J. Agric. Sci. Mansoura Univ., 28 (2): 947 - 969, 2003

RESPONSE OF PEA (*Pisum sativum*, L.) PLANTS TO SOME WEED CONTROL TREATMENTS

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ABSTRACT

Two field experiments were carried out in the Experimental Farm of the National Research Centre at Shalakan, Kalubia Governorate, Egypt in the winter seasons of 2000/2001 and 2001/2002. The objective of the experiments was to investigate the effect of some weed control treatments (i.e. A. Early pre-planting : Paraquat and hand hoeing, B. After planting: Butralin, Bentazon, Fluazifop-butyl, Butralin + Bentazon, Butralin + Fluazifop-butyl, Bentazon + fluazifop-butyl and one hand hoeing) on growth, yield and yield components as well as chemical composition and associated weeds of pea plants cv. Master B. The most important results obtained from this study could be summarized as follows:

All weed control treatments significantly decreased fresh and dry weight of broad-leaved, grasses and total weeds after 50 and 70 days from sowing. Hand hoeing as early pre-planting weed control treatment gave the best control of broad-leaved, grasses and total weeds of both seasons. Also, hand hoeing as after planting weed control treatment recorded the highest decrease in fresh and dry weight of broad-leaved and total weeds of both seasons. While, Fluazifop-butyl as after planting weed control treatment recorded the lowest fresh and dry weight of grass weeds of both seasons.

Hand hoeing as early pre-planting caused a significant increase in plant height after 50 and 70 days from sowing, pod length, fresh weight of pod, number of green pods/plant, weight of 100 green seeds, yield of green pods/plant, pod yield (ton/fed) and chemical composition of pea seed in both seasons as compared with both treatments. Whereas, Paraquat as early pre-planting treatment gave the highest values of number of leaves/plant, fresh and dry weight of plant after 50 and 70 days from sowing and number of green seeds/pod when compared with hand hoeing and unweeded treatments.

After planting treatments had significant effect on growth, yield and yield components as well as chemical composition of pea seeds in both seasons. Hand hoeing followed by that of Bentazon + Fluazifop-butyl as after planting exceeded other treatments.

The interaction between early pre-planting and after planting weed control treatments had significant effect on some studied traits. Using hand hoeing as early pre-planting and hand hoeing as after planting treatments produced the lowest fresh and dry weight of total weeds after 50 and 70 days from sowing in both seasons as well as produced the highest plant height and pod yield (ton/fed) of pea in both seasons followed by that of using Paraquat as early pre-planting and Bentazon + Fluazifop-butyl as after planting weed control treatments as compared with other treatments. While, application of Paraquat as early pre-planting and hand hoeing as after planting treatment produced the highest number of green pods/plant in both seasons.

Keywords: pea, early pre-planting, after planting, hand hoeing, Paraquat, Butralin, Bentazon, Fluazifop-butyl, unweeded

INTRODUCTION

Pea (*Pisum sativum*, L.) is one of the most important leguminous vegetable crops either as green or dry pod yield in winter growing season in Egypt. The seed of pea contains a great amount of protein, carbohydrates, phosphorus and potassium. So, this vegetable crop is considered as one of the most important sources in human food nutrition. Increasing the production of pea is of great importance. Which may be achieved by using high yielding varieties and/or improving the agronomic practices among which weed control.

In Egypt, land is often irrigated before preparing seed bed to stimulate weed seed to germinate before planting the crop. Weeds, which germinate before crop sowing can be easily, eradicated by farm practices or by chemicals. Early elimination of weeds will minimize competition of weeds with the crop seedlings and consequently improve growth and yield of crop plants. Weeds which may emergence after treatment can be followed with hoeing or suitable herbicide to obtain good weed control throughout the growing season.

Combinations of various chemicals are made to broaden the spectrum of weed control and sometimes the dosage of any one herbicide can be reduced. In case of chemicals of wide effect against different weed species, It is possible to use the minimum amount of each to kill the most sensitive species.

Weeds are one of the major factors decreasing pea production (Gogoi *et al.*, 1991a, Gogoi *et al.*, 1991b and Mishra and Bhan, 1997). Satisfactory pea weed control results were obtained by hand hoeing (Singh and Nepalia, 1994, Mishra and Bhan, 1997, Vaishya *et al.*, 1999 and Kinderiene, 2000), Bentazon (Radeva, 1995, Tagic, 1995, Vulsteke *et al.*, 1997 and Dovydaitis and Auskalnis, 1999), Fluazifop-butyl (Ahmed, 1990, Hassan *et al.*, 1994 and Ahmed, 1999) and Bentazon + Fluazifop-butyl (Ahmed, 1990, Radeva, 1995 and Tagic, 1995).

Hand hoeing (Hassan, 1991), Bentazon (Ahmed *et al.*, 2001), Fluazifop-butyl (Ahmed, 1990 and Ahmed *et al.*, 2001), Bentazon + Fluazifop-butyl (Ahmed, 1990 and Ahmed *et al.*, 2001) and Butralin (El-Metwally and Ahmed, 2001) increased to different extents the growth characters of faba bean, soybean and mung bean if compared with unweeded treatment.

Several workers reported increasing pea yield and yield components where hand hoeing (Gogoi *et al.*, 1993 and Mishra and Bhan, 1997), Bentazon (Rasmussen, 1993, Radeva, 1995, Tagic, 1995 and Anyszka *et al.*, 1999), Fluazifop-butyl (Leela, 1993) and Bentazon + Fluazifop-butyl (Radeva, 1995 and Tagic, 1995) were used. In this respect, (Hussein, 1992 and Ahmed, 1999) reported that early control of germinated weed seedlings before planting with Paraquat or hand hoeing significantly decreased fresh weight of weeds associated and peanut plants.

The objective of the present investigation was to study the efficiency of some chemical and mechanical weed control on growth, yield and yield components and associated weeds of pea plants. Their effect on protein, phosphorus and potassium percentage in seeds was also considered.

MATERIALS AND METHODS

Two field experiments were conducted at the Experimental Farm of the National Research Centre at Shalakan, Kalubia Governorate, Egypt, during the winter seasons of 2000/2001 and 2001/2002 to study the effect of some chemical and mechanical weed control treatments on growth, yield, yield components and seed chemical composition of pea as well as the associated weeds. The soil of experiments was clay loam with medium fertility, containing 1.89% organic matter and pH 7.8.

Each of the two experiments included 24 weed control treatments which were the combination of three early pre-planting and eight after planting treatments. Every experiment was arranged in a split-plot design with four replicates. The experimental basic unit included 5 ridges, 70 cm apart and 3.0 m length, occupying an area of 10.5 m^2 (1/400 fed).

The Experimental plots were early-irrigated three weeks before sowing to enhance weed seeds to germinate. Two weeks later the germinated weed seedlings were subjected to the following three early pre-planting treatments, which arranged randomly in the main plots:

1. Mechanical control with light hand hoeing.
2. Chemical control with Paraquat (Gramoxone 20% EC) :(1, 1 dimethyl -4, 4- bipyridinum dichloride) at a rate of 1.0 L/fed.
3. Unweeded check (control).

The sub-plots included eight after planting treatments as follows:

1. Butralin (Amex-820): (N-(2-Butyl)-4-(tert-butyl)-2: 6-dinitro-aniline) was applied at a rate of 2.5 L/fed.
2. Bentazon (Basagran 48%) : (3-isopropyl 1H-2, 1, 3-benzathiadiazin - 4- (3H) one, 2, 2 - dioxide) was applied at a rate of 0.75 L/fed.
3. Fluazifop-butyl (Fusilade): (Butyl 2- (4-(5-trifluoronomethyl - 2 - pyridyloxy) phenoxy) propionate) was applied at a rate of 2 L/fed.
4. Butralin at 1.25 L+ Bentazon at a rate of 0.375 L/fed.
5. Butralin at 1.25 L + Fluazifop-butyl at a rate of 1.0 L/fed
6. Bentazon at 0.375 L + Fluazifop-butyl at a rate of 1.0 L/fed
7. One hand hoeing after 21 days from sowing.
8. Unweeded check (control)

Butralin herbicide was applied as early pre-emergence at the day of sowing. Whereas Bentazon and Fluazifop-butyl were applied as post-emergence at 2 and 4 weeks from sowing, respectively. The herbicidal treatments in each of main and sub-plots were sprayed uniformity with knapsac sprayer with spray volume of 200 L of water per feddan. Seeds of pea (*Pisum sativum,* L.) Master B cultivar were sown on 6th and 9th November for the two seasons of 2000/2001 and 2001/2002, respectively. The normal cultural practices of pea plants were followed especially fertilization and irrigation.

Assessments:

1. On weeds:

Weeds were hand-pulled from one square meter from each plot after 50 and 70 days from sowing pea seeds. Weeds were identified and classified into three groups i.e. broad-leaved, grasses and total weeds. Fresh and dry weight of each group (gm/m^2) were recorded. The common weeds in both growing seasons were: *Beta vulgaris*, L.; *Ammi majus*, L.; *Rumex dentatus*, L.; *Sonchus oleraceus*, L.; *Medicago hispida*, L.; *Melilotus indicus*, L.; *Avena fatua*, L.; *Convolvulus arvensis*, L.; *Cynodon dactylon*, L. and *Cyperus rotundus*, L.

2. On pea plants:

A. Plant growth:

Samples of five plants were chosen at random from each plot at two times namely 50 and 70 days from sowing. The following data were recorded:

1. Plant height (cm)
2. Number of leaves/plant
3. Fresh weight of plant (gm)
4. Dry weight of plant (gm).

B. Yield and its components:

At time of harvest, samples of ten plants were taken randomly from each plot, the following data were recorded:

1. Pod length (cm)
2. Average from weight of pod (gm)
3. Number of green pods/plant
4. Number of green seeds/pod
5. Weight of 100 green seeds (gm)
6. Yield of green pods/plant (gm)
7. Total yield of green pods (ton/fed)

C. Chemical composition of pea seeds:

1. **Protein percentage (%):** Protein percentage was estimated as total nitrogen using the micro-Kjeldahl's method which outlined by Association of Official Agricultural Chemists (A.O.A.C., 1980).

2. **Phosphorus percentage (%):** Phosphorus in dry seeds of pea was determined according to Troug and Mayer (1939).

3. **Potassium Percentage (%):** Potassium was determined in dry seeds by using a flame photometer as described by Jackson (1967).

Statistical analysis:

Data were subjected to the proper statistical analysis by technique of analysis of variance (ANOVA) of split – plot design for each experiment as mentioned by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

1. Growth of weeds:

The effect of early pre-planting and after planting weed control treatments on fresh and dry weight of pea weeds after 50 and 70 days from sowing are presented in Tables (1 and 2). Data indicated that the growth of

predominant weeds was significantly affected by early pre-planting and after planting weed control treatments in both 2000/2001 and 2001/2002 seasons.

a. Effect of early pre-planting treatments:

The effect of three early pre-planting weed control treatments namely; hand hoeing, Paraquate at 1.0 L/fed and unweeded control on fresh and dry weight of broad-leaved, grasses and total weeds per square meter were recorded at 50 and 70 days from sowing for both growing seasons.

Data recorded in Tables (1 and 2) showed that early control for germinated weed seedlings before planting with hand hoeing or Paraquat significantly decreased fresh and dry weight of broad-leaved, grasses and total weeds as compared with unweeded treatment.

Hand hoeing treatment gave the lowest fresh and dry weight of broad-leaved, grasses and total weeds after 50 and 70 days for both seasons, followed by that of Paraquat treatment. On the contrary, the highest values were recorded when pea plants were unweeded.

Generally, results reported in Tables (1 and 2) concluded that early hand hoeing is useful for controlling annual weeds especially to reduce their competition and seed production. Hoeing also caused good aeration of the soil and this might encourage germination of weed seeds. This favourable effect of hoeing on weed germination may be offset by the more effective elimination of weeds by hoeing.

In this connection, Paraquat at 1.0 L/fed can be used as a contact weed killer to destroy weed seedlings which appeared before sowing and 2-3 weeks after false irrigation. This agro-technique can be used as a successful weed control management to encourage germination of weed seeds before crop sowing and minimize the subsistence of weed seed bank in soil. Germinated weed seedlings before sowing can be easily killed by hand hoeing and Paraquat treatments. These results are in general agreement with those recorded by Hassan (1991), Hussein (1992) and Ahmed (1999) who reported that early control for germinated weed seedlings before planting with hand hoeing or Paraquat significantly decreased fresh and dry weight of weeds as compared with unweeded check.

b. Effect of after planting weed control treatments:

Effect of Butralin, Bentazon, Fluazifop-butyl, Butralin + Bentazon, Butralin + Fluazifop-butyl and Bentazon + Fluazifop-butyl as well as hand hoeing on fresh and dry weight of weed classes grown with pea plants was recorded after 50 and 70 days from sowing for both 2000/2001 and 2001/2002 growing seasons.

- After 50 days from sowing :

Data presented in Table (1) demonstrate that fresh and dry weight of broad-leaved, grasses and total weeds were significantly affected by chemical and mechanical weed control treatments.

Chemical and mechanical weed control treatments significantly reduced fresh and dry weight of broad-leaved weeds after 50 days from sowing as compared with unweeded check. Hand hoeing exerted the highest

reduction in fresh and dry weight of broad-leaved weeds. Therefore, it decreased fresh and dry weight of broad-leaved weeds by 93.61 and 93.62%, for both 2000/2001 and 2001/2002 seasons, respectively.

With respect to other weed control treatments, the results in Table (1) show that the highest efficiency in decreasing fresh and dry weight of broad-leaved weeds was obtained from Bentazon followed by Bentazon + Fluazifop-butyl treatment in both seasons.

Elimination of pea weeds with chemical and mechanical weed control treatments significantly decreased fresh and dry weight of grassy weeds than unweeded treatment. Fluazifop-butyl followed by hand hoeing and Bentazon + Fluazifop-butyl treatments gave the highest controlling effect on grassy weeds grown with pea after 50 days from sowing in both 2000/2001 and 2001/2002 growing seasons. Vice-versa, the highest values were observed with unweeded treatment.

The available results revealed also that all weed control treatments reduced significantly the fresh and dry weight of total weeds if compared with unweeded treatment. Hand hoeing was the best treatment in controlling total weeds. It reduced their fresh weight by 93.66% for both seasons. With regard to other weed control treatments, the results indicated that Bentazon + Fluazifop-butyl gave good control of total weeds followed by that of Butralin and Bentazon treatments, respectively.

- After 70 days from sowing :

The results of weed control treatments after 70 days from sowing presented in Table (2) showed significant effect on fresh and dry weight of broad-leaved weeds. Hand hoeing treatment induced a significant depression in fresh and dry weight of broad-leaved weeds followed by Bentazon and Bentazon + Fluazifop-butyl treatments, respectively. On the contrary, the highest values were recorded with unweeded check in both growing seasons.

Relevant data showed that fresh and dry weight of grass weeds were significantly decreased by different weed control treatments (Table 2). Fluazifop-butyl, hand hoeing and Bentazon + Fluazifop-butyl treatments were very effective in controlling most grass weeds at 70 days form sowing. Vice-versa, the highest values were observed with unweeded treatment in both growing seasons.

The effect of weed control treatments on fresh and dry weight of total weeds (gm/m^2) after 70 days from sowing is shown in Table (2). The lowest values of fresh and dry weight of total weeds were obtained when hand hoeing, Bentazon + Fluazifop-butyl and Butralin were applied. On the other side, the highest values were recorded when pea plants were unweeded in both 2000/2001 and 2001/2002 seasons.

From the above mentioned results, one could deduce that hand hoeing treatment had a more beneficial effect in controlling pea weeds irrespective to the promising significant depressing effect of chemical weed control treatments in this respect. Similar results on the importance of hoeing in controlling pea weeds were recorded by Timmer *et al.* (1993); Singh and Nepalia (1994), Mishra and Bhan (1997), Vaishya *et al.* (1999); Kinderiene (2000) and Radwan and Hussein (2002).

Table (1): Averages of fresh and dry weight of pea weeds (gm/m^2) after 50 days from sowing as affected by different weed control treatments during 2000/2001 and 2001/2002 seasons.

Character / Treatments	Fresh weight of weeds (gm/m^2)						Dry weight of weeds (gm/m^2)					
	Broad-leaved		Grasses		Total weeds		Broad-leaved		Grasses		Total weeds	
	2000/2001	2001/2002	2000/2001	2001/2002	2000/2001	2001/2002	2000/2001	2001/2002	2000/2001	2001/2002	2000/2001	2001/2002
A. Early pre-planting weed control treatments												
Hand hoeing	180.71	191.55	95.33	100.08	276.04	291.63	27.86	29.66	15.13	15.89	42.99	45.55
Paraquat	200.81	212.85	105.90	112.26	306.71	325.11	30.89	32.74	18.57	17.82	49.46	50.56
Unweeded check	281.11	300.79	148.28	163.16	429.39	463.95	43.27	46.28	23.54	25.90	66.81	72.18
F-Test	**	**	**	**	**	**	**	**	**	**	**	**
LSD 5%	4.23	9.81	4.45	6.40	15.68	14.50	0.65	1.60	3.72	1.03	2.29	2.28
1%	6.40	14.87	6.74	9.70	23.75	21.96	0.99	2.42	5.63	1.56	3.47	3.45
B. After planting weed control treatments												
Butralin	126.36	134.50	54.13	58.00	180.49	192.50	19.44	20.68	13.28	9.19	32.72	29.87
Bentazon	70.27	74.77	146.53	157.00	216.80	231.77	10.82	11.51	23.26	24.93	34.08	36.44
Fluazifop-butyl	457.37	486.73	8.80	9.40	466.17	496.13	70.52	74.88	1.40	1.50	71.92	76.38
Butralin + Bentazon	91.37	97.23	168.53	183.33	259.90	280.56	14.05	14.99	26.75	29.11	40.80	44.10
Butralin + Fluazifop-butyl	317.77	338.17	67.33	72.13	385.10	410.30	48.88	52.02	10.69	11.46	59.57	63.48
Bentazon+ Fluazifop-butyl	82.50	87.80	39.60	42.58	122.10	130.38	12.75	14.02	6.29	6.76	19.04	20.78
Hand hoeing	37.30	39.67	26.40	28.27	63.70	67.94	5.74	6.10	4.19	4.48	9.93	10.58
Unweeded check	584.10	621.63	420.67	450.60	1004.77	1072.23	89.85	95.63	66.77	71.53	156.62	167.16
F-Test	**	**	**	**	**	**	**	**	**	**	**	**
LSD 5%	11.16	10.68	5.83	6.33	20.74	14.58	1.76	1.71	4.76	1.00	3.57	2.36
1%	14.79	14.16	7.72	8.38	27.93	19.64	2.34	2.27	6.30	1.33	4.81	3.17

Table (2): Averages of fresh and dry weight of pea weeds (gm/m^2) after 70 days from sowing as affected by different weed control treatments during 2000/2001 and 2001/2002seasons.

Character / Treatments	Fresh weight of weeds (gm/m^2)						Dry weight of weeds (gm/m^2)					
	Broad-leaved		Grasses		Total weeds		Broad-leaved		Grasses		Total weeds	
	2000/2001	2001/2002	2000/2001	2001/2002	2000/2001	2001/2002	2000/2001	2001/2002	2000/2001	2001/2002	2000/2001	2001/2002
A. Early pre- planting weed control treatments												
Hand hoeing	560.24	612.96	285.98	300.23	846.22	913.19	86.19	94.29	45.39	47.65	131.58	141.94
Paraquat	662.69	723.70	338.86	370.46	1001.55	1094.16	101.94	111.33	53.79	58.81	155.73	170.14
Unweeded check	1124.45	1203.15	593.20	627.60	1717.65	1830.75	173.00	185.10	94.15	99.61	267.15	284.71
F-Test	**	**	**	**	**	**	**	**	**	**	**	**
LSD 5%	24.43	12.87	22.55	27.23	152.61	36.11	3.74	1.99	3.57	4.32	3.24	25.05
1%	37.01	19.49	34.16	41.26	231.19	54.69	5.67	3.01	5.42	6.55	4.91	37.95
B. After planting weed control treatments												
Butralin	447.63	484.40	188.63	204.43	636.26	688.83	68.87	74.52	29.94	32.44	98.81	106.96
Bentazon	248.93	269.30	510.63	553.40	759.56	822.70	38.30	41.43	81.06	87.84	119.36	129.27
Fluazifop-butyl	1620.20	1753.00	30.67	33.13	1650.87	1786.13	249.27	269.68	4.86	5.27	254.13	274.95
Butralin + Bentazon	323.67	350.17	587.57	645.57	911.24	995.74	49.80	53.86	93.25	102.47	143.05	156.33
Butralin + Fluazifop-butyl	1125.67	1217.93	234.63	254.27	1360.30	1472.20	173.18	187.38	37.24	40.36	210.42	227.74
Bentazon+ Fluazifop-butyl	292.27	316.27	138.00	83.43	430.27	399.70	44.95	48.64	21.91	13.25	66.86	61.89
Hand hoeing	132.17	142.90	92.00	99.63	224.17	242.53	20.34	21.98	14.60	15.81	34.94	37.79
Unweeded check	2069.13	2238.87	1465.97	1588.23	3535.10	3827.10	318.33	344.45	232.69	252.10	551.02	596.55
F-Test	**	**	**	**	**	**	**	**	**	**	**	**
LSD 5%	41.38	45.07	25.52	38.06	143.93	72.45	6.37	6.93	4.05	6.04	9.26	21.78
1%	54.83	59.71	33.81	50.43	193.84	97.58	8.44	9.18	5.36	8.01	12.47	29.33

Comparing the efficiency of herbicidal treatments on mortality (%) of pea weeds, one might observe that Bentazon caused a great deleterious effect on fresh and dry weight of broad-leaved weeds. Fluazifop-butyl recorded the lowest values of fresh and dry weight of grass weeds. Whereas, Bentazon + Fluazifop-butyl recorded the lowest fresh and dry weight of total weeds. These results are in accordance with those obtained by Leela (1993); Rasmussen (1993); Radeva (1995); Tagic (1995); Dovydaitis and Auskalnis (1999); Miller and Libbey (1999); Vaishya *et al.* (1999) and Kinderiene (2000).

c. Effect of interaction:

The results in Figs. (1, 2, 3 and 4) indicated that the interaction between early pre-planting and after planting weed control treatments on fresh and dry weight of total weeds after 50 and 70 days from sowing in both 2000/2001 and 2001/2002 seasons was significant.

The obtained results verified that early pre-planting control for weed seedlings with hand hoeing followed by one hand hoeing was highly efficient of decreasing fresh and dry weight of total weeds as compared with other treatments. With regard to other weed control treatments, data also indicated that plots early weeded with Paraquat and treated later with hand hoeing gave the best results in controlling total weeds grown with pea after 50 and 70 days from sowing in both seasons. The superiority of mechanical weed control over herbicidal treatments could be attributed to the large spectrum of weed species controlled by frequent hand hoeing compared with herbicides. These results agreed with the findings of Hassan (1991), Hussein (1992) and Ahmed (1999).

2. Pea plants:

A. Plant growth:

The effect of early pre-planting and after planting weed control treatments on plant height (cm), No. of leaves/plant as well as fresh and dry weight of pea plants (gm) after 50 and 70 days from sowing in both seasons are presented in Tables (3 and 4) .

a. Effect of early pre-planting treatments:

It can be seen from data mentioned in Tables (3 and 4) that all growth characters of pea plants were significantly increased by application of early pre-planting treatments as compared with unweeded check. The highest values of number of leaves/plant as well as fresh and dry weight of pea plant (gm) were recorded when pea plots early treated with Paraquat followed by hand hoeing treatment. The tallest plants were obtained by hand hoeing treatment. However, pea plants suffered from severe weed competition in the unweeded plots gave the lowest values of growth characters comparing with those early weeded with Paraquat or hand hoeing at 50 and 70 days from sowing in both seasons. These results were in general agreement with those recorded by Hussein (1992) and Ahmed (1999).

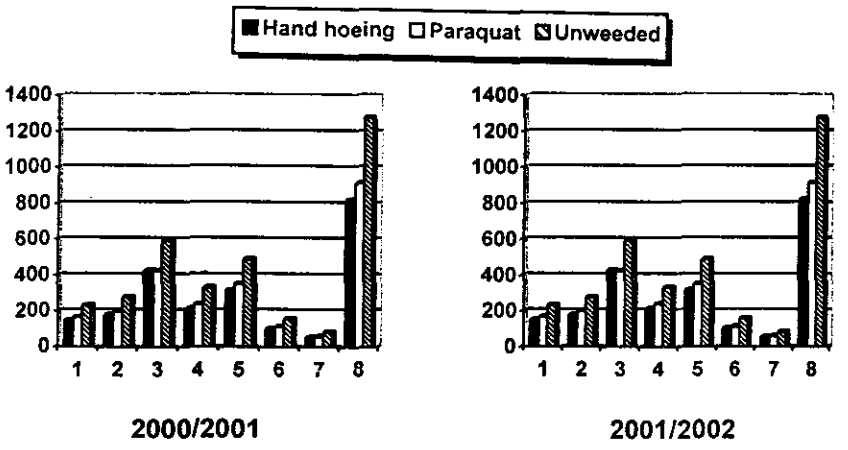

Fig. 1: Averages of fresh weight of total weed (gm/m^2) after 50 days from sowing as affected by the interaction between early pre-planting and after planting weed control treatments in 2000/2001 and 2001/2002 growing seasons

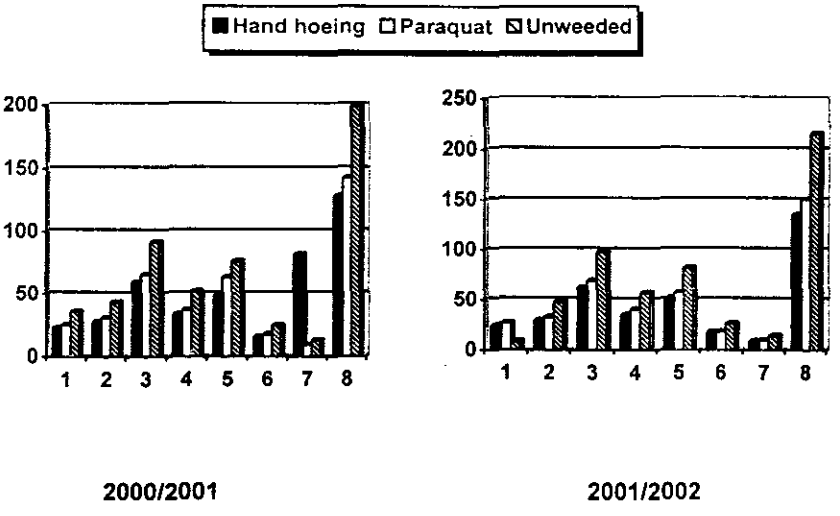

Fig. 2: Averages of dry weight of total weed (gm/m^2) after 50 days from sowing as affected by the interaction between early pre-planting and after planting weed control treatments in 2000/2001 and 2001/2002 growing seasons

1 Butralin
2 Bentazon
3 Fluazifop-butyl
4 Butralin + Bentazon
5 Butralin + Fluazifop-butyl
6 Bentazon + Fluazifop-butyl
7 Hand hoeing
8 Unweeded

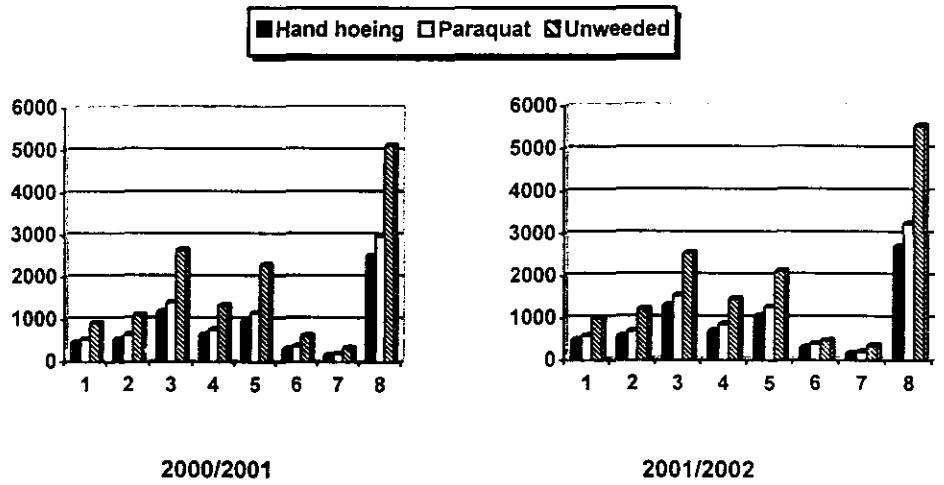

Fig. 3: Averages of fresh weight of total weed (gm/m^2) after 70 days from sowing as affected by the interaction between early pre-planting and after planting weed control treatments in 2000/2001 and 2001/2002 growing seasons

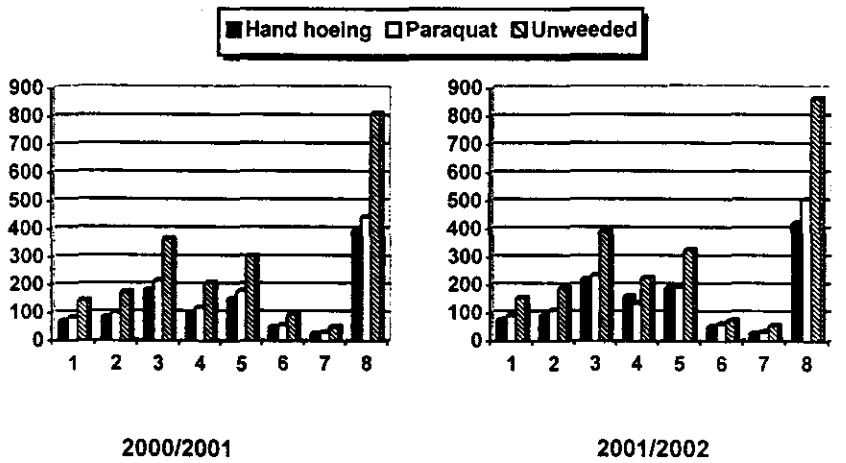

Fig. 4: Averages of dry weight of total weed (gm/m^2) after 70 days from sowing as affected by the interaction between early pre-planting and after planting weed control treatments in 2000/2001 and 2001/2002 growing seasons.

1 Butralin
2 Bentazon
3 Fluazifop-butyl
4 Butralin + Bentazon
5 Butralin + Fluazifop-butyl
6 Bentazon + Fluazifop-butyl
7 Hand hoeing
8 Unweeded

b. Effect of after planting treatments:

Data presented in Tables (3 and 4) indicate that plant height (cm), number of leaves/plant as well as fresh and dry weight of pea plant (gm) were significantly increased as compared with unweeded control as a result of controlling weeds by weed control treatments. Maximum values were obtained by hand hoeing, followed by that of Bentazon + Fluazifop-butyl and Butralin + Fluazifop-butyl treatments. On the other hand, the lowest values was obtained by unweeded control at 50 and 70 days from sowing in both 2000/2001 and 2001/2002 seasons.

Pea plants in the unweeded treatment suffer competition for light, water, minerals and space and this might contribute much for the depression in growth of pea plants. On the contrary, elimination of weeds minimized the weed competition for pea plants and this, in turn, improved the growth of pea plant. This conclusion explains the positive correlation between the excellent efficiency of hand hoeing treatment in controlling pea weeds and its obtained superiority in growth characters of pea plants. Similar results on the harmful effect of weeds on growth characters were recorded by Hassan (1991), Hussein (1992) and Ahmed (1999).

c. Effect of interaction:

Data also revealed that there was a significant interaction effect between early pre-planting and after planting weed control treatments on plant height (cm) at 50 and 70 days from sowing in both growing seasons as graphically illustrated in Figs. (5 and 6). The highest values were recorded when pea plots early treated with hand hoeing and subjected latter to hand hoeing. Plant height of this treatment significantly exceeded all treatments in this study and over plant height of unweeded treatment by about 37.60 and 17.86 at 50 days from sowing as well as 28.50 and 21.23 at 70 days from sowing in both seasons, respectively. Unweeded plots produced the lowest values and significantly lower than all applied treatments.

Effective elimination of weeds increased the capacity of pea plants in utilizing the environmental factors i.e. light, water and mineral nutrient in building great amount of metabolites available for building new tissues and this might account for the previous finding.

B. Yield and yield components of pea plants:

Data recorded on yield of pea and its components as affected by early pre-planting and after planting weed control treatments for both seasons are presented in Tables (5 and 6).

a.Effect of early pre-planting treatments:

Data mentioned in Tables (5 and 6) showed that yield and yield components of pea plants were significantly increased by application of early pre-planting treatments as compared with unweeded treatment. The highest values of pod length (cm), fresh weight of pod (gm), number of green pods/plant, weight of 100 green seeds (gm), yield of green pods/plant (gm) and pod yield (ton/fed) where recorded when pea plots were early pre-plating treated with hand hoeing, followed by Paraquat treatment. Whereas, the

Table (3): Averages of plant height (cm), number of leaves/plant as well as fresh and dry weight of pea plant (gm) after 50 days from sowing as affected by different weed control treatments during 2000/2001 and 2001/2002 seasons.

Characters / Treatments	Plant height (cm)		Number of leaves /plant		Fresh weight of plant (gm)		Dry weight of plant (gm)	
	2000/2001	2001/2002	2000/2001	2001/2002	2000/2001	2001/2002	2000/2001	2001/2002
A. Early pre-planting weed control treatments								
Hand hoeing	38.41	37.56	8.25	8.38	10.81	11.00	1.90	1.93
Paraquat	37.59	37.44	8.47	9.19	11.03	11.06	1.94	1.96
Unweeded check	35.78	34.81	7.50	7.59	8.66	8.88	1.52	1.54
F-Test	**	**	**	**	**	**	**	**
LSD 5%	0.83	1.78	0.26	0.58	0.64	1.04	0.11	0.18
1%	1.25	2.70	0.39	0.88	0.97	1.58	0.16	0.28
B. After planting weed control treatments								
Butralin	37.08	36.00	7.92	8.17	9.83	10.42	1.72	1.83
Bentazon	37.25	37.00	8.25	8.42	9.83	10.33	1.73	1.81
Fluazifop-butyl	36.83	36.17	8.00	8.33	9.58	10.00	1.68	1.75
Butralin + Bentazon	37.25	36.33	8.25	8.50	10.75	10.33	1.89	1.81
Butralin + Fluazifop-butyl	38.83	37.83	8.50	8.58	10.83	11.17	1.90	1.96
Bentazon+ Fluazifop-butyl	39.08	37.83	8.75	9.00	11.17	11.00	1.96	1.99
Hand hoeing	40.92	38.42	8.92	9.25	12.25	11.83	2.15	2.05
Unweeded check	33.50	33.25	6.00	6.83	7.08	7.42	1.24	1.27
F-Test	**	**	**	**	**	**	**	**
LSD 5%	2.09	1.37	0.66	0.61	0.97	1.02	0.18	0.18
1%	2.78	1.82	0.87	0.81	1.29	1.35	0.23	0.24

Table (4): Averages of plant height (cm), number of leaves/plant as well as fresh and dry weight of pea plant (gm) after 70 days from sowing as affected by different weed control treatments during 2000/2001 and 2001/2002 seasons.

Characters / Treatments	Plant height (cm)		Number of leaves /plant		Fresh weight of plant (gm)		Dry weight of plant (gm)	
	00/2001	2001/2002	00/2001	2001/2002	00/2001	2001/2002	00/2001	2001/2002
A. Early pre-planting weed control treatments								
Hand hoeing	56.38	59.00	18.38	17.44	32.47	32.50	5.70	5.74
Paraquat	55.06	55.78	19.22	21.25	33.03	33.59	5.80	5.85
Unweeded check	52.21	53.34	12.63	13.28	20.09	21.88	3.52	3.84
F-Test	**	**	**	**	**	**	**	**
LSD 5%	0.64	1.41	1.12	1.31	2.06	1.33	0.37	0.23
1%	0.97	2.13	1.70	1.98	3.12	2.01	0.57	0.35
B. After planting weed control treatments								
Butralin	54.67	56.08	15.67	16.25	28.17	29.50	4.94	5.18
Bentazon	53.50	56.92	16.25	16.33	29.83	30.25	5.23	5.31
Fluazifop-butyl	52.42	53.92	15.83	16.08	22.67	26.83	3.98	4.71
Butralin + Bentazon	55.00	56.08	16.67	16.08	29.92	30.17	5.25	5.29
Butralin + Fluazifop-butyl	56.08	57.33	18.50	19.67	31.17	31.08	5.47	5.45
Bentazon+ Fluazifop-butyl	56.17	57.50	18.50	19.75	31.33	31.17	5.50	5.47
Hand hoeing	61.33	60.75	20.50	20.75	36.00	36.75	6.32	6.45
Unweeded check	47.25	49.75	12.00	13.67	19.17	18.83	3.36	3.30
F-Test	**	**	**	**	**	**	**	**
LSD 5%	2.99	1.80	1.78	1.17	3.04	1.86	0.53	0.32
1%	3.97	2.39	2.36	1.55	4.02	2.46	0.70	0.43

Table (5): Yield component of pea plants as affected by different weed control treatments during 2000/2001 and 2001/2002 seasons.

Characters / Treatments	Pod Length (cm)		Fresh weight of pod (gm)		No. of green seeds/pod		No. of green pods/plant		Weight of 100 green seeds (gm)		Yield of green pods/plant (gm)	
	00/2001	2001/2002	00/2001	2001/2002	00/2001	2001/2002	00/2001	2001/2002	00/2001	2001/2002	00/2001	2001/2002
A. Early pre-planting weed control treatments												
Hand hoeing	10.60	10.95	8.93	8.68	8.01	8.11	7.70	8.25	50.11	50.44	61.05	62.53
Paraquat	10.49	10.89	8.89	8.50	8.13	8.44	7.69	8.21	48.29	49.94	59.80	61.02
Unweeded check	9.66	10.30	7.75	8.09	7.53	7.55	5.51	5.93	47.13	47.37	43.90	47.87
F-Test	**	*	**	*	*	*	**	**	**	**	**	**
LSD 5%	0.17	0.14	0.59	0.38	0.28	0.35	0.50	0.54	0.83	0.88	1.26	1.70
1%	0.26	---	0.89	---	---	---	0.77	0.82	1.25	1.33	1.91	2.58
B. After planting weed control treatments												
Butralin	10.20	10.42	8.17	8.17	7.37	7.97	6.60	6.93	46.16	48.78	53.37	55.33
Bentazon	10.40	10.80	8.37	8.30	7.93	8.07	6.83	7.27	47.16	49.87	55.35	57.33
Fluazifop-butyl	9.77	10.40	8.00	7.80	7.27	7.37	5.93	6.27	44.90	48.28	46.49	47.64
Butralin + Bentazon	10.50	11.10	9.17	8.97	8.17	8.43	7.57	8.30	51.04	50.93	60.24	62.89
Butralin + Fluazifop-butyl	10.40	10.90	8.60	8.77	8.13	8.23	7.10	7.70	49.19	50.26	57.64	61.66
Bentazon+ Fluazifop-butyl	10.60	11.15	9.33	9.20	8.77	8.67	7.77	8.40	51.53	52.38	62.81	64.69
Hand hoeing	10.80	11.60	9.70	9.37	9.20	9.07	8.87	9.47	53.87	53.56	66.73	69.43
Unweeded check	8.67	9.40	6.83	7.07	6.27	6.47	5.07	5.37	44.24	42.60	36.70	37.96
F-Test	**	**	**	**	**	**	**	*_*	**	**	**	**
LSD 5%	0.74	0.75	0.67	0.68	0.59	0.58	0.22	0.60	1.36	1.50	2.05	2.82
1%	0.98	0.99	0.89	0.89	0.79	0.77	0.29	0.80	1.81	1.99	2.71	3.74

Table (6): Yield of pods (ton/fed) and chemical composition of pea seeds as affected by different weed control treatments during 2000/2001 and 2001/2002 seasons.

Characters / Treatments	Pod yield (ton/fed)		Protein %		Phosphorus %		Potassium %	
	00/2001	2001/2002	00/2001	2001/2002	00/2001	2001/2002	00/2001	2001/2002
A. Early pre-planting weed control treatments								
Hand hoeing	4.64	4.69	23.49	24.24	0.342	0.330	1.75	1.72
Paraquat	4.49	4.58	23.28	23.89	0.332	0.320	1.72	1.69
Unweeded check	3.30	3.59	21.94	23.00	0.295	0.279	1.67	1.64
F-Test	**	**	**	**	**	**	*	*
LSD 5%	0.11	0.07	0.65	0.41	0.009	0.016	0.049	0.044
1%	0.17	0.10	0.90	0.62	0.013	0.024	----	----
B. After planting weed control treatments								
Butralin	4.01	4.15	22.40	23.30	0.303	0.287	1.67	1.65
Bentazon	4.15	4.32	22.57	23.43	0.313	0.297	1.69	1.67
Fluazifop-butyl	3.65	3.58	22.10	23.20	0.287	0.270	1.64	1.61
Butralin + Bentazon	4.52	4.72	23.36	23.83	0.333	0.322	1.72	1.70
Butralin + Fluazifop-butyl	4.33	4.62	23.37	24.17	0.345	0.333	1.76	1.74
Bentazon+ Fluazifop-butyl	4.71	4.85	23.77	24.43	0.357	0.350	1.79	1.78
Hand hoeing	5.01	5.21	24.13	24.80	0.372	0.365	1.83	1.81
Unweeded check	2.76	2.85	21.50	22.50	0.273	0.253	1.58	1.53
F-Test	**	**	**	**	**	**	**	**
LSD 5%	0.13	0.13	0.71	0.74	0.015	0.014	0.058	0.093
1%	0.17	0.18	0.94	0.99	0.020	0.019	0.077	0.070

highest value of number of green seeds/pod was obtained from Paraquat treatment followed, by hand hoeing treatment. Data also revealed that hand hoeing treatment increased pod yield by 40.61 and 30.64% in both seasons as compared with unweeded treatment. In this respect, Paraquat treatment increased pod yield by 36.06 and 27.58% in both seasons, respectively. On the contrary, the lowest values of yield and yield components were obtained when pea plots were unweeded.

b. Effect of after planting weed control treatments:

Data recorded in Tables (5 and 6) demonstrate clearly that elimination of weeds by hand hoeing and herbicides markedly increased pod length (cm), fresh weight of pod (gm), number of green seeds/pod, number of green pods/plant, weight of 100 green seeds (gm), yield of green pods/plant (gm) and pod yield (ton/fed) as compared with the unweeded treatment in both seasons. Hand hoeing recorded the highest values of the previously mentioned characters, followed by Bentazon + Fluazifop-butyl, Butralin + Bentazon and Butralin + Fluazifop-butyl treatments. They significantly increased pod yield over the unweeded check by 81.5, 70.7, 63.8 and 56.9% in 2000/2001 season, respectively. The corresponding increases in 2001/2002 season were 82.8, 70.2, 65.6 and 62.1%. The superiority of these treatments in producing high pod yield might be due to their high efficiency in controlling broad spectrum of weeds without damage to pea plants. This reduced the competitive effect of weeds and led to the gain in pod yield. Similar results on the enhancing effect of hand hoeing and herbicides on yield and yield components of pea plants were reported by Gogoi *et al.* (1991a); Gogoi *et al.* (1993); Leela (1993); Rasmussen (1993); Radeva (1995); Tagic (1995); Mishra and Bhan (1997) and Anyszka *et al.* (1999).

Pea plants in the unweeded treatment suffer competition for light, water, minerals and space and this might contribute much for the depression in growth, yield and yield components of pea plants. So, weeds grown with pea plants significantly reduced pod yield in the unweeded treatment by 44.9 and 45.3% in both seasons, respectively as compared with hand hoeing treatment. The findings are in good agreement with those of (Singh *et al.*, 1986; Gogoi *et al.*, 1991b; Mishra and Bhan, 1997; Vaishya *et al.*, 1999 and El-Kholi and El-Metwally, 2002).

c. Effect of interaction:

Number of green pods/plant and pod yield were significantly affected by the interaction between early pre-planting and after planting weed control treatments in both 2000/2001 and 2001/2002 seasons as shown in Figs. (7 and 8).

Early elimination of weeds with Paraquat or hand hoeing before planting followed with hand hoeing gave the highest number of green pods/plant as compared with other weed control treatments under investigation for both seasons.

Results also cleared that pod yield was significantly affected by the interaction, whereas early elimination of weeds with hand hoeing followed with hand hoeing or Bentazon + Fluazifop-butyl gave the significantly highest number of green pods/plant and pod yield (ton/fed)over all other treatments in

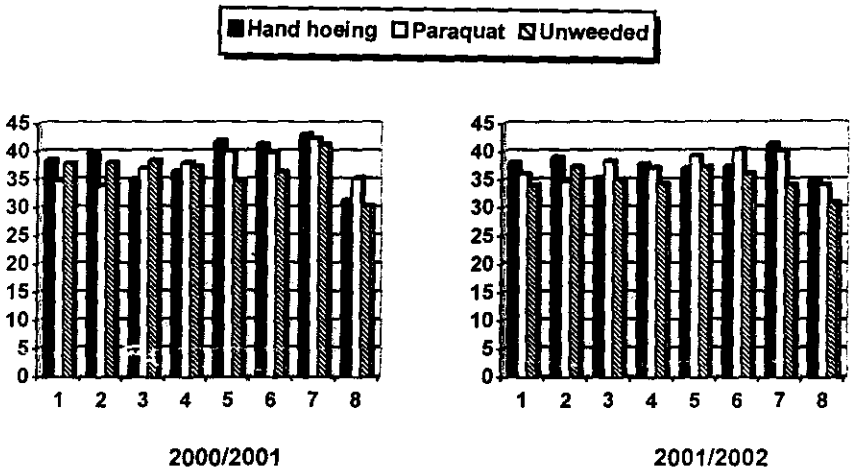

Fig. 5: Averages of plant height (cm) after 50 days from sowing as affected by the interaction between early pre-planting and after planting weed control treatments in 2000/2001 and 2001/2002 growing seasons.

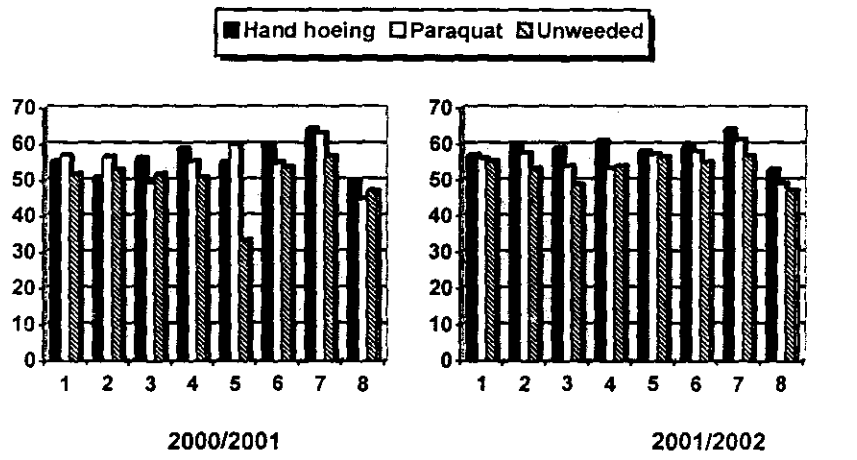

Fig. 6: Averages of plant height (cm) after 70 days from sowing as affected by the interaction between early pre-planting and after planting weed control treatments in 2000/2001 and 2001/2002 growing seasons.

1 Butralin
2 Bentazon
3 Fluazifop-butyl
4 Butralin + Bentazon
5 Butralin + Fluazifop-butyl
6 Bentazon + Fluazifop-butyl
7 Hand hoeing
8 Unweeded

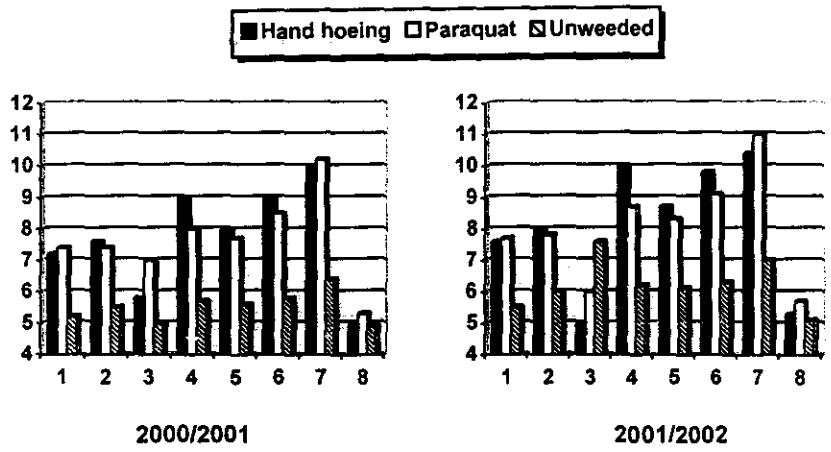

Fig. 7: Number of green pods/plant as affected by the interaction between early pre-planting and after planting weed control treatments in 2000/2001 and 2001/2002 growing seasons.

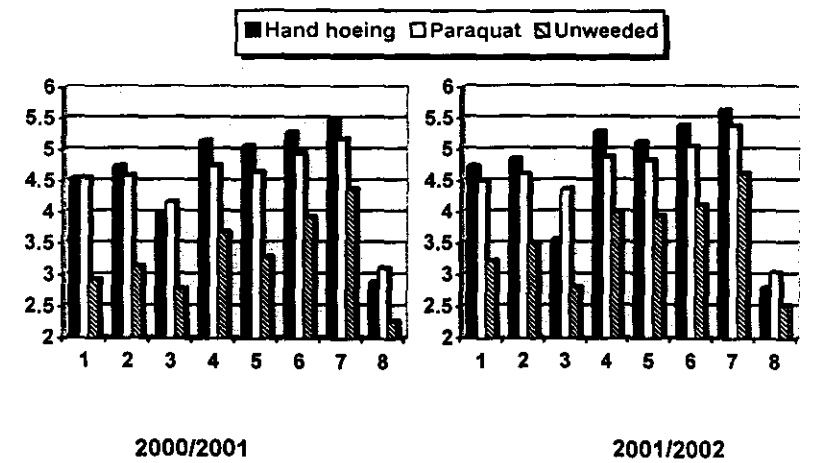

Fig. 8: Pod yield (ton/fed) as affected by the interaction between early pre-planting and after planting weed control treatments in 2000/2001 and 2001/2002 growing seasons.

1 Butralin
2 Bentazon
3 Fluazifop-butyl
4 Butralin + Bentazon
5 Butralin + Fluazifop-butyl
6 Bentazon + Fluazifop-butyl
7 Hand hoeing
8 Unweeded

both seasons. On the other side, unweeded plots gave the lowest values of number of green pods/plant and pod yield (ton/fed).

From the above-mentioned data, one could deduce the importance of early elimination of weed seedlings, which customly emerged after the common false irrigation. Light hand hoeing or Paraquat at 1.0 L/fed are sufficient to destroy germinated weed seedlings and enhanced the efficiency of chemical and mechanical weed control treatments used latter.

C. Chemical composition of pea seeds:

Data presented in Table (6) show that the effect of early pre-planting and after planting weed control treatments on chemical composition of pea seeds in both 2000/2001 and 2001/2002 seasons.

a. Effect of early pre-planting treatments:

Results in Table (6) indicate that early pre-planting treatments had significant effect on percentages of protein, phosphorus and potassium of pea seeds as compared with unweeded treatment. Data also clear that the highest values were achieved by hand hoeing treatment, followed by Paraquat treatment in both seasons. On the other side, the lowest value was recorded when pea plots were unweeded. In this connection, Hassan (1991) found that early pre-planting weed control with Paraquat or hoeing had no significant effect on percentages of chemical composition of soybean seeds.

b. Effect of after planting weed control treatments:

Data in Table (6) indicated that all weed control treatments caused significant increases in percentages of protein, phosphorus and potassium over the unweeded check. The highest values were observed from hand hoeing treatment, followed by that of Bentazon + Fluazifop-butyl, Butralin + Fluazifop-butyl and Butralin + Bentazon treatments, respectively in both 2000/2001 and 2001/2002 growing seasons whereas, the lowest values were recorded from unweeded check.

Unweeded plots showed the lowest values of chemical composition of pea seeds. High infestation of weeds in unweeded plots reduced the amounts of elements observed by pea plants and reduced crop capacity in utilizing other environmental factors and this, in turn, decreased total amounts of protein, phosphorus and potassium yielded from pea seeds. These results were in harmony with those obtained by Ahmed *et al.* (2001); El-Metwally and Ahmed (2001) and Radawan and Hussein (2002).

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J. Agric. Sci. Mansoura Univ., 28 (2), February, 2003

إستجابة نباتات البسلة لبعض معاملات مكافحة الحشائش

إبراهيم محمد المتولى و سامية أمين سعد الدين
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أجريت تجربتان حقليتان بمزرعة المركز القومى للبحوث بشلقان محافظة القليوبية خلال موسمى ٢٠٠٠/٢٠٠١ و ٢٠٠١/٢٠٠٢ لدراسة إستجابة نباتات البسلة لبعض معاملات مكافحة الحشائش قبل الزراعة (العزيق مرتين ، الباراكويت والمقارنة) وبعد الزراعة (البنتازون ، البيوترالين ، الفلوزيفوب-بيوتيل ، البيوترالين + البنتازون ، البيوترالين + الفلوزيفوب-بيوتيل ، البنتازون + الفلوزيفوب-بيوتيل ثم العزيق مرة واحدة والمقارنة) ويمكن تلخيص أهم النتائج فيما يلى :

أظهرت جميع معاملات مكافحة الحشائش نقصاً معنوياً فى الوزن الغض والجاف للحشائش العريضة والضيقة والوزن الكلى بعد ٥٠ و ٧٠ يوم من الزراعة . وقد أعطى العزيق اليدوى قبل الزراعة أفضل مكافحة للحشائش العريضة والضيقة والكلية خلال موسمى الدراسة . وكذلك أعطى العزيق اليدوى بعد الزراعة أفضل مقاومة للحشائش العريضة والكلية بينما أعطى الفلوزيفوب-بيوتيل بعد الزراعة أفضل مكافحة للحشائش الضيقة خلال موسمى الدراسة.

أدى إستخدام العزيق اليدوى قبل الزراعة إلى زيادة معنوية لصفات طول النبات بعد ٥٠ ، ٧٠ يوم من الزراعة وطول القرن والوزن الغض للقرن وعدد قرون النبات ووزن ١٠٠ بذرة ومحصول القرون للنبات والمحصول الكلى (طن/فدان) والتركيب الكيماوى للبذور . بينما أدى استخدام الباراكويت قبل الزراعة إلى زيادة معنوية لصفات عدد أوراق النبات والوزن الغض والجاف للنبات بعد ٥٠ ، ٧٠ يوم من الزراعة وعدد البذور للقرن بالمقارنة بالعزيق اليدوى والكنترول.

أوضحت النتائج أيضاً أن جميع معاملات مكافحة الحشائش المستخدمة كان لها تأثير معنوى على صفات النمو والمحصول ومكوناته والتركيب الكيماوى للبذور . وقد حقق العزيق اليدوى يليه معاملة البنتازون + الفلوزيفوب-بيوتيل افضل النتائج.

أدى التفاعل بين معاملات الحشائش قبل وبعد الزراعة زيادة معنوية فى بعض الصفات تحت الدراسة حيث أدى استخدام العزيق اليدوى قبل وبعد الزراعه إلى الحصول على أقل وزن غض وجاف للحشائش الكلية بعد ٥٠ و ٧٠ يوم من الزراعة خلال موسمى الدراسة وكذلك أعطى أفضل النتائج بالنسبة لطول نباتات البسلة والمحصول الكلى (طن/فدان) تليها معاملة الباراكويت قبل الزراعة ، البنتازون + الفلوزيفوب-بيوتيل بعد الزراعة على التوالى بالمقارنة ببقية المعاملات بينما أدى إستخدام الباراكويت قبل الزراعة والعزيق اليدوى بعد الزراعة إلى الحصول على أعلى القيم بالنسبة لعدد قرون النبات خلال موسمى الدراسة.