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Evaluations of Weed Control Treatments on Broomrape, Annual Weeds, and Productivity of Pea Crop

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ABSTRACT

This study was conducted in Sakha Agricultural Research Station, to evaluate the effect of five weed control treatments (Stomp, 1.7 L fed^{-1} + Fusilade forte, 1.4 L fed^{-1} + Round up, 0.04 L fed^{-1}), (Amex, 2.5 L fed^{-1} + Fusilade forte, 1.4 L fed^{-1} + Round up, 0.04 L Fed^{-1}), (Alfagran, 0.5 L fed^{-1} + Fusilade forte, 1.4 L fed^{-1} + Round up, 0.04 L fed^{-1}), (Alfagran, 0.5 L fed^{-1} + Select super, 0.25 L fed^{-1} + Round up, 0.04 L fed^{-1}), (Hand hoeing twice to annual weeds at 30 and 50 days after sowing (DAS) and hand pulling to broomrape twice at 70 and 90 DAS) and weedy check, on annual weeds, broomrape, yield and its components in peas during 2020/2021 and 2021/2022 seasons. Results illustrated that all weed control treatments decreased significantly the annual weeds and broomrape growth and increased significantly yield and its components. The lowest percentage of broomrape growth was obtained by Round up at 0.04 L. /fed., twice after (45 and 60 days from sowing) in both seasons compared with weedy check treatment. These results indicated that in heavily infested soil with weeds and broomrape, uses the weed control treatments (Alfagran + Select Super + Round up) (Alfagran + Fuselied Forte + Round up) or (Amex + Fuselied Forte + Round up) or (Stomp + Fuselied Forte + Round up) which recorded best the annual weeds and broomrape control and increase of pea seeds yield (ton/fed), and the highest values of the economic criteria.

Keywords: broomrape, pea, annual weeds, herbicides and glyphosate

INTRODUCTION

Peas (*Pisum sativum* L.) are considered one of the most important sources of protein, carbohydrates, vitamins and minerals in many countries and it has a role in the Egyptian economy as an export crop. It can grow through different types of soil ranging from light sandy loom to heavy clay in texture. The total cultivated green pea area was 42502 feds with a mean production of 2.20-ton fed.$^{-1}$ (the yearly book of economics and statistics of Ministry of Agric. in Egypt, 2021).

Broomrape (*Orobanche crenata*) is an obligate root parasitic weed globally, it significantly reduces the qualitative and yield attributes of a pea. The efficient control of broomrape is very difficult because of its complicated parasitic nature Fawad *et al*. (2022). Depending on the host crop, yield loss can almost result in the complete loss of the crop, as in the case of peas (Rubiales *et al.*, 2003). Broomrape in pea fields can reduce yield by 46-50 % (Ismail and Fakkar, 2008). the best *Orobanche* control in peas (*Pisum sativum*, L.) was obtained by spraying glyphosate twice in January or February Jacobsohn and Kelman, (2017). Application of glyphosate twice at a rate of 8.2 g a.i./ ha, gave a 97.8% reduction of broomrape and increased bean seed yield by 141.5 %, compared to untreated plots (El-Metwally *et al.*, 2013). The best broomrape control and increased pea seed yield (t/ha), glyphosate (6.35 g a.i./ha) should be sprayed twice. Dawood *et al*. (2019)

Weeds are considered the most important problem in plant-producing, as the presence of weeds causes a reduction in yield by up to 40% Khaffagy *et al*. (2022). Weed control plays an important role in increasing the productivity of crops. Weed control treatments (Bazagran by 750 cm fed^{-1} + Fusilade super by 1.5 L fed^{-1} + Orban by 0.2 L fed^{-1}) reduced the dry weight of annual weeds, number and dry weight of broomrape spikes compared with the untreated plots Ismail and Fakkar, (2008). Pre-emergence herbicides are the most commonly used in green pea cultivation because they eliminate competition between a crop plant and weeds even during the critical early growth stage (Wagner and Nadasy, 2006). The use of (Fusilade, S + Alfagran) and hand hoeing after 30 and 45 days after sowing decreased the dry weight of grassy, broad-leaved and total weeds, while, increasing plant height, 100-green seeds weight and seed yield (kg fed.$^{-1}$) compared with un weeded treatment El-Dakkak *et al.*, (2010). Weed control treatments (butralin at 2.0 L fed.$^{-1}$ + hand hoing) reduced the dry weight of grassy, broad-leaved, and total weeds, and increased pea yield by 76.9 % as compared with untreated control Khaffagy and Kasem (2016). Stomp-extra, Amex, Basagran and hand-hoeing-twice decreased dry-weight of total weeds compared with untreated. Results concluded that pea's productivity is greatly affected by competition with weeds Mousa, *et al*, (2022). Farmers can enhance weed management strategies by using weed control and a seeding rate at 60kg/feddan, as a weed-control-method for sustainable production toward increasing yield and income.

The aim of the current study was to estimate the role of weed control treatments in the control of broomrape,

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annual weeds and pea productivity under Kafr El-Sheikh Governorate conditions.

MATERIALS AND METHODS

During the 2020/ 2021 and 2021 /2022 winter seasons, At Sakha Agricultural Research Station, Kafr El-Sheikh Governorate Egypt two field experiments were conducted. This experiment was carried out to study the effectiveness of some weed control treatments on broomrape, annual weeds, peas growth and yield. The local seed peas *(Pisum sativum* L.) variety Indian Master B at a rate of 48 kg fed.$^{-1}$, The previous crop was rice. The peas were sowing November 1st and 25th in two seasons respectively. The experimental unit consisted of five rows, 0 .7 m wide and 6.0 m long, making an area of 21.0 m^2. Hills were 25 cm apart and contained whole cold stored locally produced peas seeds. Harvesting was accomplished 120 days from sowing in both seasons. Phosphorus fertilizer (calcium super phosphate P_2O_5) was applied at once in 30 units of P_2O_5 Fed.$^{-1}$, during sowing. Nitrogen fertilizer was added in 40 units N Fed.$^{-1}$, in three equal doses, the first one was added at planting in the form of ammonium sulphate and potassium fertilizer was added in 48 units of K_2O Fed.$^{-1}$, in the form of potassium sulphate, after 60 days from sowing. All other agricultural practices for peas production were carried out as common in this area. The experiment treatments were conducted in a Randomize complete block design with four replicates. The weed control treatments were Randomly arranged in the plots as follows:

1. Stomp Extra 45.5 % CS (pendimethalin) at the rate of 1.7 L fed.$^{-1}$ applied after sowing and before irrigation + Fusilade forte 15 % EC (fluazifop-p-butyl) at the rate of 1.4 L fed.$^{-1}$ applied at 30 days after sowing (DAS) + Round up 48% WSC (glyphosate) at the rate 0.04 L Fed.$^{-1}$ applied at 45 and 60 (DAS).
2. Amex 48% EC (butralin) at the rate of 2.5 L fed.$^{-1}$ applied after sowing and before irrigation + Fusilade forte 15 % EC at the rate of 1.4 L fed.$^{-1}$ applied at 30 (DAS) + Round up 48% WSC at the rate 0.04 L Fed.$^{-1}$ applied at 45 and 60 (DAS).
3. Alfagran 48% AS (bentazon) at the rate of 0.5 L fed.$^{-1}$ applied at 21 (DAS) + Fusilade forte 15 % EC at the rate of 1.4 L fed.$^{-1}$ applied at 30 (DAS) + Round up 48% WSC at the rate 0.04 L Fed.$^{-1}$ applied at 45 and 60 (DAS).
4. Alfagran 48% AS (bentazon) at the rate of 0.5 L fed.$^{-1}$ + Select super 12.5 % EC (Clethodium) of 0.25 L fed.$^{-1}$ applied at 30 (DAS) + Round up 48% WSC at the rate 0.04 L Fed.$^{-1}$ applied at 45 and 60 (DAS).
5. Hand hoeing twice to annual weeds at 30 and 50 (DAS) and hand pulling to broomrape twice at 70 and 90 (DAS).
6. Weedy check (control).

The herbicides were applied by using a knapsack sprayer CP_3 with a volume of 200 L fed.$^{-1}$ of water. Table (1) shows the trade, common and chemical names of the herbicides.

Table 1. Trade, common and chemical names of the herbicides used in this study.

Trade name	Common name	Chemical name
Stomp Extra 45.5 % CS	pendimethalin	*N*-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine
Amex 48 % EC	Butralin	4-(1,1-dimethylethyl)-*N*-(1-methylpropyl)-2,6-dinitrobenzenamine
Fusilade forte 15 % EC	fluazifop-p-butyl	butyl(*R*)-2-[4-[[5-(trifluoromethyl)-2-pyridinyl] oxy] phenoxy] propanoate
Alfagran 48 % AS	Bentazone	3-(1-methylethyl)-1*H*-2,1,3-benzothiadiazin-4(3*H*)-one 2,2-dioxide
Select super 12.5 % EC	Clethodium	[2-[1-[[(3-Chloro-2-propen-1-yl) oxy] amino] propyl]-5-[2-(ethylsulfonyl) propyl]-3,5-dihydroxy-2-cyclohexen-1-one]
Round up 48 % WSC	Glyphosate	*N*-(phosphonomethyl)glycine

Data recorded:

1) On broomrape:

At harvest, five guarded broomrape spikes were randomly hand-pulled from each subplot to determine:

- Broomrape spike length.
- Number and dry weight (g) of broomrape spikes plant^{-1}
- Number and dry weight (g) of broomrape spikes m^{-2}.

The dry weight of broomrape was determined after 48 hours of drying in a forced draft oven at 70º C**.**

2) On annual weeds:

At 70 and 90 days after sowing the peas, weeds were hand-pulled from one square meter in each plot randomly. The annual weeds were identified into species and classified into broad-leaved, grassy, and total weeds. The fresh weight of each species was determined as (g m^{-2}). The dominant weed species in the experimental plots in both seasons were listed in Table (2)

Table 2. Scientific, English and family names for weed-accompanied pea crops in the experimental sit during the 2020/2021 and 2021/2022 seasons.

Weed types	Scientific name	English name	Family name
Broad- Leaved weeds	*Beta vulgaris, L.*	Sea beet	Chenopodiaceae
	Coronopus squamatus	Water Cress	Cruciferae.
	Anagallis aravensis	Scarlet Pimpernel	Primulaceae
	Medicago polymorpha	Toothed medic	Leguminosae
	Sonchus oleraceus	Sow thistle	Asteraceae
	Rumex dentatus	Dentated Dock	Polygonaceae
	Malva parviflora	Cheese – weed, mallow	Malvaceae
	Euphorbia helioscopia L.	Sun spurge	Euphorbiaceae
Grassy weeds	*Phalaris minor L.*	Lesser Canary grass	Poaceae
Parasitic weeds	*Orobanche crenata*	Broomrape	Orobanchaceae

3) On yield and its components:

At harvest, 10 guarded peas plants were hand-pulled Randomly from each plot to determine:

- Plant height (cm).
- Dry Weight of plant branch (g).
- The number of pods plant^{-1}.
- The dry weight of pods plant^{-1} (g).
- The number of seeds pod^{-1}.
- 100-seed weight (g).
- Seed yield (ton/ fed.) from the whole plot.

4) Chlorophyll Content:

Chlorophyll a and b as Mg/ml at 30 days from herbicide application was determined where approximate ratios of 1: 100 (w/v) for fresh pea leaves and N: N-dimethyl formamide, respectively, the plant material were placed in N: N- dimethyl formamide and saved in the refrigerator overnight and determined spectrophotometrically at the two wavelengths 664 and 647 according to Moran (1982), as follow:

$$\textbf{Chl a} = 12.64\ A_{664} - 2.99\ A_{647}$$

$$\textbf{Chl b} = -5.6\ A_{664} + 23.26\ A_{647}$$

Where, A664: the absorbance at wave length 664; A647: the absorbance at wave length 647

5) On NPK uptake:

The percentage of total nitrogen, phosphorus and potassium was determined on the dry ground material of pea seeds which were digested in a mixture of sulfuric acid, salicylic acid and hydrogen peroxide (Jackson, 1958). The Kjeldahl method was used to determine total nitrogen content (Rangnna, 1979). The percentage of Phosphorus and Potassium in pea seeds was determined according to Cottenie *et al.* (1982).

6) Protein content:

After harvest, Samples of seeds were Randomly taken to determine the protein content. A known weight of the finally powered seeds (0.19) was digested using the microkjeldahl method, according to AOAC (1990).

7) Correlation study:

The simple correlation matrix was carried out for the two seasons to investigate the relationship between the dry weight of broomrape, total weeds, pea seed yield and its components according to Steel and Torrie (1980).

8) Economic evaluation:

An economic evaluation of weed control treatments was described by (Cimmyt, 1988)

- Total income seed yield = seed yield (Kg/fed) X price of Kg
- Net income (NI) = Gross income – Total costs.
- Profitability (P) = (Net income/ Total costs) X 100
- Benefit/ costs Ratio (B/C) = Gross income/ Total costs.

9) Statistical analysis :

The obtained data were subjected to proper statistical analysis of variance according to the method described by Snedecor and Cochran (1980). The least significant difference (LSD) at a 5% level of significance was calculated.

RESULTS AND DISCUSSION

Effect of Weed control treatments:

On broomrape:

Data recorded in Table (3) showed that all broomrape control treatments decrease significantly spike length (cm), number of spikes plants^{-1}, dry weight (g) of spikes plants^{-1}, number of spikes m^{-2} and dry weight of spikes (g m^{-2}) of broomrape weed in both sowing seasons. (Stomp at 1.7 L fed.$^{-1}$ + fusilade forte at 1.4 L fed.$^{-1}$ + Round up at 0.04 L fed^{-1}), (Amex at 2.5 L fed.$^{-1}$ + fusilade forte + Round up), Alfagran at 0.5 L fed.$^{-1}$ + fusilade forte + Round up), (Alfagran + Select super at 0.25 L fed.$^{-1}$ + Round up) and (Hand pulling twice) decreased dry weight of spike (g m^{-2}) of broomrape by 78.04, 75.60, 77.43, 79.87 and 70.73 %in the first season and by 75, 73.25, 74.41, 76.16 and 67.44 %, in the second season respectively, as compared with weedy check treatment. This effect is due to that Round up translocates to the tubercles of broomrape during an underground stage, so it makes early effects. On the other hand, size treatments have little effect increased the broomrape characters as compared to Round up treatment. These results are in agreement with Dawood *et al*., (2019) who indicated that for best broomrape control and increased pea seed yield (t/ha), glyphosate (6.35 g a.i./ha) should be sprayed twice.

Table 3. Effect of weed control treatments on broomrape growth in 2020 / 2021 and 2021/ 2022 seasons

Weed control treatments	Rate L fed^{-1}	Broomrape spike Length (cm)		No. broomrape spike plant^{-1}		Dry weight of broomrape spike (g) plant^{-1}				No. broomrape spike m^{-2}		The dry weight of broomrape (g m^{-2})	
		2020/21	2021/22	2020/21	2021/22	2020/21	% Reduction	2021/22	% Reduction	2020/21	2021/22	2020/21	2021/22
Stomp+Fusilade forti +Round up	1.7+1.4+0.04	9.1	10	1.3	2	3.6	78.04	4.3	75	7.1	8	20.5	24
Amex+Fusilade forte +Round up	2.5+1.4+0.04	9.2	10.3	1.4	2	4	75.60	4.6	73.25	7.6	8.4	22	25.3
Alfagran+Fusilade forte +Round up	0.5+1.4+0.04	9.4	10.3	1.3	2	3.7	77.43	4.4	74.41	7.4	8.2	21.4	24.6
Alfagran+Select super +Round up	0.5+0.25+0.04	9	10	1.2	1.8	3.3	79.87	4.1	76.16	7	7.8	20.2	23.5
Hand pulling	twice	10.7	11.6	1.7	2.4	4.8	70.73	5.6	67.44	9.8	11	28.3	32.7
Weedy check	-	37.6	48.5	5.3	7.5	16.4	0	17.2	0	36	39.6	118.2	133.2
LSD $_{0.05}$		2.45	2.4	0.36	0.42	1.16		1.21		2.45	2.42	8.44	8.2

On annual weeds (g m^{-2}):

Data in Table (4) show that all weed control treatments gave a significant reduction in the fresh weight of grassy weeds g m-^{2} in both seasons. In the first season reduction percentages of fresh weight of total weeds by Alfagran + Select Super + Round up, Alfagran + Fusilade forte + Round up, Stomp + Fusilade forte + Round up, Amex + Fusilade Forte + Round up, and hand hoeing twice were 87.43, 87.07, 88.36, 89.16 and 81.41 %, and 81.87, 81.17, 80.59,81.27 and 77.8% respectively as compared with the weedy cheek plots in 1st and 2nd surveys in the first season and 87.58, 87.47, 88.23, 89.59 and 81.14%, and

82.34, 81.66, 81.10, 81.77 and 77.79 in the second season. Additionally, the fresh weight of grassy and broad-leaved weeds exhibited a similar trend. In the first and second seasons, that corresponds to Mousa *et al*, (2022) who showed that Stomp-extra, Amex, Basagran and hand-hoeing-twice decreased dry-weight of broad-leaved.

Table 4. Effect of weed control treatments on fresh weight of annual weeds (g m^{-2}) at 70 and 90 days after sowing in 2020 / 2021 and 2021 / 2022 seasons

Treatments	Rate (L fed^{-1})	Fresh weight of annual weeds (g m^{-2})							
		At 70 days after sowing				At 90 days after sowing			
		Grassy weeds	Broadleaved Weeds	Total weeds	%R	Grassy weeds	Broadleaved weeds	Total Weeds	%R
2020/2021 season									
Stomp+fusilade forte+Round up	1.7+1.4+ 0.04	27.8	147.0	174.8	87.45	252.4	640.6	893.0	81.87
Amex+fusilade forte+Round up	2.5+1.4 +0.04	36.9	142.8	179.7	87.07	265.8	661.5	927.3	81.17
Alfagran+fusillade forte+Roundup	0.5+1.4+0.04	44.7	117.2	161.9	88.36	283.7	671.9	955.6	80.59
Alfagran +Select super+Round up	0.5+0.25+0.04	35.8	114.9	150.7	89.16	268.3	653.8	922.1	81.27
Hand hoeing	Twice	49.7	208.8	258.5	81.41	366.3	727.5	1093.8	77.79
Weedy check		261.7	1128.8	1390.5	0	1425.1	3499.2	4924.3	0
LSD 0.05		8.47	9.18	14.54		13.80	172.92	169.66	
The 2021/2022 season									
Stomp+fusilade forte+Round up	1.7+1.4+0.04	31.1	164.7	195.8	87.58	282.7	717.5	1000.2	82.34
Amex+fusilade forte+Round up	2.5+1.4+0.04	41.2	156.3	197.5	87.47	297.7	740.9	1038.6	81.66
Alfagran +fusilade forte+Roundup	0.5+1.4+0.04	50.1	135.4	185.5	88.23	317.7	752.5	1070.2	81.10
Alfagran +Select super+Round up	0.5+0.25+0.04	40.2	123.9	164.1	89.59	300.4	732.2	1032.6	81.77
Hand hoeing	Twice	57.1	240.1	297.2	81.14	421.2	836.6	1257.8	77.79
Weedy check		308.1	1268.0	1576.1	0	1638.9	4024.1	5663.0	0
LSD 0.05		8.75	15.45	21.69		15.79	198.88	195.14	

%R= Reduction

On yield and its components:

Results presented in Table (5) indicated that weed control treatments (Stomp + Fusilade forte + Round up) and (Amex + Fusilade forte + Round up) gave the highest values of plant height and dry weight of plant branch (g) by (60.98 and 58.13 cm) and (25.57 and 23.75 gm) in the first season and (58.26 and 55.54 cm) and (24.43 and 22.70 gm) in the second season respectively, followed by (Alfagran + Select super + Round up) and (Alfagran + Fusilade forte + Round up). Also, Alfagran + Select super + Round up and Stomp + Fusilade forte + Round up increased the number of pods $plant^{-1}$, dry weight of pods $plant^{-1}$ and number of seed $pods^{-1}$ peas by (16.63 and 16.53), (68.66 and 68.25g) and (7.73 and 7.71) in the first season and (15.89 and 15.80), (65.60 and 65.22g) and (7.39 and 7.36) in the second season respectively. (Alfagran + Select super + Round up) and (Stomp + Fusilade forte + Round up) increased the weight of 100-seed and seed yield (ton/fed) by (19.67 and 20.78%) and (74.4 and 74.01%) in the first seasons and (22.19 and 23.28 %) and (75.0 and 74.71 %) in the second seasons, respectively, as compared with weedy check treatments. The increase in seed yield/fed may be due to the increase of pea growth and yield components namely the number of branches $plant^{-1}$, number of pods $plant^{-1}$, and 100-seed weight, and; due to the decrease in the fresh weight of annual weeds, number and dry weight of broomrape spikes. The previous results are in agreement with those by Zeid and Hemeid (2019) Indicated that, under farmer's field conditions, glyphosate spraying resulted in a clear reduction in the number of emerged spikes from 18 to 49% and the number of photo-assimilates accumulated by the parasite from 1 to 42%, depending on the variety and that was related to the number of sprays applied.

Table 5. Effect of weed control treatments on yield and its components in 2020 / 2021 and 2021 / 2022 seasons.

Weed control treatments	Rate (L $fed.^{-1}$)	Plant height (cm)	The dry weight of plant (g)	No. pods $plant^{-1}$	The dry weight of pods $plant^{-1}$(g)	No. seeds $pods^{-1}$	100-seed weight (g)	Seed yield (ton $fed.^{-1}$)	%I
				2020 / 2021season					
Stomp+fusilade forte+ Round up	1.7+1.4+0.04	60.98	25.57	16.53	68.25	7.71	44.64	1.77	74.01
Amex+fusilade forte+ Round up	2.5+1.4+0.04	58.13	23.75	16.13	66.77	7.52	43.50	1.71	73.09
Alfagran +fusilade forte+ Roundup	0.5+1.4+0.04	56.64	18.76	15.88	66.32	7.17	42.80	1.43	67.83
Alfagran +Select super+ Round up	0.5+0.25+0.04	57.37	21.20	16.63	68.66	7.73	44.02	1.80	74.4
Hand hoeing	Twice	51.30	12.77	9.44	36.41	4.47	36.67	0.74	37.84
Weedy check		38.75	7.80	4.50	16.04	3.70	35.36	0.46	0
LSD 0.05		2.61	1.47	0.91	3.95	0.38	2.07	0.15	
				The 2021/2022 season					
Stomp+fusilade forte+Round up	1.7+1.4+0.04	58.26	24.43	15.80	65.22	7.36	42.65	1.70	74.71
Amex+fusilade forte+Round up	2.5+1.4+0.04	55.54	22.70	15.41	63.79	7.18	41.56	1.63	73.62
Alfagran +fusilade forte+Roundup	0.5+1.4+0.04	54.12	17.93	15.17	63.37	6.85	40.89	1.36	68.38
Alfagran +Select super+Round up	0.5+0.25+0.04	54.81	20.25	15.89	65.60	7.39	42.05	1.72	75.0
Hand hoeing	Twice	47.47	11.82	8.74	33.70	4.14	33.93	0.69	37.68
Weedy check		35.87	7.22	4.17	14.87	3.43	32.72	0.43	0
LSD 0.05		2.44	1.41	0.86	3.73	0.36	1.95	0.14	

%I= Improving

On chlorophyll content:

The results presented in table (6) showed significant differences among the weed control treatments on both chlorophyll a and b at 30 days from the application of herbicides in the two seasons. Regarding weed control treatment, (Stomp+ Fusilade forte+ Round up) and (Amex+ Fusilade forte+ Round up) recorded the highest values of both chl. a (10.38 and 10.03 Mg ml^{-1}) and chl. b (3.73 and 3.34 Mg ml^{-1}) in first season; and (10.00 and 9.08 Mg ml^{-1}) for chl a, and (3.92 and 3.80 Mg ml^{-1}) for chl b, in the second season, respectively. Followed by treatments (Alfagran + Fusilade forte+ Round up) and (Alfagran + Select Super + Round up), while hand hoeing and hand pulling were recorded for chl. a (8.80 and 7.79 Mg ml-1) and chl. b (2.92 and 3.20 Mg ml-1) in the first and second seasons respectively. It gave the lowest values of chlorophyll pigments a and b in the two sowing seasons, as compared to the weedy check treatment, according to Soliman (2016) cleared that different glyphosate treatments showed the least decreased chlorophyll a and b content as compared to uninfested and untreated clover plants.

Table 6. Effect of weed control treatments on chlorophyll content (Mg/g) at 30 days from herbicides application in the 2020/2021 and 2021/2022 seasons

Weed control	Rate	chlorophyll a		chlorophyll b		Total chlorophyll			
Treatments	L $fed.^{-1}$	2020/21	2021/22	2020/21	2021/22	2020/21	I %	2021/22	I%
Stomp + Fusilade+ Round up	1.7+1.4+0.04	10.38	10.00	3.73	3.92	14.11	22.89	13.92	33.48
Amex +Fusilade + Round up	2.5+1.4+0.04	10.03	9.08	3.34	3.80	13.37	18.61	12.88	28.11
Alfagran+Fusilade+Roundp	0.5+1.4+0.04	9.68	8.58	3.30	3.56	12.97	16.10	12.14	23.72
Alfagran+ Select+ Round up	0.5+0.25+0.04	8.96	8.06	3.25	3.54	12.21	10.88	11.60	20.13
Hand hoeing or hand pulling	Twice	8.80	7.79	2.92	3.20	11.72	7.13	10.99	15.72
weedy check		8.36	6.37	2.53	2.89	10.88	0.00	9.26	0.00
LSD $_{0.05}$		0.36	0.35	0.31	0.25	0.67		0.60	

I%= Improving percent of chlorophyll content was calculated concerning control.
(Mg/g) = Content chlorophyll determined by Mg per g in leaves of pea plants

On NPK uptake:

Data in Table (7) indicated that treated pea plants grain by the herbicides and hand hoeing increased uptake NPK elements more than weedy check plants. That may be due to the herbicides used and hand hoeing gave highly effective on depressing weeds species as mentioned before which permits a more available NPK (untreated). So, all weed control treatments exhibited increases in pea yield (ton/fed) accompanied by significant increases in the uptake of three elements of nutrients namely, Nitrogen, Phosphors and Potassium. (Stomp + Fuselied forte + Round up), (Amex + Fuselied Forte + Round up) and (Alfagran+ Select+ Round up) treatments increased nitrogen uptake (Kg/fed) by 99.53, 94.19 and 76.58%, Phosphorus uptake (Kg/fed) by 6.02, 5.74 and 4.68%, and potassium uptake (Kg/fed) by58.46, 54.11 and 42.00 %, respectively, than weedy check treatment. Similar results were obtained by Hussein and Radwan (2002) who discovered that differences calculated in N and P contents of tubers between hand hoeing or half rate of metribuzin herbicide + one hand hoeing application were significant if compared to unweeded check treatment. It could be stated that weeds associated with potato plants may reduce the plant growth and N &P contents of potato tubers, since weeds more competitors for nutrients uptake as compared with domestic plants

Table 7. Effect of weed control treatments on NPK uptake kg $fed.^{-1}$ in pea seeds (combined) analysis in 2020/2021 and 2021/2022 seasons).

Weed control	Rate	Nutrient %			Nutrient uptake (kg $fed.^{-1}$)			Protein	I
Treatments	L $fed.^{-1}$	N	P	K	N	P	K	%	%
Stomp + Fusilade forte + Round up	1.7+1.4+0.04	5.72	0.346	3.36	99.53	6.02	58.46	21.48	47.44
Amex +Fusilade forte + Round up	2.5+1.4+0.04	5.64	0.344	3.24	94.19	5.74	54.11	21.24	46.85
Alfagran+Fusilade forte +Roundp	0.5+1.4+0.04	5.47	0.344	3.00	76.58	4.68	42.00	21.04	46.34
Alfagran+ Select+ Round up	0.5+0.25+0.04	5.52	0.355	3.06	92.18	5.59	51.1	21.00	46.24
Hand hoeing or hand pulling	Twice	5.13	0.301	2.88	36.94	2.18	20.74	19.78	42.92
weedy check		4.57	0.271	2.32	20.57	1.22	10.44	11.29	0.00
LSD $_{0.05}$		0.17	0.02	17.14	17.14	1.82	7.26	0.06	

I%= Improving percent of protein content was calculated concerning control.

Correlation among studied characters and peas yield:

Data presented in Table (8) indicated clearly that simple correlation coefficients between broomrape spikes length, number of broomrape spikes $plant^{-1}$, number of broomrape spikes m^{-2}, Broomrape dry weight (g m^{-2}) and fresh weight of total annual weeds (g m^{-2}) at 70 DAS and peas yield was statistically significant and strongly negative at 5% level. This means that previous broomrape characters were more aggressive in their parasite to seed yield (ton fed^{-1}) of peas. Additionally, correlation analysis showed that the increases in growth characteristics and yield components had a positive impact on the yield increases.

Economic evaluation:

Results in the table (9) showed that the minimum total cost was obtained will all herbicide treatments, compared to hand hoeing and hand pulling twice. However, all herbicide treatments gave the highest values of the studied economic criteria mainly due to the HAD, the criteria flax yield. (Stomp + Fusilade + Round up) and (Alfagran + Select super + Round up) were ranked for increasing the profitability and benefit-cost ratio, by (257.77 and 3.58%) and (283.93 and 3.88%), in the first season, respectively, the following treatments were (Amex+ Fusilade + Round up) and (Alfagran + Select super + Round up) by (238.04 and 3.38%) and (195.09 and 2.95%),

respectively, as compared hand hoeing and hand pulling treatment. As for the second season, the data had the same trend, but the hand hoeing and pulling treatment was very expensive, as the purification is done for annual weeds and broomrape is expensive, so it is necessary to apply integrated weed management in pea crops. On the other hand, using herbicides will result in the highest reduction in total annual weeds and broomrape weeds as well as an increase in pea yield and its components.

Table 8. Correlation coefficient between all studied characters analysis between peas yield and its components in 2020/2021 and 2021/2022 seasons.

Studied characters	No. broomrape spikes plant^{-1}	No. broomrape spikes m^{-2}	Broomrape dry weight (g m^{-2})	Fresh weight of the total Weeds (g m^{-1}) at 70 DAS	Plant height (cm)	The dry weight of plant (g)	No. pods Plant^{-1}	The dry weight of pods plant^{-1}(g)	No. seed pods^{-1}	100 seed weight (g)	Seed yield (ton fed^{-1})
2020/2021 season											
Broomrape spikes length (cm)	0.976**	0.986**	0.982**	0.943**	-0.822**	-0.721**	-0.815**	-0.815**	-0.736**	-0.621**	-0.714**
No. broomrape spikes plant^{-1}		0.988**	0.987**	0.895**	-0.854**	-0.723**	-0.828**	-0.824**	-0.742**	-0.673**	-0.725**
No. broomrape spikes m^{-2}			0.999**	0.911**	-0.844**	-0.734**	-0.824**	-0.820**	-0.743**	-0.655**	-0.724**
Broomrape dry weight (g m^{-2}				0.896**	-0.838**	-0.719**	-0.810**	-0.807**	-0.738**	-0.647**	-0.711**
Fresh weight of total weeds (g m-1) at 70 DAS					-0.769**	-0.742**	-0.834**	-0.830**	-0.752**	-0.609**	-0.729**
Plant height (cm)						0.835**	0.887**	0.881**	0.795**	0.803**	0791**
The dry weight of plant (g)							0.896**	0.880**	0.888**	0.834**	0.885**
No. pods Plant^{-1}								0.980**	0.939**	0.*	0.917**
The dry weight of pods plant^{-1}(g)									0.947**	0.876**	0.923**
No. seed pods^{-1}										0.849**	0.977**
100 seed weight (g)											0.832**
The 2021/2022 season											
Broomrape spikes length (cm)	0.964**	0.971**	0.977**	0.972**	-0.798**	-0.719**	-0.814**	-0.812**	-0.727**	-0.627**	-0.716**
No. broomrape spikes plant^{-1}		0.988**	0.986**	0.912**	-0.842**	-0.727**	-0.824**	-0.818**	-0.738**	-0.680**	-0.722**
No. broomrape spikes m^{-2}			0.998**	0.923**	-0.834**	-0.732**	-0.819**	-0.813**	-0.740**	-0.664**	-0.724**
Broomrape dry weight (g m^{-2}				0.932**	-0.825**	-0.728**	-0.815**	-0.811**	-0.732**	-0.654**	-0.720**
Fresh weight of total weeds (g m-1) at 70 DAS					-0.774**	-0.743**	-0.832**	-0.828**	-0.753**	-0.628**	-0.732**
Plant Height (cm)						0.853**	0.903**	0.898**	0.822**	0.834**	0.817**
Dry weight of plant (g)							0.900**	0.886**	0.894**	0.854**	0.890**
No. pods Plant^{-1}								0.981**	0.944**	0.896**	0.922**
Dry weight of pods plant^{-1}(g)									0.951**	0.897**	0.927**
No. seed pods^{-1}										0.875**	0.978**
100 seed weight (g)											0.857**

Table 9. Effect of weed control treatments on economic evaluation of pea crop in 2020/2021 and 2021/2022 seasons

Weed control Treatments	Rate L fed.$^{-1}$	Total income (L. E./fed)	Total cost (L. E./fed)	Net benefit (L. E./fed)	Benefit-cost ratio (B/C)	Profitability (P)
				2020/2021		
Stomp + Fusilade+ Round up	1.7+1.4+0.04	35400	9895	25506	3.58	257.77
Amex +Fusilade + Round up	2.5+1.4+0.04	34200	10117	24083	3.38	238.04
Alfagran+Fusilade+Roundp	0.5+1.4+0.04	28600	9692	18908	2.95	195.09
Alfagran+ Select+ Round up	0.5+0.25+0.04	36000	9280	26720	3.88	283.93
Hand hoeing or hand pulling	Twice	14800	11950	2850	1.24	23.85
weedy check		9200	8950	250	1.03	2.79
				2021/2022		
Stomp + Fusilade+ Round up	1.7+1.4+0.04	34000	9895	24106	3.436	243.63
Amex +Fusilade + Round up	2.5+1.4+0.04	32600	10117	22483	3.222	222.23
Alfagran+Fusilade+Roundp	0.5+1.4+0.04	27200	9692	17508	2.806	180.64
Alfagran+ Select+ Round up	0.5+0.25+0.04	34400	9280	25120	3.707	270.69
Hand hoeing or hand pulling	Twice	13800	11950	1850	1.155	15.48
weedy check		8600	8950	-350	0.961	-3.91

CONCLUSION

These results reflected the importance of using herbicide treatments (Stomp, 1.7 L fed^{-1} + Fusilade forte, 1.4 L fed^{-1} + Round up 0.04 L fed^{-1}) or (Amex 2.5 L fed^{-1} + Fusilade forte 1.4 L fed^{-1} + Round up 0.04 L Fed^{-1}) or (Alfagran 0.5 L fed^{-1} + Fusilade forte 1.4 L fed^{-1} + Round up 0.04 L fed^{-1}), (Alfagran 0.5 L fed^{-1} + Select super 0.25 L fed^{-1} + Round up 0.04 L fed^{-1}) to control the total annual weeds and broomrape prevailing in pea fields. These practices gave the heights reduction in broomrape and total annual weeds and increased seed yield productivity of pea crop under the conditions of this study.

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تقيم معاملات مكافحة الحشائش علي الهالوك والحشائش الحولية و انتاجية محصول البسلة

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الملخص

أجريت هذه الدراسة بمحطة البحوث الزراعية بسخا، محافظة كفرالشيخ لتقييم تأثير خمس معاملات لمكافحة الحشائش (استومب 1.7 لتر/ف + فيوزيليد فورتي 1.4 لتر/ف+ راوند اب 0.04 لتر/ف)،(أميكس 2.5 لتر/ف + فيوزيليد فورتي 1.4 لتر/ف + راوند اب 0.04 لتر/ف)، (الفاجران0.5 لتر/ف+ فيوزيليد فورتي 1.4 لتر/ف+ راوند اب 0.04لتر/ف) ، (الفاجران0.5 لتر/ف+ سيليكت سوبر0.25 لتر/ف + راوند اب 0.04 لتر/ف) (العزق اليدوي مرتين للحشائش الحولية بعد 30 و 50 يومًا من الزراعة ، نقاوة يدوية للهالوك مرتين بعد 70 و 90 يوم من الزراعة) بالاضافة الي معاملة كنترول وذلك لدراسة تأثير ذلك علي الحشائش الحولية ، الهالوك، المحصول ومكوناته في البسلة خلال موسمي 2020-2021 و 2021-2022. أوضحت النتائج أن جميع معاملات مكافحة الحشائش أدت إلى انخفاض معنوي في نمو الحشائش والهالوك وزيادة معنوية في المحصول ومكوناته. أقل نسبة نمو من الهالوك المحصول تم الحصول عليها بمعاملة راوند اب عند 0.04 لتر / فدان ، مرتين بعد (45 و 60 يوم من الزراعة) في كلا الموسمين مقارنة بمعاملة الكنترول. أشارت هذه النتائج إلى أنه في التربة شديدة الاصابة بالحشائش الحولية والهالوك ، يتم استخدام اي من معاملات مكافحة الحشائش (الفاجران + سيليكت سوبر + راوند اب) أو (الفاجران + فوزيليد فورت + راوند أب) أو (أميكس + فوزيليد فورتي + راوند أب) أو (استومب + فيوزيليد فورتي + راوند اب) التي اظهرت أفضل مكافحة للحشائش السنوية والهالوك وزيادة محصول بذور البسلة (طن/ فدان) ، وأعلى قيم للمعايير الاقتصادية.

الكلمات الداله: الهالوك, البسلة, الحشائش الحولية, مبيدات الحشائش و جليفوسيت