Bull. Fac .Agric., Cairo Univ. 64:369-378. (2013).

INTEGRATION BETWEEN NITROGEN, MANURE FERTILIZERS, CULTURAL PRACTICES AND GLYPHOSATE ON BROOMRAPE (*Orobanche crenata* **Forsk) CONTROL IN FABA BEANS (***Vicia faba* L.).

(Received: 12.12.2013)

By
A.E.A. Ismail

Weed Research Central Laboratory, Agriculture Research Center, Giza, Egypt.

ABSTRACT

In Upper Egypt, the level of broomrape infestation is so high because of high temperature, which led to a decline of faba beans cultivated area. The control of this parasite is very difficult because no measures is adequate by itself for controlling *Orobanche*. Furthermore due to many reasons as the late attachment to the host make the use of pre-emergence herbicides not effectiive. In addition, the limited selectivity with post-emergence herbicides. For this reason, two field experiments were conducted in a heavly broomrape infested soil in Shandaweel Research Station, Sohag Governorate, Agricultural Research Center during 2011/12 and 2012/13 winter seasons to study the potential integration between N and manure fertilizers, trap crops, hand pulling and selective herbicides on broomrape development and yield of faba beans. Each experiment consisted of 54 treatments included three levels of N- fertilizer (0, 10 and 20 kg N/ fad.), three manure levels (0, 10 and 20 m^3/ fed.) and six broomrape control treatments (Glyphosate, Glyphosate follwed by one hand pulling, faba beans-fenugreek, fenugreek plus hand pulling, hand pulling twice and untreated check). Split split plot design in three replications was used. The results revealed that adding 10 and 20 kg N/fad. reduced *Orobanche* infestation by 22.3 and 43.9 %, while improved seed yield by 14.9 and 13.1 %, respectively, compared to unfertilized plots. Organic manure improved seed yield by 1.5 and 4.2 %, respectively, compared to without manure treatment. Application of glyphosate alone or with hand pulling gave higher reduction in the number and weight of broomrape by 97.1, 97.1, 97.0, and 97.3 %, respectively, as compared with untreated check, and improved seed yield by 75.6 and 72.1 %, respectively. Both *Orobanche* hand pulling and fenugreek intercropping followed by one hand pulling contributed 72.6 and 53.2 %, respectively. For *Orobanche* infestation and improving faba bean seed yield by 34.7 and 57.9 %, respectively. These results suggest that it is possible to use a suitable cultural orobanche control package. This regime consists of N- fertilizer complement with fenugreek can be considered as a non chemical package orobanche control and environment friendly. We can advice faba bean farmers to adopt this orobanche control package. Faba beans seed yield ardab/fed. was negatively and significantly correlated with the number and weight of broomrape spike/m^2 and positively and significantly correlated with most traits of yield the in combined analysis.

Key words: *cultural practices ,faba bean, glyphosate, manure fertilizers , nitrogen fertilizers, Orobanche crenata Forsk.*

1. INTRODUCTION

Broomrape (*Orobanche crenata*) is a holoparasite plant which threatens seriously faba beans production in the world. In the Nile valley, Egypt, faba bean fields are often infested with *Orobanche* spp. In Middle and Upper Egypt, the level of infestation is so high that there have been a complete crop failure (Telaye and Saxena 1986). The yield losses due to *Orobanche* infestation is proportional according to the level of infestation which could reach up to 90-100% (Anonymous, 1994), Saxena *et al*. (1994) by 5-100%. The control of this parasitic weed is very difficult because no measure is adequate by itself for controlling *Orobanche*. Further, due to many reasons such as the late attachment to the host, the use of pre-emergence herbicides is not suitable sides, limited selectivity with post-emergence herbicides in faba beans. Their early in site detection for efficient control is crucial but difficult, because of their sub-surface development. Thus, attempt to integrate weed management between agricultural methods (fertilizers, intercropping), hand pulling, trap crop and selected herbicides is highly needed.

Many researchers found that the use of

manure and N-fertilizers can play an important role in reducing the level of broomrape infestation. Other researchers report that the high nitrogen application reduced the development of Egyptian broomrape and crenate broomrape (Kasasian, 1973). Low fertility is considered an important factor associated with severe infestation of fields by broomrape (Gharib, 1973). Farmers in Jordan have commonly observed that the addition of manure to the soil can reduce the infestation of broomrape in their fields (Abu-Irmaileh 1979). Similarly, nitrogen reduced *0. crenata* infestation on faba beans (Kukula and Masri, 1984). In field experiments, they reported that 40 kg/ha ammonium nitrate were able to reduce the number of emerged Orobanche shoots and increased the yield of faba beans. Van Hezewijk *et al*. (1991) demonstrated significant reductions of *0 . crenata* Forsk in faba bean following the applications of ammonium sulfate equivalent to 14 and 28 kg N/ha. Pieterse (1991) reported that nitrogenous fertilizers reduced crenate broomrape seed germination and radical length of the germinated seedlings. High soil nitrogen fertility has been suggested to reduce the severity of crop damage caused by broomrape (Demirkan and Nemli, 1994 and Van Hezewijk *et al*., 1991).

The effects of N from different sources had different inhibitory effects. Experiments on the direct effects of nitrogen on broomrape seeds strongly implicate the reduced forms of nitrogen such as urea, ammonium sulfate (Jain and Foy 1992; Pieterse 1996), and ammonium nitrate (Abu-Irmaileh 1994; Nandula *et al*.,1996). Urea and ammonium sulfate were shown to decrease the percent ago of seed germination and radical elongation of crenate broomrape when applied during pre-conditioning and germination (Pieterse 1991).

On the other hand, the use of trap crops cause germination of broomrape seeds without themselves being attacked (Musselman 1980). Trap crops offer the advantage of stimulating broomrape germination without being parasitized as flax, fenugreek and Egyptian clover (Al-Menoufi 1991). Megahed (1988) and Al-Menoufi (1991) reported that intercropping fenugreek with faba beans significantly reduced the percentage of *O. crenata* parasitizing faba beans with a noticeable increase in faba beans production. Some Egyptian farmers, in some locations, used to cultivate fenugreek, turnip and/ or coriander in the faba bean fields to reduce the emergence of broomrape in their fields. Intercropping faba beans with fenugreek gave interesting results. It increased small- seeded faba bean yield by 49% compared to a highly infested check with *Orobanche foetida* (Kharrat and Halila, 1999). Bakheit *et al*. (2001) revealed that intercropping faba bean with each of lupin, fenugreek and Egyptian clover reduced the *Orobanche crenata* Forsk infestation of faba bean and increased the seed yield.

Many researchers as Al-Marsafy *et al.* (2000 & 2001) studied the feasibility of hand pulling as alternative or complement with glyphosate. This method can only be recommended for low Orobanche infestations to prevent further increases of the parasite populations and seed bank. The next best treatments were the application of glyphosate twice and/or *Orobanche* hand-pulling twice 30 and 110 days after sowing. These respective treatments increased faba bean seed yield by 416, 372 and 312% compared to the untreated check.

Herbicides are the most important of the available methods for *Orobanche* spp. control. Shaban *et al.* (1986), in Egypt, studied the effect of different doses of glyphosate (0.82 and 122 a.i.g /ha) on broomrape in faba beans. They noticed that plant height and the number of pod/ plant decreased, while the number of branches/plant increased with increasing the dose of glyphosate. Glyphosate gave a good control of *Orobanche* with 2 sprays at 15 day intervals, starting at attachment or budding stages, with 60 to 70 g a.i./ha. (Kharrat and Halila 1996). Glyphosate at the rate of 178.7cc/ha. applied twice controlled more than 96 % of broomrape and increased seeds and straw yield by 103 and 68 %, respectively (Hassanein and Kholosy , 1997).

This study aimed to estimate the magnitude of contribution of the use of mineral and manure fertilizers, trap crops, hand pulling and selective herbicides alone or as in integration with each other for controlling broomrape, and increased yield and its components in faba beans.

2. MATERIALS AND METHODS

Two field experiments were conducted at Shandaweel Research Station, Sohag Governorate during 20011/12 and 2012/13 winter seasons to study the effect of nitrogen and organic manure fertilizers and Orobanche control in faba beans crop in naturally infested soil with Orobanche. Soil texture of the experimental plots in both seasons was sandy loam.

Each experiment included thirty six treatments which were combinations of three N rates, three manure treatments and six *Orobanche* control treatments in a split split plot design in three replications as follows:

Table (1): Chemical analysis of the soil used.

Chemical analysis / Seasons	Soil texture	O. M	pH	$CaCo_3$	Available nitrate		
					N	P	K
2011/12 season	Sandy loam	0.6	7.9	7.50	14	18	12
2012/13 season		0.8	7.7	7.55	13	17	13

Table (2): Chemical analysis of farm yard manure (FYM) applied in the trait.

Component	Organic matter %	pH	Total nitrogen %	Organic carbon %	C/N ratio	P %	K %
Fertilizer of (FYM)	20.02	7.7	0.49	11.61	23.69	0.24	1.10

2.1. Main plots (N- fertilization)

2.1.1. None (0.0) fertilization (untreated check)

2.1.2. 10.0 kg N/ fed..

2.1.3. 20.0 kg N/ fed..

Mineral nitrogen was applied as ammonium sulphate (33.5 % N) at the rate of 10 and 20 kg N/fad. before the first and second irrigations.

2.2. Sub plots organic fertilization **(**Manure**) :**

2.2.1. None (0.0) manure fertilization (untreated check).

2.2.2. 10.0 m^3 / fed..

2.2.3. 20.0 m^3 / fed..

2.3. Sub Sub plots Orobanche control treatments

2.3.1. Glyphosate {N- (phosphonomethyl) glycine} known commercially as Roundup (48% WSC) used at twice with equal rate of 36 g a.i. /fed., applied at the beginning of the flowering stage with 21 day interval between two applications.

2.3.2. Glyphosate used at twice with equal rate of 36 g a.i. /fed. at beginning of the flowering stage with 21 days interval between two applications following by one hand pulling.

2.3.3. Faba bean+ fenugreek(*Trigonella foenum* L.)

2.3.4. Faba bean + fenugreek followed by one hand pulling.

2.3.5. Hand pulling twice.

2.3.6. Untreated (control).

Faba bean cultivar (Giza 483) was planted in 10 and 15th November in both seasons with rate 35 kg/feddan. Fenugreek as trap crop was planted after 21 days from faba beans sowing. The rate of seed for fenugreek was 30 kg/faddan, which disperse sowing in the middle of furrow for faba beans. We removed fenugreek plants after 3 weeks to avoid trap crop/faba bean competition in early stages. The normal cultural practices were carried out according to the local recommendations.

The sub sub plot area was 10.5 m^2 containing five rows 3.5 m length and 60 cm apart. The herbicidal treatments were sprayed with a knapsack sprayer with one nozzle boom. The water volume used was 200 liters/fed.

2.4. Data recorded

2.4.1. Broomrape

Directly before faba beans harvest the number of broomrape spike/m^2 was counted and the dry weight of broomrape/m^2 was estimated.

2.4.2. Yield and its components

At harvest, (mid April) samples of ten plants were collected at random from the central rows of each plot to study the following parameters : plant height (cm), the number of branches/plant, the number of pods/plant, weight of pods (g/plant), seed weight (g/plant), 100 seed weight (g). Seed yield (ard./fad.) was estimated from the whole of each plot.

2.5. Statistical analysis

The results were statistically analyzed according to Gomez and Gomez (1984) for each single season and combined analysis were also done. The comparisons of means were carried out using the least significant different (L.S.D) test at 5% probability level. Bartlet test of homogeneity for error indicated that the variance of data of both seasons was insignificant. Thus, the combined analysis was carried out.

3. RESULTS AND DISCUSSION

3.1. Effect of N-fertilizer, organic manure and broomrape control treatments on broomrape and yield components of faba bean

3.1.1. Effect of N-fertilizer on broomrape and yield components of faba bean

Data in Table (3) revealed that increasing nitrogen from 0 to 20 kg N/fed reduced the number and dry weight of broomrape spikes/m^2 by 22.3, 43.9, 19.1and 40.6 %, respectively, as compared with non- fertilizer, under combined analysis. This might be due to the fact that nitrogenous fertilizers reduced crenate broomrape seed germination and radicle length of germinated seedings (Pieterse, 1991.). Nitrogen from different sources had different inhibitory effects. The effect could be due to a direct interaction with the

Table (3): Effect of N-fertilizer on broomrape growth, yield and yield components of faba bean in 2011/12 and 2012/13 seasons and combined analysis.

N- fertilizer kg N/fed.	2011 / 12 Winter season								
	Orobanche		Faba bean						
	No. of spikes /m^2	Weight of spikes /m^2	Plant height (cm)	No .of branches / plant	No. of pods / plant	Weight of pods / plant	Seed weight (g) / plant	100-seeds weight (g)	Seed yield ardab / fed
0.0	14.1	57.1	81.4	2.42	4.6	17.9	13.5	88.7	6.04
10.0	9.7	42.6	80.4	2.52	5.7	18.8	13.6	87.9	6.88
20.0	6.7	28.9	82.1	2.49	5.9	18.8	11.8	87.6	7.24
L.S.D$_{0.05}$	**3.57**	**14.55**	**n. s**	**n. s**	**1.04**	**n. s**	**n. s**	**n. s**	**0.22**
2012 / 13 Winter season									
0.0	17.4	70.5	78.3	1.68	4.5	10.9	9.0	74.2	5.40
10.0	14.8	60.4	81.2	1.77	4.7	11.1	9.4	74.5	6.27
20.0	10.9	47.6	79.2	1.76	4.4	10.5	8.7	74.6	5.70
L.S.D$_{0.05}$	2.00	10.47	n. s	n. s	n. s	n. s	n. s	n. s	0.28
Combined data									
0.0	15.7	63.8	79.9	2.05	4.5	14.4	11.2	81.5	5.72
10.0	12.2	51.6	80.8	2.15	5.2	15.0	11.5	81.2	6.57
20.0	8.8	37.9	80.6	2.12	5.2	14.6	10.3	81.1	6.47
L.S.D$_{0.05}$	**1.70**	**7.18**	**n. s**	**n. s**	**0.44**	**n. s**	**0.76**	**n. s**	**0.15**

metabolism of broomrapes by altering the osmostic balance (Ernst,1988), since the high nitrogen supply would reduce the uptake of potassium (Welte and Wemer1962) for which the parasite has a high demand (Ernst, 1988). Also, several authors reported direct toxicity by nitrogen fertilizers to the seeds of broomrape. These results are in line with those obtained by Gharib (1973), Kukula and Masri (1984), Pieterse, (1991) Van Hezewijk *et al*. (1991) and Demirkan and Nemli (1994).

The data in Table (3) and Figure (1) revealed that increasing nitrogen had significant influence on the number of pods/plant, seed weight (g) / plant and seed yield (ardab/fed) in the combined analysis. Adding of 10 and 20 kg N/fed. recorded the highest values of the number of pods/plant by 15.6 %, for each as compared with non-fertilizer. For seed yield (ardab/fed), increasing nitrogen from 10 to 20 kg N/fed. increased seed yield by 14.9 and 13.1 %, respectively, as compared with non-fertilizer, under combined analysis. These results are in agreement with those of Kukula and Masri (1984).

3.1.2. Effect of organic manure on broomrape and yield components of faba bean

Not much work has been done on the organic fertilizer to control *Orobanche* spp. The number of broomrape spikes/m^2 was significantly affected by organic manure, under combined analysis (Table 4). Increasing manure from 0 up to 20 m^3/fad. reduced the number of broomrape spikes/m^2 by 5.3 and 13.7 %, respectively, under combined analysis compared with zero manure.

This might be due to the high content of nitrogen compound (Table 2).

These results are in line with those obtained by Jain and Foy (1992). Some researchers have reported that the addition of manure and nitrogenous fertilizers resulted in improved crop yields due to a detrimental effect of the fertilizers on the parasitic infestations. But others have attributed the beneficial effects of nitrogenous fertilization directly to improve crop performance and tolerance to attack by the parasite.

Data in Table (4) revealed that the effect of organic manure was significant in plant height (cm) and seed yield (ardab/fed), under combined analysis.There was no significant difference of plant height (cm) between these two rates of manure compared without manure. Adding organic manure at 10 and 20 m^3 /fad. gave the highest plant (81,2 cm) compared without organic manure (78.9 cm). For seed yield (ardab/fed) of faba beans, application of organic manure from 0 up to 20 m^3/fed**.** increased seed yield by 1.5 and 4.2 %, respectively under combined analysis.

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

Data in Table (5) indicated that the numbers and dry weight of broomrape spikes/m^2 were significantly affected by broomrape control treatments, under combined analysis. Glyphosate twice followed by one hand pulling, glyphosate twice, hand pulling twice and fenugreek followed by one hand pulling decreased significantly the number of broomrape spikes by 97.1, 97.1, 72.6

Table (4): Effect of manure fertilizers on broomrape growth, yield and yield components of faba bean in 2011/12 and 2012/13 seasons and combined analysis.

Manure m^3/fed.	2011 / 12 winter season								
	Orobanche		Faba bean						
	No. of spikes /m^2	Weight of spikes /m^2	Plant height (cm)	No .of branches / plant	No. of pods / plant	Weight of pods / plant	Seed weight (g) / plant	100-seeds Weight (g)	Seed yield ardab / fed
0.0	10.3	43.5	78.7	2.46	5.1	17.1	12.8	87.4	6.61
10.0	10.4	45.0	82.6	2.46	5.5	19.3	13.0	87.8	6.67
20.0	10.1	40.1	82.6	2.51	5.6	19.0	13.1	89.0	6.88
L.S.D$_{0.05}$	**n. s**	**n. s**	**1.7**	**n. s**	**0.36**	**1.54**	**n. s**	**n. s**	**0.12**
2012 / 13 winter season									
0.0	14.4	64.4	79.1	1.69	4.5	11.1	9.3	73.6	5.68
10.0	14.3	60.7	79.8	1.75	4.4	10.6	8.8	74.5	5.78
20.0	12.8	53.4	79.9	1.77	4.5	10.9	9.0	74.6	5.91
L.S.D$_{0.05}$	**2.23**	**n. s**	**n. s**	**0.06**	**n. s**	**n. s**	**n. s**	**n. s**	**0.18**
Combined data									
0.0	13.1	54.1	78.9	2.08	4.8	14.1	11.1	80.5	6.14
10.0	12.4	52.5	81.2	2.10	5.0	15.0	10.9	81.0	6.23
20.0	11.3	46.8	81.2	2.14	5.1	14.9	11.1	82.3	6.40
L.S.D$_{0.05}$	**1.39**	**n. s**	**1.27**	**n. s**	**n. s**	**n. s**	**n. s**	**n. s**	**0.10**

and 53.2 %, under combined analysis. The same trend was achieved with the weight of broomrape spikes by 97.3, 97.0, 73.8 and 51.7 %, respectively, compared with untreated check. This result revealed that the application of herbicide as Roundup (glyphosate) gave the best effect on broomrape followed by hand pulling. This effect due to glyphosate treatment with broomrupe underground stage, so it makes early effects, while, the effect of hand pulling is usually after broomrape emergence above ground. Also, fenugreek has a good effect. These results are in agreement with those of Megahed (1988) ,Al-Menoufi (1991), Kharrat and Halila (1996) and Bakheit *et al*. (2001)**.**

Data presented in Table (5) reported that plant height (cm), the number of branches/plant, the number of pods/plant, weight of pods (g/plant), seed weight (g/plant), 100-seeds weight (g) and seed yield (ardab/fad.) under combined analysis were significantly affected by broomrape control treatments. All broomrape control treatments gave the highest values of plant height (cm), the number of branches/plant, the number of pods/plant, weight of pods (g/plant), seed weight (g/plant), 100-seeds weight (g) and seed yield (ardab/fed) than untreated treatment, under combined analysis. Seed yield (ardab/fed) increased by all broomrape control treatments, the highest values were obtained from Roundup twice plus one hand pulling, roundup twice, hand pulling twice and intercropping fenugreek plus one hand pulling by 75.6, 72.1, 34.7 and 57.9 % respectively, compared to untreated plot. This increase of seed yield may be due to the increase the number of branches/plant, number of pods/plant, weight of pods (g/plant), seed weight (g/plant) and due to the decrease of the number and dry weight of broomrape spikes. These results are in agreement with those of Megahed (1988), Al-Menoufi (1991), Hassanein and Kholosy , (1997) and Bakheit *et al*. (2001)

3.2. Interactions

3.2.1. Effect of interactions between N-fertilizer and organic manure on broomrape and yield of faba bean

The effects of the interactions between N-fertilizer and organic manure on yield components of faba bean under combined analysis were not statistically significant at (0.05) level, meaning that the two factors act independently and their data were excluded. Meanwhile, the effect of the interaction between N-fertilizer and organic manure were significant on plant height (cm), number of branches / plant and seed yield (ard./fad.). Adding 10 and 20 kg N /fad with organic manure at 10 and 20 m^3 /fad. gave the highest values of seed yield (ard./fad.) compared with the control. These results are in line with those obtained by Jain and Foy (1992). Some researchers reported that the addition of manure and nitrogenous fertilizers resulted in improved crop yields due to a detrimental effect of the fertilizers on the parasitic infestations.

3.2.2.Interaction between N-fertilizer and broomrape control treatments on broomrape and yield of faba bean

The effects of the interactions between N-

Table (5):Effect of broomrape treatments on broomrape control, yield and yield components of faba bean in 2011/12 and 2012/13 seasons and combined analysis.

Broomrape control treatments (g a.i./fed.)	2012 / 13 Winter season								
	Orobanche		Faba bean						
	No. of spikes /m^2	Weight of spikes /m^2	Plant height (cm)	No. of branches / plant	No. of pods / plant	Weight of pods / plant	Seed weight (g) / plant	100-seeds Weight (g)	Seed yield ardab / fed.
1- Glyphosate 36 twice	1.0	4.5	83.0	2.57	5.9	20.6	13.8	88.5	7.36
2- Glyphosate 36 twice + H.P	1.0	4.4	82.4	2.50	6.0	20.2	14.2	89.5	7.63
3- Faba bean-fenugreek	14.9	61.9	81.7	2.73	5.5	18.4	13.1	87.0	6.67
4- Faba bean-fenugreek + H.P	12.4	53.7	80.4	2.47	5.5	18.9	12.8	87.2	6.84
5-Hand pulling twice	7.9	33.4	82.6	2.47	5.6	18.9	13.8	89.9	6.74
6- Untreated (chick)	23.7	99.5	77.5	2.12	3.9	14.0	10.2	86.3	5.09
L.S.D$_{0.05}$	**2.23**	**8.23**	**2.6**	**0.21**	**0.61**	**1.72**	**1.33**	**3.66**	**0.19**
2012 / 13 Winter season									
1- Glyphosate 36 twice	0.8	3.3	80.3	1.73	4.9	11.8	10.0	76.1	6.72
2- Glyphosate 36 twice + H.P	0.7	2.7	78.3	1.88	4.8	11.7	9.7	73.5	6.74
3- Faba bean-fenugreek	20.2	86.2	80.4	1.69	4.5	10.7	8.8	75.2	5.83
4- Faba bean-fenugreek + H.P	16.9	72.4	79.7	1.70	4.6	11.2	9.4	76.8	6.07
5-Hand pulling twice	9.2	34.2	78.6	1.80	4.5	10.9	9.1	80.7	6.27
6- Untreated (chick)	38.3	158.4	80.0	1.62	3.7	8.9	7.2	64.2	3.09
L.S.D$_{0.05}$	**2.59**	**10.98**	**n. s**	**0.14**	**0.64**	**1.41**	**1.34**	**7.10**	**0.35**
Combined data									
1- Glyphosate 36 twice	0.9	3.9	81.7	2.15	5.4	16.2	11.9	82.3	7.04
2- glyphosate 36 twice + H.P	0.9	3.5	80.4	2.19	5.4	15.9	11.9	81.5	7.18
3- Faba bean-fenugreek	17.6	74.3	81.1	2.21	5.0	14.5	10.9	81.1	6.25
4- Faba bean-fenugreek + H.P	14.5	62.2	80.1	2.09	5.1	15.1	11.1	82.0	6.46
5-Hand pulling twice	8.5	33.8	80.6	2.13	5.1	14.9	11.5	85.3	6.51
6- Untreated (chick)	31.0	128.9	78.8	1.87	3.8	11.5	8.7	75.3	4.09
L.S.D$_{0.05}$	**1.58**	**6.73**	**1.85**	**0.13**	**0.37**	**0.97**	**0.80**	**2.64**	**0.20**
H.P = Hand pulling									

fertilizer and broomrape control treatments on yield components of faba bean under combined analysis were statistically insignificant at (0.05) level, meaning that the two factors act independent and their data were excluded. Meanwhile, the effect of interaction between N-fertilizer and broomrape control treatments on the number and weight of spikes /m^2 was statistically significant at (0.05) level (Table 7). The number and weight of spikes /m^2 tended to decrease under high N-fertilizer than the number and weight of spikes /m^2 under zero N-fertilizer. This showed that the role of nitrogen in broomrape control and consequently the number and weight of spikes /m^2 was decreased.

This result demonstrated the role of integration between N-fertilizer, agricultural, mechanical and chemical methods in controlling

Table (6): Effect of the interaction between N-fertilizer and manure on broomrape and yield of faba bean in 2011/12 and 2012/13 seasons and combined analysis.

Treatments		Combined data		
N- fertilizer (kg N/fed.)	**Manure m^3/fed.**	**Plant height (cm)**	**No .of branches / plant**	**Seed yield ardab / fed.**
0.0	**0.0**	77.6	2.02	5.64
	10.0	79.8	2.12	5.71
	20.0	82.2	2.00	5.80
10.0	**0.0**	81.0	2.17	6.33
	10.0	81.7	2.11	6.47
	20.0	79.9	2.16	6.92
20.0	**0.0**	78.1	2.05	6.45
	10.0	82.1	2.08	6.50
	20.0	81.8	2.24	6.47
L.S.D$_{0.05}$		**2.19**	**0.14**	**0.17**

Table (7): Effect of the interaction between N-fertilizer and broomrape control treatments on broomrape and yield of faba bean in 2011/12 and 2012/13 seasons and combined analysis.

Treatments		Combined data	
N- fertilizer kg N/fed.	**Broomrape control treatments (g a.i./fed.)**	**No. of spikes /m^2**	**Weight of spikes /m^2**
0.0	**1- Glyphosate 36 twice**	1.7	7.2
	2- Glyphosate 36 twice + H.P	1.8	7.4
	3- Faba bean- fenugreek	22.1	89.0
	4- Faba bean- fenugreek + H.P	18.0	73.6
	5-Hand pulling twice	11.2	45.1
	6- Untreated (chick)	39.5	160.7
10.0	**1- Glyphosate 36 twice**	0.7	3.4
	2- Glyphosate 36 twice + H.P	0.6	2.2
	3- Faba bean- fenugreek	18.5	78.9
	4- Faba bean- fenugreek + H.P	15.3	69.1
	5-Hand pulling twice	7.9	30.6
	6- Untreated (chick)	30.4	125.6
20.0	**1- Glyphosate 36 twice**	0.2	1.0
	2- Glyphosate 36 twice + H.P	0.3	1.0
	3- Faba bean- fenugreek	12.4	54.9
	4- Faba bean- fenugreek + H.P	10.3	43.9
	5-Hand pulling twice	6.4	25.8
	6- Untreated (chick)	23.2	100.5
L.S.D 0.05		**1.74**	**11.65**

H.P = hand pulling

broomrape in faba bean. The role of fenugreek, hand pulling and herbicide in these results isconcerning.

3.2.3.Interaction between manure and broomrape control treatments on broomrape and yield of faba bean

The effects of the interaction between manure and broomrape control treatments were statistically significant on plant height and the number of branches / plant at 0.05 levels (Table 8). The effect of the interaction between organic manure at 10 and 20 m^{-2} /fad. with Roundup and fenugreek gave the highest value of plant height (82.8 and 82.1 cm) than comparable treatments with organic manure at zero (79.9 and 79.4 cm), respectively. This may be owing to the effect of the interaction between the role of organic manure with mechanical and chemical methods in controlling broomrape in faba bean. Meanwhile, the effect of the interaction between organic manure and broomrape control treatments on the number of branches / plant did not gave any difference between organic manure at 0, 10, 20 m^{-2} /fed,meaning that the role of organic manure on increasing faba bean branches was very limited. This may be due to the fact that the amount of N is low in the organic manure than synthetic nitrogenous fertilizers.

Table (8): Effect of the interaction between manure and broomrape control treatments on broomrape and yield of faba bean in 2011/12 season and combined analysis.

Treatments		Combined data	
Manure m^3/fed.	**Broomrape control treatments (g a.i./fed.)**	**Plant height (cm)**	**No .of branches / plant**
0.0	**1- Glyphosate 36 twice**	79.4	2.08
	2- Glyphosate 36 twice + H.P	80.7	2.26
	3- Faba bean- fenugreek	79.9	2.21
	4- Faba bean- fenugreek + H.P	80.6	2.22
	5-Hand pulling twice	80.2	2.03
	6- Untreated (chick)	78.3	1.68
10.0	**1- Glyphosate 36 twice**	82.8	2.24
	2- Glyphosate 36 twice + H.P	80.1	2.12
	3- Faba bean- fenugreek	81.2	2.17
	4- Faba bean- fenugreek + H.P	80.2	2.00
	5-Hand pulling twice	81.3	2.16
	6- Untreated (chick)	79.2	1.93
20.0	**1- Glyphosate 36 twice**	82.8	2.12
	2- Glyphosate 36 twice + H.P	80.4	2.21
	3- Faba bean- fenugreek	82.1	2.24
	4- Faba bean- fenugreek + H.P	79.4	2.03
	5-Hand pulling twice	80.3	2.21
	6- Untreated (chick)	78.8	2.00
L.S.D 0.05		**3.21**	**0.22**

Table (9): Correlation analysis between seed yield (ard./fed.) and the studied traits (combined over 2011/2012 and 2012/2013 seasons).

Traits	2011/2012 Season							
	number of broomrape spike/m^2	**weight of broomrape spike /m^2**	**plant height (cm)**	**Branches No. of /plant**	**number of pods/plant**	**weight of pods (g/plant)**	**seed weight (g/plant)**	**100 seed weight (g)**
Seed yield (ard./fed.)	-0.758**	-0.750**	0.198*	0.274**	0.613**	0.472**	0.218**	0.083
	2012/2013 Season							
Seed yield (ard./fed.)	-0.772**	-0.765**	0.005	0.207**	0.512**	0.500**	0.516**	0.448**
	Combined analysis							
Seed yield (ard./fed.)	-0.767**	-0.759**	0.134*	0.397**	0.583**	0.525**	0.455**	0.468**

3.2.4.Interaction between N- fertilizer, manure and broomrape control treatments

All interaction effects between N- fertilizer, manure and broomrape control treatments under combined analysis were not statistically significant at (0.05) level. It means that the three factors act independently and their data were excluded.

3.3. Correlation analysis

Data presented in Table (9) indicated that faba bean seed yield ardab/fed. was negatively and significantly correlated with number and weight of broomrape spikes/m^2. Moreover, it was positively and significantly correlated with all traits of yield components under combined analysis.

It can be concluded from this study the feasibility of using cultural methods as N-fertilizer, organic manure and fenugreek intercropping as alternative to both hand pulling and the use of herbicide to control orobanche in faba bean. Farmers can earn more money and increasing faba beans yield or helping to increase faba bean growing in upper Eygpt.

4. REFERENCES

Abu-Irmaileh. B. E. (1979). Effect of various fertilizers on broomrape (*Orobanche ramosa*) infestation of tomatoes. p. 278-284 in L. J. Musselman, A. D. Worsham, and R. E. Eplee, eds. Proc. Second. Int. Symp. Parasitic Weeds, N. C. State Univ., Raleigh, N.C.

Abu-Irmaileh. B. E. (1994). Nitrogen reduces branched broomrape (*Orobanche ramosa*) seed germination. Weed Sci., 42:57-60.

Al-Marsafy H.T., Hassanein E.E., Nassar A.N. and Fakkar A.A. (2000). Feasability of Orobanche hand pulling in faba bean fields as alternative or complement to Orobanche chemical control. Nile Valley program for wild oats and other weeds control in winter cereals and some other winter crops.8th Ann. Coord. Meet., Cairo, 3-7 Sept. pp. 297-302.

Al-Marsafy H.T., Hassanein E.E., Nassar A.N. and Fakkar A.A. (2001). Feasibility of Orobanche hand pulling in faba bean fields as an alternative or as a complement to chemical control . Nile Valley program for wild oats and other weeds control in winter cereals and some other winter crops. 9th Ann. Coord. Meet. 2-6 sept. Cairo, Egypt. P.P. 282-285.

Al-Menoufi O.A. (1991). Crop rotation as a control measure of *Orobanche crenata* in *Vicia faba* fields. In: Progress in Orobanche Research, (Wegmann K. and Musselman L.J., Eds.), (Tubingen, GE), 241-247.

Anonymous (1994). Demonstration Book for Faba Bean Cultivation. Ministry of Agriculture, A.R.E. 39 pp. (In Arabic).

Bakheit B. R., Allam A. Y. and Galal A. H. (2001). Intercropping faba bean with some legume crops for control of *Orobanche crenata.* Assiut J. of Agric, Sci. , 32 (3):1-9.

Demirkan H. and Nemli Y. (1994). Effects of some fertilizers on *Orobanche ramosa* L. on tomato. Pages 499-501 in A. H. Pieterse, J.A.C. Verkleij, and S. J. ter Borg, eds. Proceedings of the Third International Work-shop on Orobanche and Related Striga Research. Amsterdam, The Netherlands: Royal Tropical Institute.

Ernst W. H. 0. (1988). Mineral nutrition of *Nicotiana tabacum* cv.Bursana during infection by *Orobanche ramosa*. Pages 80-85 in S. L. Borg, ter ed. Proceedings of a workshop on biology and control of Orobanche. LH/VPO, Wageningen, The Netherlands

Gharib M. S. (1973). Biological and economical aspects of the broomrapes, *Orobanche* spp., in Northern Iraq. p. 44-47 in Proc. Eur. Weed Res. Counc. Symp. Parasitic Weeds, Malta.

Gomez K.A. and Gomez A.A. (1984). Statistical Procedures for Agricultural Research. John Wiely and Sons. Inc, New York.

Hassanein E.E. and Kholosy A.S. (1997). Demonstration plots of faba bean for broomrape control on Fayoum Governorate . NVRP for wild oats control in wheat and other winter crops. 5th Annual Meeting, Cairo, 11-15 Sept:109-111.

Jain R. and Foy C. L. (1992). Nutrient effects on parasitism and germi-nation of Egyptian broomrape (*Orobanche aegyptiaca*). Weed Technol. 6: 269-275.

Kasasian L. (1973). Miscellaneous observations on the biology of *Orobanche crenata* and *0. aegyptiaca*. Pages 68-75 in Proc. Eur. Weed Res. Counc. Symp. Parasitic Weeds, Malta.

Kharrat M. and Halila M.H. (1996). Control of *Orobanche foetida* on *Vicia faba:* comparison between different control measures. Pages 734-738in Advances in Parasitic plant research (Junta de Andalucia, ed.).

Kharrat M. and Halila M.H. (1999). Evaluation d'autres moyens de lutte contre l' *Orbanche foetida* Poir. Sur ficia faba L.pages 259-264 in Advances in Prasitic Weed Control at On-farm level. Joint action to control Orobanche in the WANA region. Vol. II (Kroshel J., Abdelrabibhi M., Betz H., eds.), du 30 Mars au 2 avril 1998 Proceeding de l'atelier tenu à Rabat, Morac.

Kukula S . T. and Masri H. (1984). Integrated cultural practices and chemical control of *Orobanche crenata* in faba bean. Pages 256-261 in C. Parker, L. J. Musselman, R. M. Polhill, and A. K. Wilson, eds. Int. Symp. on Parasitic Weeds. Aleppo, Int. Ctr. for Agric. Res. in the Dry Areas. (ICARDA).

Megahed M.A. (1988). Responses of some faba bean cultivars to phosphorus fertilization and broomrape control methods. M.S. Thesis, Fac. Agric., Cairo Univ.Egypt pp:1-57.

Musselman L. J. (1980). The biology of *Striga*, *Orobanche*, and other root-parasitic weeds. Annu. Rev. Phytopathol. 18: 463-489.

Nandula V. K., Foy C. L. and Westwood J. H. (1996). Environmental influences on germination of Orobanche. Pages 409-416 in M. T. Moreno, J. I. Cubero, D. Berner, D. Joel, and L. J. Musselman, eds. Advances in Parasitic Plant Research. Cordoba, Spain: Junta de An-dalucia.

Pieterse A. H. (1991). The effect of nitrogen fertilizers on the germination of seeds of *Striga hermonthica* and *Orobanche crenata*. Pages1 15-124i n K. Wegmann and L. J. Musselman, eds. 1991. Progress in Orobanche Research. Eberhard-Karls-Universitat,Tu bengen,F RG.

Pieterse A. H. (1996). The effect of nitrogen on Orobanche and Striga-state of the art. Pages 273-282 in M. T. Moreno, J. I. Cubero, D. Berner, D. Joel, and L. J. Musselman, eds. Advances in Parasitic Plant Research. Cordoba, Spain: Junta de Andalucia.

Saxena M. C., Linke K.-H. and Sauerborn J. (1994). Integrated control of Orobanche in cool-season food legumes. In: A. H. Pieterse, J. A. C. Verkleij and S. J. Terborg (eds.). Biology

and management of Orobanche. Proceedings of the Third International Workshop on Orobanche and related Striga research, pp. 419-431.

Shaban S.H.A., El-Hattab A.H., Esmat A. and Abo El-Suoud M.R. (1986). Recovery of faba bean (*Vicia faba* L.) plants as affected by glyphosate. J. Agron. and Crops Sci. 158: 294-303.

Telaye A. and Saxena M. C. (1986). Orobanche in faba bean field in Ethiopia. FABIS Newsletter, 14: 33.

Van Hezewijk M. J., Linke K. H., Verkleij J.A.C. and Pieterse A. H. (1991). The effect of ammonium fertilizer in combination with nitrification inhibitors on *Orobanche crenata* infestation in faba bean. Pages 470-483 in J. K. Ransom, L. J. Musselman, A. D. Worsham, and C. Parker, eds. Proceedings of the Fifth International Symposium on Parasitic Weeds. Nairobi, Kenya: CIMMYT.

Welte E. and Wemer W. (1962). Lonen-Austauschversuche uber die Beein-flussung der Kationenaufnahmed er Pflanzen durch die Stickstoff-Form. Agrochimica 6:337-348. 60

التكامل بين التسميد النيتروجيني والعضوي والمعاملات الزراعية ومبيدات الحشائش في مكافحة الهالوك في الفول البلدي

عبده عبيد أحمد إسماعيل

المعمل المركزي لبحوث الحشائش- مركز البحوث الزراعية- الجيزة- مصر

ملخص

نظرا للارتفاع الشديد فى درجات الحرارة بالوجه القبلى، فأن حقول الفول البلدي تصاب بشدة بطفيل الهالوك. مما أدى إلى تقلص المساحات المنزرعة منه. وترجع صعوبة مكافحة الهالوك فى الفول البلدى لعدم وجود طريقة كافية بحد ذاتها لمكافحته وهذا يرجع لعدة أسباب منها تأخر اتصاله بالعائل مما يجعل استخدام المبيدات الأرضية (ما قبل الإنبات) غير مناسبة من جانب. ومن جانب آخر، قله المبيدات الإختيارية المستخدمة فيها بعد الإنبات. لذا تم إقامة تجربتين حقليتين في حقول فول مصابة بالهالوك بمحطة البحوث الزراعية بشندويل- محافظة سوهاج التابعة لمركز البحوث الزراعية خلال الموسم الشتوي 2011/ 2012و 2012/ 2013م لدراسة مدى إمكانية التكامل بين إضافة السماد النيتروجيني والعضوي و تحميل الحلبة على الفول البلدى و استخدامه كمحصول صائد للهالوك و النقاوة اليدوية و المبيدات فى مكافحة الهالوك وزيادة محصول الفول البلدى. تكونت كل تجربة من 54 معاملة عبارة عن ثلاثة مستويات من السماد النيتروجيني (صفر، 10 و 20 كجم نيتروجين/ فدان) استقبلت القطع الرئيسية ، ثلاثة مستويات من السماد العضوي (صفر، 10 و 20 متر مكعب / فدان) وضعت فى القطع الشقية الأولى و ست معاملات مكافحة هالوك (مبيد الجليفوسيت، مبيد الجليفوسيت متبوعا بنقاوة يدوية مرة واحدة، تحميل حلبة على الفول البلدى، تحميل حلبة على الفول البلدى متبوعا بنقاوة يدوية مرة واحدة، بنقاوة يدوية مرتين و بدون معاملة) وضعت فى القطع الشقية الثانية. استخدم تصميم القطع المنشقة مرتين مع ثلاثة مكررات. أدت إضافة السماد الأزوتى بمقدار 10 و 20 كجم نيتروجين/ فدان إلى خفض الإصابة بالهالوك بمقدار22,3 و 43,9 % و زيادة محصول البذور للفول بمقدار 14,9 و 13,1 % على التوالي مقارنة بعدم إضافة السماد الأزوتى.

لم يكن للسماد العضوي أي تأثير ملموس على مكافحة الهالوك و المحصول. أدت إضافة السماد العضوى بمقدار 10 و 20 متر مكعب / فدان الى زيادة محصول البذور للفول البلدى بمقدار 1,5 و 4,2 % على التوالي مقارنة بعدم إضافة السماد العضوي. أعطى استخدام مبيد الجليفوسيت بمفردة و مبيد الجليفوسيت متبوعا بنقاوة يدوية مرة واحدة أعلى انخفاض فى عدد ووزن الهالوك بمقدار 97,1, 97,1، 97,0 و 97,3 % على التوالي و أعلى زيادة فى المحصول بمقدار 75,6 و 72,9 على التوالى مقارنة بالمعاملة. من ناحية أخرى ساهمت كل من النقاوة اليدوية مرتين و تحميل الحلبة على الفول البلدى كمحصول صائد للهالوك فى مكافحة الهالوك بمقدار 72,6 و 53,2 % على التوالى و حسنت فى محصول الفول البلدى بمقدار 34,7 و 57,9 % على التوالى. يتبين من هذه النتائج إمكانية استخدام حزم من التوصيات الزراعية مثل السماد الأزوتى مع التحميل بالحلبة فى مكافحة الهالوك فى الفول البلدى كحزم صديقة للبيئة و كبديل جيد لاستخدام المبيدات. ومن ثم ننصح مزارعى الفول البلدى بان يكونوا ذو خبرة بهذه الحزم من التوصيات مما يتيح استخدامها فى التوسع فى زراعات الفول البلدى فى الوجه القبلى ومجابهه مشكلة الهالوك. أرتبط محصول الحبوب (إردب/ فدان) ارتباطا سالبا بعدد ووزن الهالوك و ارتباطا موجبا بمعظم مكونات المحصول في الموسمين.

المجلة العلمية لكلية الزراعة – جامعة القاهرة – المجلد (64) العدد الرابع (أكتوبر2013):369-378.