Orobanche* problems in faba bean (*Vicia faba* L.). Proceeding of a Workshop on Biology and Control of *Orobanche*. Lh/vpo. Wageningen, the Netherlands: 160-165.

15. Sauerborn, J. and M. C. Saxena. 1987. Effect of soil solarization on *Orobanche* spp. Infestation and other pests in faba bean and lentil. Proceeding of the 4th International Symposium on Parasitic Flowering Plants. Philipps Univ., Marburg Germany: 733-744.

16. Zahran, M. K.. 1982. Weed and *Orobanche* control in Egypt. Faba Bean Improvement Martinus Nijhoff publishers. The Hague. The Netherlands: 191-198.

17. Zaitoun, F. M. F.; O. A. Al-Menoufi and H. C. Weber. 1991. Susceptibility of five varieties of *Vicia faba* to infection with *Orobanche crenata*. Proceedings of the 5th International Symposium of Parasitic Weeds. Nairobi Kenya: 208-216.

سلوك معاملات مكافحة الهالوك في محصول الفول البلدي

محمد طاهر بهجت فايد[١]، أحمد حمدي[٢]، سامية محمود[٢]، محمد شعبان[٢]

١ *قسم المحاصيل – كلية الزراعة – جامعة عين شمس.*
٢ *برنامج المحاصيل البقولية – معهد المحاصيل – مركز البحوث الزراعية.*

أجريت تجربتان حقليتان بمحطة البحوث الزراعية بسدس بمحافظة بني سويف خلال موسمي (١٩٩٦/٩٧، ١٩٩٧/٩٨) لتقييم ١٠ معاملات لمكافحة الهالوك في محصول الفول البلدي وقد أشارت النتائج أن أعلى عدد للهالوك كان ٥٣,٣ شمراخ/م٢ فى معاملة المقارنة التى يمثلها الصنف جيزة ٢ الحساس للهالوك، بينما معاملات المكافحة: تأخير ميعاد الزراعة، الرش بالجليفوسيت، المكافحة المتكاملة الكيميائية، المكافحة المتكاملة غير الكيميائية وزراعة الصنف المتحمل جيزة ٤٢٩ أعطت أقل عدد من شماريخ الهالوك تراوح من ٥,٣ إلى ١٠,٣ شمراخ/م٢ . وقد أظهرت هذه المعاملات الخمس تفوقا كبيرا فى النسبة المئوية لخفض عدد نباتات الهالوك فى المتر المربع حيث بلغت على الترتيب مقارنة بصنف المقارنة جيزة ٢ ٨١،٩٠، ٨٨، ٨٧، ٨٧٪

وتشير النتائج أيضا إلى أن معاملة المكافحة المتكاملة غير الكيميائية أعطت ١٠٤٦ كجم/فدان (٦,٨ أردب/فدان) مقارنة بمعاملة المكافحة المتكاملة الكيميائية التى حققت محصولا قدره ٩٩٥ جم/فدان (٦,٤ اردب/فدان) بدون فروق معنوية بين المعاملتين، وتفوقت كلا المعاملتين على جيزة ٢ في المحصول بحوالي ٥٠-٤٨ ضعفا، أما معاملة تأخير ميعاد الزراعة فجاءت فى المرتبة الثالثة في المحصول إذ حققت ٦٤٨ كجم/فدان (٤,٩ أردب /فدان) متفوقة بذلك على جيزة ٢ بمقدار ٣٧ ضعفا، بينما جاءت معاملة الصنف جيزة ٤٢٩ فى المرتبة الرابعة في المحصول، ولذلك تعتبر تلك المعاملات بصفة عامة ومعاملتي المكافحة المتكاملة بصفة خاصة أفضل المعاملات في مكافحة الهالوك وفى انتاجية المحصول ومكوناته.