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EFFECT OF GLYPHOSATE FOLIAR SPRAY ON PEA PLANT
GROWTH, CHEMICAL COMPOSITION, GREEN POD YIELD
AND OROBANCHE SPP. CONTROL

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ABSTRACT

Two field experiments were carried out at the Experimental Farm of the Faculty of Agriculture at Moshtohor, Zagazig University, in heavily infested soil with broom rape (*Orobanche crenata*) during the winter seasons of 1990/1991 and 1991/1992, to study the effect of glyphosate (lancer or round up) on plant growth, green pod yield of pea and broom rape control as well as chemical composition of both plant foliage and green seeds. Pea plants were sprayed at the beginning of flowering once, twice or three times with each of the used concentrations i.e., 0.25 cm³ or 0.45 cm³/L. Obtained results did not show any clear and consistent trend for different used concentration of the glyphosate on pea plants vegetative growth characteristics.

Concerning weeds control the glyphosate was more effective in controlling *Orobanche* spp. when pea plants were sprayed twice with 0.45 cm³/L. where it decreased the number and weight of the air dry spikes of the broom rape in each experimental plot. Moreover, the same treatment, increased the total yield of the green pods as compared with the control or any other used glyphosate treatment as well as the highest content of N, P and K in either plant foliage or green seeds.

INTRODUCTION

The parasitism phenomenon of *Orobanche* spp. on legume crops has drawn the attention of many workers. The only effective, but expensive means of broom rape control has been soil sterilization by either chemical fumigation or

solarization. Glyphosate herbicide selectively controls or suppresses broom rape in legume crops. The reduction of plant growth due to the withdrawal of nutrients, metabolites and water by the parasites was reported by El-Ghamrawy (1968) and Harb (1979). No measure, up to date, could be considered decisive in controlling broom rape plants. Mesa and Carcia (1984) indicated a significant correlation Co-efficient between the number of *Orobanche crenata* plants and broad bean seed yield. Also, promising results in controlling *Orobanche* spp. were reported when glyphosate was applied at low concentration to broad bean or pea plants at beginning of flowering and again 20 days later or at the end of flowering stage respectively (Kelili et al., 1983 on peas; Micolis and Bianco, 1984; Nassib et al., 1984 and Nassib et al., 1990 on broad bean).

Moreover, Mohamedian et al. (1988) working on pea revealed that glyphosate was more effective in controlling broom rape at 75 or 100 ppm when sprayed at the beginning of flowering or 15 days later. Kelili et al. (1983); Mohamedien et al. (1988) reported promising results with respect to green pea pod yield. Njoroge and Kimemia (1990) stated also that the most effective weed control method was achieved by glyphosate treatment and clean weeding. Such treatment nearly doubled the yields as compared with the unweeded coffee.

The aim of this work was to investigate the effect of glyphosate (lancer or round up) on broom rape control; pea plant growth and green pod yield.

MATERIALS AND METHODS

This experiment was carried out at the Experimental Farm of the Faculty of Agriculture, Moshtohor, Zagazig University during the winter

seasons of 1990/1991 and 1991/1992 pea seeds (Pisum sativum, L.) cv. Little Marvel, were sown in hills 10 cm apart at both sides of ridges on October 21th and 27th of 1990 and 1991 seasons, respectively. Sowing was done in an area heavily infested with broom rape. The area of the experimental plot was about 10.5 m². It included 5 ridges 3-5 m long and 60 cm wide. A complete randomized block design with three replicates was adopted.

The experiment consists of 10 treatments which were 9 treatments of glyphosate foliar spray frequency, i.e., 3 concentrations of glyphosate at 0.25, 0.35, 0.45 cm³/L for one, two or three sprays, in addition to the control treatment. The glyphosate (N- "phosphon methyl" glycine) 360 gm active ingredient per litre known as lancer was used as foliar spray. The first spray was done at the beginning of flowering. Moreover, the second and the third sprays were carried on at 15 and 30 days after the first one, respectively.

Fertilization was done as commonly followed in the district at a rate of 45 kg N, 32 kg P₂O₅ and 24 kg K₂O per fed. Such amounts of fertilizers were divided into 2 equal doses. The first portion was added 21 days after sowing and the second at the beginning of flowering stage. A random sample of 5 plants from each experimental plot was taken after ending the spraying program for measuring the vegetative growth characteristics, i.e., plant length, number of leaves and branches per plant as well as whole plant fresh and dry weight (gm).

At harvest time, the mature green pods for each treatment were collected for recording data of the total yield.

Macro-elements were determined in the second seasons of growth. The determination

were carried out in the dry matter of either plant foliage and green seeds according to the methods described by Pregl (1945), for total N, Murphy and Riely (1962), for phosphorus, Brown and Lilleland (1946) for potassium.

All obtained data were subjected to statistical analysis according to Gomez and Gomez (1983).

RESULTS AND DISCUSSION

I. Plant vegetative growth:

Data presented in Table (1) show the effect of glyphosate foliar spray on the vegetative growth characteristics of pea plants during the two seasons of growth. From such data, it is evident that most of the used concentrations of glyphosate significantly increased the different studied characters of pea plants vegetative growth, i.e. plant length, number of leaves, number of branches, fresh weight and dry weights per plant than those of control treatment. Moreover, it is evident from each data that foliar spray of glyphosate at 0.35 or 0.45 cm³/L either one, twice or three times showed the highest values in this respect at both seasons of this work. It is worthy to note that the response of each character to glyphosate foliar application was different than the other one and also from season to the other and the frequency of spraying of each concentration. These results are logic and expected due to the unsymmetry of the planted area with either annual or noxious weeds intensity. The reduction of plant growth of the control treatment plants may be due to the withdrawal of nutrients and metabolites by the parasites. This was also reported by El-Ghamrawy (1968) and Harb (1979) working on *vicia faba*.

Table (1): Effect of glyphosate foliar spray on vegetative growth of pea plants.

Season Treatments	1990/1991				1991/1992														
	Plant length of leaves /plant (cm)	Plant Number of leaves /plant	Fresh weight /plant (g)	Dry weight /plant (g)	Plant length of leaves /plant (cm)	Plant Number of leaves /plant	Fresh weight /plant (g)	Dry weight /plant (g)											
Control	0.00	79.3	25.3	2.2	85.2	14.2	80.9	23.6	2.2	84.2	12.6								
Once	0.25	103.0	23.2	2.4	122.2	20.7	93.4	32.0	3.6	151.0	15.3								
	0.35	96.0	32.3	3.0	144.8	22.2	91.8	33.7	3.0	156.6	13.3								
	0.45	101.3	27.2	2.3	136.6	18.4	97.9	37.9	4.5	122.7	15.0								
Twice	0.25	85.0	24.3	2.3	137.0	22.9	83.9	25.4	2.4	127.1	11.1								
	0.35	85.0	31.3	2.6	109.4	17.7	84.9	32.2	3.5	110.0	15.9								
	0.45	98.3	33.5	2.3	125.1	16.8	94.3	29.8	3.6	98.6	15.4								
Three times	0.25	90.3	29.8	2.8	125.5	16.9	86.9	24.6	2.7	139.3	13.3								
	0.35	93.3	27.8	2.5	151.7	19.6	94.7	26.6	3.0	149.5	12.7								
	0.45	96.3	28.6	2.7	103.3	13.8	101.2	26.8	2.4	135.7	15.1								
L.S.D. at 0.05										9.9	1.9	0.1	3.4	3.6	8.0	4.7	0.1	3.9	1.7

II. Number and weight of broom rape plants and green pod yield of pea:

Data in Table (2) showed that spraying pea plants with glyphosate herbicide at any one of the different used treatments significantly decreased number and dry weight of broom rape plants than the control treatment. It is also obvious, from such data, that foliar spray of glyphosate at $0.45 \text{ cm}^3/\text{L}$ for three times resulted in the lowest values in this respect at both seasons of this work. The significant reduction in number and air dry weight of broom rape spikes in pea fields as a result of glyphosate spray may be due to the direct effect of glyphosate on suppression of seed germination of broom rape when the herbicide was translocated from leaves to the roots. It might be explained also as that the chemical substance could stimulate some endogenous hormones in pea roots which depressed seed germination of broom rape. Obtained results and explanations are in accordance with those reported by Kelili et al. (1983) and Mohamedin et al. (1988) working on peas, Micolis and Bianco (1984), Nassib et al. (1984) and Nassib et al. (1990) on broad bean. Another explanation was also pointed out by Foy and Jain (1986) working on broad bean. They stated that ^{14}C -glyphosate is translocated from host leaves to broom rape shoots where it accumulates in concentrations greater than in any part of the host plant including the apical meristem.

As regards to green pod yield per faddan, the same data in Table (2) revealed that most used glyphosate treatments significantly increased the green yield of pea pods. Meanwhile, it is evident that plants treated twice with glyphosate at $0.45 \text{ cm}^3/\text{L}$ produced the highest green pod yield as compared with the control or other glyphosate treatments at both seasons of this work. Such treatment that showed higher

pod yield also showed increments in dry weight of plant foliage and also highest content of N, P and K in either plant foliage or green pod. The stimulative effect of nitrogen proved to be effective in increasing green pod yield of pea plants.

These results are in line with those reported by Kelili et al. (1983) and Mohamedin et al. (1988) working on pea; Njoroge and Kimemia (1990) working on weed control in coffee fields.

Table (2): Effect of glyphosate foliar spray on number and weight of broom rape spikes as well as total green pod yield of pea.

Season Treatment	1990/1991			1991/1992			
	Air dry spikes/plot	Total green pod yield/ fad. (g)	Total green pod yield/ fad. (Ton)	Air dry spikes/plot	Total green pod yield/ fad. (g)	Total green pod yield/ fad. (Ton)	
spray frequ- ency	Concent- ration cm ³ /L	Number	Weight	Number	weight	yield/ fad. (Ton)	
Control Once	0.00	18.0	71.0	2.568	16.6	60.0	2.881
	0.25	6.7	67.3	2.632	6.0	33.3	3.726
	0.35	6.4	33.3	2.756	5.0	28.3	3.930
	0.45	6.3	25.7	3.112	1.0	10.0	4.325
Twice	0.25	6.0	41.7	2.644	3.3	16.6	3.234
	0.35	6.3	31.0	3.156	3.3	10.0	3.760
	0.45	5.2	22.0	4.604	1.0	3.3	4.616
Three times	0.25	4.3	20.3	2.632	2.0	9.3	3.580
	0.35	3.2	17.6	4.584	1.0	3.3	3.433
	0.45	1.7	13.0	4.508	0.7	3.3	3.480
L.S.D. at 0.05		3.6	3.7	0.108	1.3	2.7	0.101

III. chemical composition:

Data in Table (3) revealed that foliar spray of glyphosate on pea plants either one, two or three times at 0.25, 0.35 or 0.45 cm³/L proved to be effective treatments in increasing nitrogen, phosphorus and potassium contents in either plant foliage or green seeds as compared with control treatment. Such increments was significant with the exception of nitrogen content in plant foliage. Spraying pea plants twice at 0.45 cm³/L proved to be the best treatment in this respect.

Table (3): Effect of glyphosate foliar spray on the chemical composition of plant foliage and green seeds of pea (mg/100 g D.W.).(1991/1992 season).

Treatments spray Concent- frequ- ration ency cm ³ /L	Foliage			Green seeds			
	N	P	K	N	P	K	
Control 0.00	3000	180	1189	3112	249	1160	
Once	0.25	3211	385	1351	4472	321	1350
	0.35	3360	393	1413	4541	383	1520
	0.45	3641	399	1432	4923	395	1590
Twice	0.25	4622	395	1623	5289	282	1681
	0.35	4717	475	1752	5643	429	2113
	0.45	5135	481	1811	5839	475	2230
Three	0.25	4625	422	1760	5375	355	1680
	0.35	4700	451	1785	5800	529	2114
	0.45	4439	410	1690	5761	500	2231
L.S.D. at 0.05	n.s.	6	9	29	10	11	

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تأثير الرش بالانصر على نمو نباتات البسله ومحصول القرون الخضراء والتركيب الكيماوى ومقاومة الهالوك

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أجريت تجربتان حقليتان بمزرعة التجارب بكلية الزراعة بمشتهر - جامعة الزقازيق وذلك فى ارض موبؤه بالهالوك وذلك خلال الموسم الشتوى لعامى ١٩٩٠/١٩٩١، ١٩٩١/١٩٩٢ لدراسة تأثير الرش بمركب الانصر على النمو الخضرى ومحصول القرون الخضراء لنباتات البسله وكذلك على مدى مقاومه الهالوك . وقد رشت نباتات البسله مع بداية مرحله الازهار مرة ومرتين أو ثلاث مرات وذلك باحد التركيزات المستخدمة وهى ٠.٢٥ ، ٠.٣٥ او ٠.٤٥ سم^٣ / لتر . وأوضحت النتائج المتحصل عليها بانها لم يكن هناك اتجاه واضح وثابت على مواصفات النمو الخضرى للبسله . كما اوضحت النتائج ايضا ان الانصر كان اكثر فاعلية فى مقاومة الهالوك عندما رشت النباتات مرتين بتركيز ٠.٤٥ سم^٣ / لتر حيث كان لهذا التركيز اكبر الاثر فى تقليل العدد والوزن الجاف لنباتات الهالوك بالقطعة التجريبية . كما كان لهذا التركيز ايضا اثره الفعال فى زيادة المحصول الكلى للفدان من القرون الخضراء مقارنة بالكنترول او اى من المعاملات الاخرى المستخدمة . وكذلك اظهر هذا التركيز اعلا محتوى من النيتروجين والفوسفور والبوتاسيوم فى كل من المجموع الخضرى والبذور الخضراء .