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EFFECT OF GLYPHOSATE, FOSAMINE AMMONIUM AND THEIR MIXTURE FOR CONTROLLING *Orobanche crenata* IN PEAS (*Pisum sativum*).

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ABSTRACT

In pot trails, during two successive seasons (2001/2002) and (2002/2003) foliar application of glyphosate (10 – 25 ppm), fosamine ammonium (50 – 200 ppm) and their mixture (5 ppm glyphosate + 25 ppm fosamine ammonium - 12.5 ppm glyphosate + 100 ppm fosamine ammonium) was evaluated for controlling *Orobanche crenata* in peas (*Pisum sativum* L.). Both phosphorus herbicides and their mixture substantially controlled *O. crenata* parasitism in peas, by reducing the number, fresh and dry weights of *O. crenata* tubercles as compared with infected control. Applying glyphosate at (25 ppm) and its mixture with fusainine (12.5 ppm glyphosate + 100 ppm fosamine ammonium) showed potential effect for eliminating *O. crenata* infestation in peas as compared with other their concentrations. Fosamine ammonium showed some phytotoxicity on the host particularly at higher concentrations either as compared with glyphosate or mixture.

Both herbicides and their mixture significantly increased the root and shoot biomass of pea plant as well as pea yield, as compared with infected control.

It has been suggested that glyphosate has potential effect for controlling *Orobanche crenata* parasitism in pea plant, rather than fosamine ammonium or their mixture.

INTRODUCTION

Broomrape is considered one of the most serious agricultural problems in food legumes in Egypt, Mediterranean countries as well as different parts of the world, causing severe damage to legume crops such as broad bean, peas, lentils, vetch, grass peas and chickpea (Mauromicale *et al.*, 2000 and Amesllem, *et al.*, 2001).

Although special attention has been given to control *Orobanche crenata* in faba bean fields, yet very few attempts has been made to control *Orobanche* infecting pea plants. In this connection, Garcia-Torres *et al.*, 1997 and 1998 reported that *Orobanche crenata* infestation is a permanent threat of winter legumes in Southern and Eastern Spain and completely destroyed about 80 % of peas.

In recent years, peas (*Pisum sativum* L.) is considered one of the most important leguminous vegetable crop in Egypt either as green or dry pod yield for containing a great amount of protein, phosphorus and potassium (El-Metwally and Saad El-Din, 2003).

Obviously, the phosphorus herbicide glyphosate has shown satisfactory results for controlling *Orobanche* spp. infestation in faba bean. Petzolodt (1981), showed that the post-emergence application of the low rates of glyphosate in broad beans (*Vicia faba*) resulted in satisfying control of *Orobanche crenata* and increased yield. Mesa-Garcia and Garcia-Torres

(1982) also showed that, glyphospahte applied at 0.12 kg/ha to *Vicia faba* infested with *Orobanche crenata* delayed weed emergence and increased the crop yield. But 2 applications of glyphosate were required where the beans had been sown early and *O. crenata* levels were high. Also, El-Masry *et al.* (1991) found that in a pot trail over 2 successive years, glyphosate successfully prevented infection of faba beans by *O. crenata* when applied twice at 0.35 and 0.5 ml/litre with an interval of 3 weeks between treatments but not when applied once at 0.35 ml. Yehia and Mekky (2002) reported recently that, the highest number of branches, number of pods, pod weight, seed weight and seed yield of faba bean were obtained with glyphosate applied three times at three-week intervals. Also, glyphosate has shown satisfactory results for controlling *Orobanche* spp. In sunflower (Petzoldt and Sneyd (1986) and Garcia-Torres *et al.*, 1991), tobacco (Langston *et al.*, (1985), Musselman, (1993) and Covarelli (2002), pea and lentil (Arjona-Berral *et al.*, 1988 and Garcia-Torres *et al.*, 1997 and 1998).

Since glyphosate is becoming too expensive in Egypt, great attention has been focused for examining other novel phosphorus herbicide such as fosamine ammonium for controlling *O. crenata* parasitism in faba bean and tomato (Khalaf, 1998). This chemical has been introduced by Du Pont Ltd. for controlling woody plant, certain perennial weeds such as *Convolvulus arvensis* and *Pteridium aquilinium*. It is rapidly and ready translocated to the root system, however, little is known about its mechanism of action.

The objective of the present study is to evaluate the herbicidal activity of glyphosate, fosamine ammonium and their mixture for controlling *Orobanche crenata* parasitism in the pea plants. The effect of both herbicides on pea plants was investigated.

MATERIALS AND METHODS

Pot experiments were carried out in the green house of Bot. Dept., National Research Centre, Dokki, Cairo, to investigate the effect of glyphosate and Fosamine omnoium on controlling Orobanche parasitism in pea plants.

Eighty one pots 30 cm diameter filled with Nile clay soil were infested with *Orobanche crenata* seeds (0.2 gm/pot) at 5 cm depth from the soil surface. Pea seeds (*Pisum sativum* cv. Master B) were sown (6 seeds/pot) at 3 cm from the soil surface. The pea plants were thinned to 4 plants/pot at the seedling stage. Glyphosate (N-phosphonomethyl glycine, 36 a.i. % Monsanto Ltd.) was applied at the concentrations of 10, 15 and 25 ppm, while fosamine ammonium (ammonium ethyl carbamoyl phosphonate, 48 a.i. % Du Pont Ltd.) was applied at 50, 100 and 200 ppm. Mixture of the two herbicides was applied at (5 ppm glyphosate + 25 ppm fosamine ammonium, 7.5 ppm glyphosphate + 50 ppm fosamine ammonium and 12.5 ppm glyphosate + 100 ppm fosamine ammonium). The two herbicides and their mixture were sprayed at the first flowering bud stage (45 days from sowing). An additional of eighteen pots were also used, nine for infected and nine for healthy

controls. The pots were maintained under greenhouse conditions and watered as required.

Orobanche crenata samples and growth host characteristicses were recorded for each treatment at the flowering, pod and harvest stages (60, 90 and 120 days, respectively) three pots were taken form each treatment. The number, fresh and dry weight (gm, 50°C, 96 hrs) of *Orobanche* tubercles/12 pea plants were recorded. The time of emerging the *Orobanche* shoot from the soil surface was observed. The effect of herbicides on the host growth characteristics at (60, 90 and 120 days from sowing) were recorded as follows :

1. Root length (cm).
2. Plant height (cm).
3. Number of leaves.
4. Fresh and dry weight of root/plant (gm).
5. Fresh and dry weight of shoot biomass/plant (gm).
6. Yield and yield components : Number of pods/plant, number of seeds/pod, weight of pods/plant (gm. Dr. wt.), seed yield/plant (gm. Dr. wt.) and weight of 100 seeds (gm. Dr. wt.).

Phytotoxicity of the two herbicides and their mixture were observed on the parasitic weed and host development. The treatments were arranged in completely randomized design and the data were subjected to standard analysis of variance by means and L.S.D. 0.05 (Snedecor and Cochran, 1967).

Herbicidal activity on some chemical composition of pea plant :

The effect of two herbicides and their mixture on the content of chlorophyll, protein and carbohydrates, was determined at the pod stage (90 days from sowing). Leaves'disk samples were collected and kept in mixture of hydroquinone, acetone (85 %) and calcium carbonate for determining chlorophyll content. The shoot (leaves and stem) and root samples were taken and dried at 45°C for 96 hrs., followed by the samples were ground and stored for determining the total nitrogen and carbohydrate contents.

A. Chlorophyll content :

The chlorophyll (a and b) were determined spectrophotometrically in the pea's leaf according to the method of Saric *et al.*, (1967).

B. Total nitrogen content :

The total nitrogen content in pea samples (shoot and root) was estimated using microkjeldahl method (Allen, 1953).

C. Total carbohydrates content :

Determination of total carbohydrates in the shoot and root system of treated and untreated plants was carried out according to Smith *et al.* (1964) and estimated colourimetrically by the phenol-sulphuric acid method as described by Montogomery (1961).

RESULTS

Foliar application of glyphosate, fosamine ammonium or their mixture showed a potential effect for controlling *Orobanche crenata* in peas (*Pisum sativum* L.). The data from observations indicated that both organophosphorus herbicides or their mixture reduced *Orobanche* infestation and depressed the number of *Orobanche* spikes emerging from soil surface by (12.5 to 100 %) as compared with infected control at different stages of growth. The data presented in Table (1) showed that high infestation of *Orobanche* parasitism was observed with infected control, quait number and considerable fresh and dry weight of *Orobanche* tubercles being obtained. *Orobanche* shoots started to emerge from soil surface 85 days after sowing.

Applying glyphosate at the highest concentrations (15 and 25 ppm) potentially controlled *O. crenata* in pea plants by reducing the number, fresh and dry weight of *Orobanche* tubercles either as compared with infected control at the pod and harvest stages (90 and 120 days from sowing, Table 1). However, applying glyphosate at the low concentration (10 ppm) failed to give good control of *Orobanche crenata*.

It is obvious from Table (1) that fosamine ammonium herbicide also gave promising results for controlling *O. crenata*. At the highest rate (200 ppm), fosamine ammonium gave completely control of *Orobanche parasitism* in pea plant at the pod and harvest stages. However, applying fosamine ammonium at lower concentrations (50 and 100 ppm) controlled *Orobanche* in pea plant by (12.5 to 55.6 %) at pod and harvest stages (Table 1).

The mixture of the two herbicides was less effective than glyphosate or fosamine ammonium on controlling *Orobanche crenata* parsitism in pea plant. Foliar application of the mixture at highest rate (12.5 ppm glyphosate + 100 ppm fosamine ammonium) gave good results for controlling *Orobanche* in pea by (37.5 to 100 %) as compared with other treatments or infected control. However the lower rates of application reduced *Orobanche* infestation by (25 to 55.6 %) as compared with infected control (Table 1).

The two organophosphorus herbicides used and their mixture did not show phytotoxicity on the root and shoot biomass of the host particularly at lower concentrations as compared with healthy control. However, the two herbicides showed some phytotoxicity symptoms at the highest concentrations which was characterized by abscission of the older leaves and flowers of the host.

The effect of glyphosate, fosamine ammonium and their mixture on some morphological characteristics of pea plant infected with *Orobanche* is summarized in Table (2). The data revealed that the infected control significantly decreased the root and shoot biomass of the host as compared with herbicidal treatments or healthy control, causing a significant reduction in the root and stem length, number of leaves, fresh and dry weight of root and stem per plant either at the flowering or pod stages.

Table (1) : Influence of glyphosate, fosamine ammonium and their mixture on *Orobanche crenata* development in Peas (*Pisum sativum*).

Treatments	Concentrations ppm	Date of spraying from sowing "days"	Physiological stage							
			Pod stage "90 days from sowing"				Harvest stage "120 days from sowing"			
			No. of *Orob.* Tubercles/12 pea plants	Reduction % of infected control	Fresh wt. of *Orob.* Tubercles /12 pea plants (gm)	Dry wt. of *Orob.* Tubercles/ 12 pea plants (gm)	No. of *Orob.* Tubercles /12 pea plants	Reduction % of infected control	Fresh wt. of *Orob.* Tubercles /12 pea plants (gm)	Dry wt. of *Orob.* Tubercles/ 12 pea plants (gm)
Healthy control			Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Infected control			8	100	11.2	2.0	9	100	12.3	2.2
Glyphosate	10	45	7	12.5	3.3	0.6	5	44.4	7.5	0.8
	15		1	87.5	0.6	0.1	2	77.8	1.5	0.3
	25		1	87.5	0.3	0.06	0.0	100	0.0	0.0
Fosamine ammonium	50	45	7	12.5	6.9	1.0	6	33.3	4.3	0.6
	100		5	37.5	4.0	0.7	4	55.6	2.8	0.5
	200		0.0	100	0.0	0.0	1	88.9	0.9	0.3
Mixture	5 gly. + 25 Fos.A.	45	6	25.0	7.2	1.3	4	55.6	3.3	0.4
	7.5 gly. + 50 Fos.A		6	25.0	3.5	0.6	2	77.8	1.2	0.2
	12.5 gly.+100 Fos.A		5	37.5	0.5	0.1	0.0	100	0.0	0.0

Table (2) : Effect of glyphosate, fosamine ammonium and their mixture on some growth characteristics of Peas (*Pisum sativum*) (Combined analysis of two seasons).

Treatments	Concentrations ppm	Root biomass						Shoot biomass							
		Flowering stage "60 days from sowing"			Pod stage "90 days from sowing"			Flowering stage "60 days from sowing"				Pod stage "90 days from sowing"			
		Root length (cm)	Fresh wt. gm/ plant	Dry wt. gm/plant	Root length (cm)	Fresh wt. gm/plant	Dry wt. gm/ plant	No. of leaves /plant	Stem length (cm)	Foliage fresh wt. gm/plant	Foliage dry wt. gm/plant	No. of leaves /plant	Stem length (cm)	Foliage fresh wt. gm/plant	Foliage dry wt. gm/plant
Healthy control		14.67	0.80	0.40	19.00	1.20	0.53	12.67	34.33	37.00	7.40	16.33	51.33	96.10	19.80
Infected control		12.67	0.37	0.23	13.67	0.70	0.35	9.33	25.33	14.70	2.63	12.00	28.33	37.43	6.87
Glyphosate	10	14.67	0.60	0.35	15.33	0.90	0.47	10.67	27.67	19.40	3.50	14.00	32.67	53.90	9.60
	15	13.67	0.50	0.30	14.67	0.83	0.42	10.00	27.33	15.90	2.93	13.33	32.00	44.70	8.00
	25	13.33	0.47	0.28	14.33	0.40	0.40	9.67	27.00	14.67	2.67	12.33	32.00	38.40	7.43
Fosamine ammonium	50	13.67	0.57	0.32	15.00	0.80	0.43	11.00	27.00	22.67	3.97	14.00	32.00	54.00	9.80
	100	13.00	0.50	0.30	14.67	0.75	0.40	10.67	25.67	21.50	3.43	13.00	29.00	48.80	9.60
	200	12.67	0.47	0.28	13.67	0.70	0.38	10.33	25.00	16.13	3.30	12.67	28.33	37.43	8.63
Mixture	5 gly. + 25 Fos.A.	14.67	0.60	0.35	15.67	0.97	0.50	11.00	27.67	25.43	4.30	14.00	33.00	62.53	12.37
	7.5 gly. + 50 Fos.A	13.33	0.57	0.30	14.00	0.87	0.43	10.00	24.33	18.87	4.03	11.00	29.67	49.37	9.53
	12.5 gly.+100 Fos.A	13.00	0.53	0.28	13.67	0.83	0.40	9.33	23.67	18.63	3.37	9.33	28.33	49.00	8.97
L.S.D. at 5 %		1.25	0.12	0.11	1.50	0.19	0.09	1.38	1.82	3.35	0.55	1.67	3.82	6.30	0.79

Applying the two herbicides and their mixture significantly increased the root and shoot biomass of pea plants as compared with infected control. However, such treatments reduced significantly the root and shoot biomass of the host as compared with healthy control particularly at the pod stage rather than at the flowering stage.

The same trend was obtained with applying the chemical compounds in relation to *Orobanche* parasitism on pea yield. The results in Table (3) showed that the two herbicides and their mixture remarkably increased the yield and its components as compared with infected control at the harvest stage (120 days) and irrespective of rates of application. In contrast a significant reduction in the number and dry weight of pods/plant, number of seeds/pod, seed yield/plant and dry weight of 100 seeds, either with the two herbicides and their mixture or infected control as compared with the healthy control. However, most of chemical treatments showed a significant declined in the pea yield as compared with healthy control at this stage of growth (Table 3).

Determination of total carbohydrate, protein and chlorophyll contents in pea either infected with *Orobanche* or treated with the two herbicides and their mixture is illustrated in Figure (1). The data showed that the parasitic weed inhibited the total carbohydrate and protein in shoots by (37.16 % and 22.8 %) and in roots by 20.83 % and 20.77 %) respectively, whereas, reduced the chlorophyll content by (31.4 %) in infected control. Similarly, fosamine ammonium and their mixture eliminated the same chemical composition in pea plant already infected with *Orobanche crenata* as compared with infected control or glyphosate treatments. Such reduction increased with increasing the herbicidal concentrations. In contrast, applying glyphosate on pea plant showed a stimulatory effect on the chemical composition particularly at the low and moderate concentrations (10 and 15 ppm), by increasing the total carbohydrate in shoot and root biomass and chlorophyll content of pea plant (Fig. 1). However, applying glyphosate at highest concentration (25 ppm) reduced the chemical composition, to some extent, in pea plant as compared with infected control or other treatments.

Orobanche infestation on pea plant was more effective in reducing the protein content as compared with glyphosate, fosamine ammonium or their mixture, either in the shoot or root. Applying the two herbicides and their mixture at the lower concentrations showed less inhibitory effect on the total protein as compared with the higher concentrations.

Table (3) : Influence of glyphosate, fosamine ammonium and their mixture on yield and its components of Peas (*Pisum sativum*) (Combined analysis of two seasons).

Treatments	Concentrations ppm	Physiological stage: Harvest stage "120 days from sowing"				
		No. of pods/ plant (gm)	Dry wt. of pods /plant	No. of seeds/pod	Seed yield / plant (gm)	Dry wt. of 100 seeds (gm)
Healthy control		7.3	16.0	7.0	12.27	18.6
Infected control		3.33	6.13	4.00	4.33	13.60
Glyphosate	10	4.67	10.30	5.67	7.47	15.8
	15	4.33	9.53	5.33	7.10	15.23
	25	3.67	9.23	5.00	6.97	15.10
Fosamine ammonium	50	4.67	9.27	5.67	7.23	15.67
	100	3.67	8.80	5.33	6.10	14.87
	200	3.33	8.07	5.00	5.90	14.27
Mixture	5 gly. + 25 Fos.A.	5.33	11.57	6.33	9.10	16.80
	7.5 gly. + 50 Fos.A	4.00	8.27	5.00	6.37	14.53
	12.5 gly.+100 Fos.A	3.67	7.77	4.67	5.70	14.00
L.S.D. at 5 %		0.93	1.35	1.44	1.24	1.62

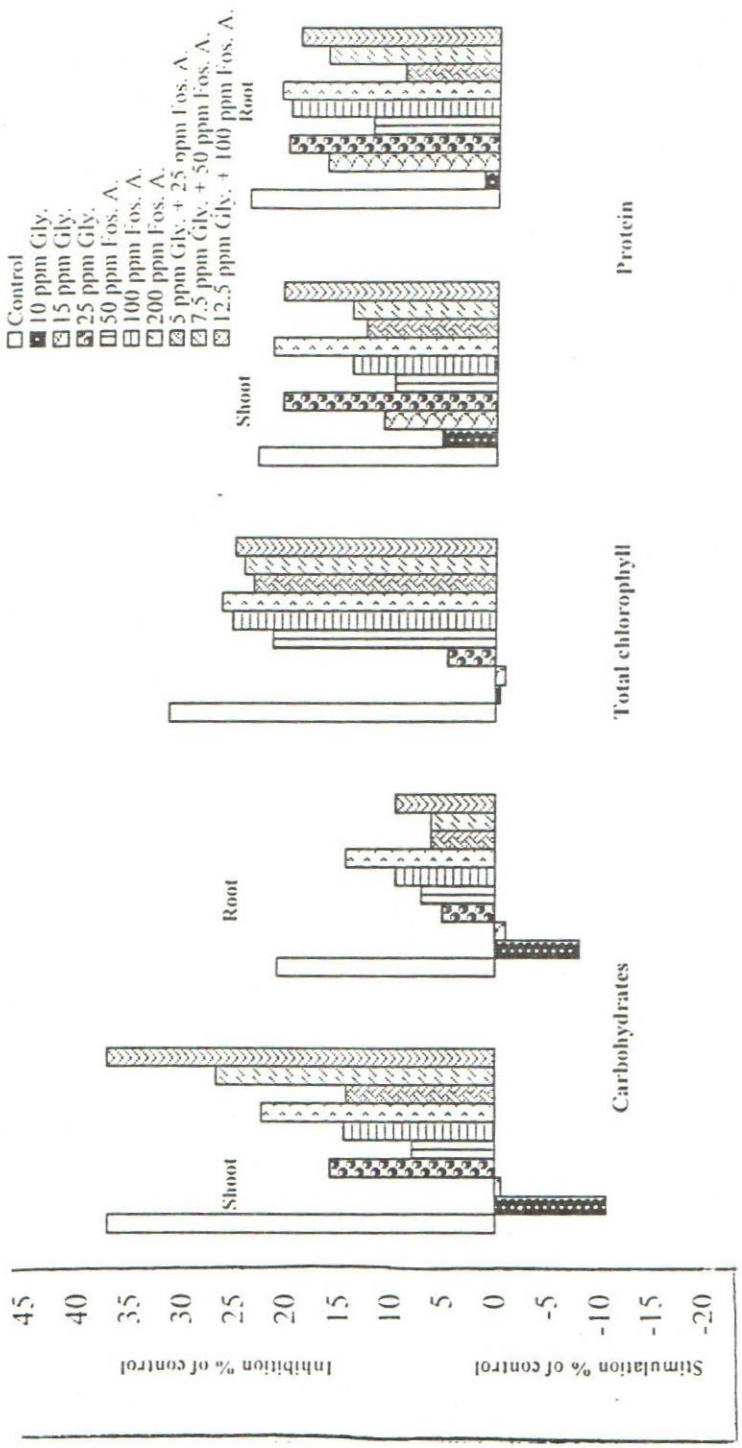

Fig (1): Herbicidal effect of glyphosate, fosamine ammonium and their mixture on some chemical composition in pea plant at different concentrations.

DISCUSSION

Although organophosphorus compounds have been developed mainly as insecticides, a number of such compounds have shown herbicidal activity. However, several attempts have been paid to control *Orobanche crenata* in broad beans with organophosphorus herbicides, however, little attention have been focused to control *Orobanche crenata* in peas. In this connection, Garcia-Torres, *et al.* (1997 and 1998) reported that *O. crenata* infestation is a permanent threat of winter legumes in Southern and Eastern Spain and completely destroyed about 80% of peas (40000 ha) in province of Sevill.

The present investigation would seem to indicate that glyphosate and fosamine ammonium phosphorus herbicides and their mixture gave promising results for controlling *Orobanche* spp. In pea plants, by reducing the number, fresh and dry weight of *O. crenata* tubercles as well as depressing the *Orobanche* spikes to emerge from the soil surface, particularly at higher concentrations as compared with infected control. These results have been supported by results obtained by Khalaf and Abo El-Suoud (1996) and Khalaf (1998) revealed that the organophosphorus herbicides have shown promising results for controlling broomrape (*O. crenata* and *O. ramose*) in fabe bean and tomato respectively and perennial weed (*Cyperus longus*) in cotton. Similar studies have indicated that foliar application of glyphosate at different rate and number of applications, gave potential effect for controlling *O. crenata* in faba bean (Halila, 1998, El-Masry *et al.*, 1991, Garcia-Torres, *et al.*, 1997 and Yehia and Mekky, 2002).

Applying the two herbicides or their mixture, significantly increased the root and shoot biomass of pea plant as well as pea yield at lower rates of application as compared with infected control. Such results have been agreed with results obtained by Yehia and Mekky (2002) who reported recently that, the highest number of branches, number of pods, pod weight, seed weight and seed yield were obtained with glyphosate applied three times at three-week intervals (Petzoldt, 1981; Zahran, *et al.*, 1981; Mesa-Garcia and Garcia-Torres 1982 and Nandal and Arya, 1995).

The reduction of pea yield treated either with glyphosate or fosamine ammonium and their mixture, particularly at higher concentrations might be partially related to the herbicidal phytotoxicity rather than *Orobanche crenata* infestation. These results have been confirmed by the results obtained by Mesa-Garcia *et al.*, (1982), who revealed that phytotoxicity at low rates (60 and 120 g/ha) caused slight chlorosis which disappeared after few weeks, whereas, higher rates caused twisted leaves and stunted growth, however, injury was higher with application during vegetative growth than during flowering or pod production. Also, Hussein *et al.* (1998) showed that reducing the level of glyphosate (50 % of recommended rate, combined with NPK nutrients 75 days after planting) reduced the risk of toxic effects on *V. faba*. Khalaf and Abo El-Suoud (1996) and Khalaf (1998) showed that yield reduction of faba bean and tomato at higher concentrations (50 – 100 ppm

glyphosate and 500 – 1000 ppm fosamine ammonium) might be associated with herbicidal phytotxoicity.

On other hand, applying the two organophosphorus herbicides and their mixture at higher concentrations decreased carbohydrate, chlorophyll and protein contents, however, it was surprising that applying glyphosate at the lower concentrations (10 – 15 ppm) slightly increased the carbohydrate and chlorophyll contents in pea plant as compared with infected control. These results have been agreed with results obtained by El-Mergawi and Hussein (1997) who revealed that a sublethal dose of glyphosate to faba beans (*V. faba* cv. Giza 2 and Giza 3) to control *Orobanche crenata* improved the nutritive value of seeds by increasing the levels of protein and total amino acids and decreasing contents of tannins and vicine. In contrast, Yehia and Mekky (2002) showed that the chlorophyll content of faba bean significantly decreased with glyphosate treatments. El-Masry, *et al.* (1991) reported that glyphosate successfully prevented infection of faba beans cv. Giza 4 by *O. crenata* when applied twice at 0.35 ml and 0.5 ml/litre with an interval of 3 weeks between treatments, both *O. crenata* infestation and glyphosate treatments markedly decreased total amino acids content in the leaves of the host plant.

Thus, these evidences might suggest that the present results are reconcile with the views concerning the glyphosate is still considered the most effective herbicide among other phosphorus herbicides for controlling *Orobanche* spp. in legume plants under field condition.

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تأثير مبيدى الحشائش الجليفوسيت والفوزامين امونيوم ومخلوطهما فى مقاومة حشيشة الهالوك المتطفلة على نبات البسلة

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اجريت هذه الدراسة بصوبة المركز القومى للبحوث فى الموسمين ٢٠٠١/٢٠٠٢ ، ٢٠٠٢/٢٠٠٣ لدراسة تأثير مبيدى الجليفوسيت والفوزامين امونيوم ومخلوطهما كمبيدات حشائش فسفورية فى مقاومة حشيشة الهالوك المتطفلة على نبات البسلة .

وتم رش مبيد الجليفوسيت بتركيزات من (١٠ الى ٢٥ جزء فى المليون) ، ومبيد الفوزامين امونيوم بتركيزات من (٥٠ الى ٢٠٠ جزء فى المليون) وكذا مخلوطهما (٥ جزء فى المليون جليفوسيت + ٢٥ جزء فى المليون فوزامين امونيوم الى ١٢,٥ جزء فى المليون جليفوسيت + ١٠٠ جزء فى المليون فوزامين امونيوم) وذلك عند عمر ٤٥ يوم من الزراعة لمقاومة حشيشة الهالوك المتطفل على نبات البسلة . وتم فحص مدى اصابة نبات البسلة بالهالوك عند مرحلة التزهير (٦٠ يوم بعد الزراعة) وعند مرحلة تكوين القرون (٩٠ يوم بعد الزراعة) ثم مرحلة الحصاد عند (١٢٠ يوم بعد الزراعة) وشمل الفحص عدد الشماريخ الزهرية للهالوك وكذا عدد الكورمات سواء فوق او تحت سطح التربة والوزن الرطب والجاف لهما. بالاضافة لدراسة التأثير السام لتلك المبيدات على العائل والمحصول ومكوناته وتأثير تركيز تلك المبيدات على محتوى الكلوروفيل والكربوهيدرات والبروتينات فى كل من المجموع الخضرى والجذرى لنبات العائل .

واظهرت النتائج ان كلا المبيدين ومخلوطهما قد قاوموا حشيشة الهالوك المتطفل على نبات البسلة (اوروبانكى كريناتا) من خلال تقليل عدد ووزن الشماريخ الزهرية (الرطب والجاف) بمقارنتها بالكنترول .

وقد وجد ان استخدام التركيز العالى من الجليفوسيت (٢٥ جزء فى المليون) والمخلوط (١٢,٥ جزء فى المليون جليفوسيت + ١٠٠ جزء فى المليون فوزامين امونيوم) كانا اكثر فاعلية فى مقاومة هالوك البسلة بالمقارنة بالتركيزات الاخرى . كما سبب مبيد الفوزامين امونيوم بعض مظاهر السمية على العائل خاصة عند استخدام التركيزات العالية بمقارنتها بمبيد الجليفوسيت او المخلوط . وادى استخدام المبيدين ومخلوطهما الى زيادة معنوية فى الصفات المورفولوجية لكل من المجموع الجذرى والمجموع الخضرى وكذا المحصول بالمقارنة بالكنترول المعدى .

ويمكن استنتاج ان استخدام مبيدى الجليفوسيت والفوزامين امونيوم ومخلوطهما كمبيدات حشائش فسفورية حديثة ذات فاعلية لمقاومة حشيشة الهالوك المتطفل على نبات البسلة ، الا ان استخدام مبيد الجليفوسيت كان اكثر فاعلية لمقاومة تلك الحشيشة عنه فى حالة الفوزامين امونيوم او المخلوط .