INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH IN MULTIDISCIPLINARY EDUCATION

ISSN(print): 2833-4515, ISSN(online): 2833-4531

Volume 03 Issue 09 September 2024

DOI: 10.58806/ijirme.2024.v3i9n11, Impact factor- 5.138

Page No. 1510 - 1522

Response of Broomrape, Annual Weeds and Pea Crop to Some Weed Control Treatments under Different Sowing Dates

Soliman, I. E.; M. E. Z. Kenapar[1], A.A.H. Sharshar[2]

[1,2] Weed Research Central Laboratory, Agriculture Research Center, Giza, Egypt.

https://orcid.org/0000-0002-7981-4204

ABSTRACT: Two field experiments were carried out on the yield of pea crop in soil naturally infested with annual weeds and broomrape (Orobanche crenata Forsk.), at Sakha Agricultural Research Station, Agricultural Research Center, Egypt, (31°07'N, 30°05'E) latitude. longitude) during the 2022/2023 and 2023/2024 winter seasons. This study was conducted to evaluate the effect of sowing dates (25th October and 25th November) and five weed control treatments on growth, yield components of pea as well as its associated weeds. A split plot design was used with four replicates. The main finding revealed that the studied two factors were dependent, The highest significant reduction percentage on controlling weeds included broomrape was obtained by using either of pea growing in 25th November with weed control treatments (Basagran at 0.5 L fed^{-1}+ Select Super at 0.25 L fed^{-1} + Round up Star at 0.04 L fed^{-1} (twice)), (Alpha Top at 0.5 L fed^{-1} + Fuselied Forty at 1.4 L fed^{-1} + Round up Star at 0.04 L fed^{-1}(twice)) and (Stomp Extra at 1.7 L fed^{-1} + Fuselied Forty at 1.4 L fed^{-1} + Round up Star at 0.04 L fed^{-1} (twice)), on controlling annual weeds, broomrape and on increasing pea yield and its components. The previous respective interactions gave the highest significant increasing values of pea seed yield (ton/fed), and its components in kafr El-Sheikh area.

KEYWORDS: Annual weeds, Broomrape, Pea (Pisum sativum L.), Fusilade forty, Round up Star,Select super, Stomp Extra, Basagran.

INTRODUCTION

Pea (Pisum sativum L.) is considered as one of the important sources of protein, carbohydrates, vitamins and minerals in many countries and it has a role in Egyptian economy as an export crop. It can grow through different types of soil ranging from the light sandy loom to the heavy clay in texture. The total cultivated green pea area was feddans with mean production ton $fed.^{-1}$ (the yearly book of economic and statistics of Ministry of Agric. in Egypt, 2023). In Egypt, broomrape parasite weed caused severe yield reduction in Leguminosae crops such as faba bean and pea. Till now there is no official recommendations to control broomrape in pea**. Abdallah et al., (2021)** indicated that nodules formation in pea was not affected significantly by the herbicides, except pendimethalin and butralin. Furthermore, bentazon had a positive impact on nodules formation and pods quality and could be used effectively for controlling the broadleaf weeds and it was simultaneously a selective and safe herbicide in pea cultivation. 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). Dawood et al., (2022)** indicated that in heavily infested soil with weeds and broomrape, uses the weed control treatments (Alfagran, 0.5 L fed-1 + Select super, 0.25 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) or (Amex, 2.5 L fed-1 + Fusilade forte, 1.4 L fed-1 + Round up, 0.04 L Fed-1) or (Stomp, 1.7 L fed-1 + Fusilade forte, 1.4 L fed-1 + Round up, 0.04 L fed-1) which recorded best the annual weeds and broomrape control and increase of pea seeds yield (ton/fed). Yield loss can be huge as 80 % **(Korashi et al., 1996)**. Broomrape in pea fields can reduce yield by 46-50 % **(Ismail and Fakkar, 2008)**. In Egypt, there is a few studies about the level of broomrape infection and pea yields reduction. **Jacobsohn and Kelman (2017)** indicated that the best Orobanche control in pea (Pisum sativum, L.) was obtained by spraying glyphosate twice in January or February. Application of glyphosate twice at arate of 8.2 g a.i./ ha, gave 97.8% reduction of broomrape and increased bean seed yield by 141.5 %, compared to untreated plots **(El-Metwally et al., 2013). Ismail and Fakkar, (2008)** indicated that weed control treatments (Bazagran by 750 cc 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. **Dawood et al., (2019)** indicated that heavy infested soil with broomrape it is possible to irrigation at two- or three-weeks intervals and spray glyphosate at rates 50 or 60 cm^3 $fed.^{-1}$, applied twice with three weeks intervals.

Annual weeds are a major problem in bean and pea production in the world. **Hassanein et al., (1998)** indicated that the annual weeds in pea fields can compete strongly with pea and can reduce yield of pea seeds by 62.2 %. Thus, chemical weed control

is necessary to decrease cost and increase pea productivity. Pre-emergence herbicides application can help control weeds during the early crop growth stage. Crop-weed competition is minimized by pre-emergence herbicides spray, resulting in decreasing weed dry matter and increasing crop-yield **(Mohamed, 2004)**. Pre-emergence herbicides are used most frequently in a green pea culture because they eliminate competition between crop plant and weeds even at the critical early growth stage **(Wagner and Nadasy, 2006). El-Dakkak et al., (2010)** showed that the used of (Fusilade, S + Basagran) and hand hoeing after 30 and 45 days after sowing decreased the dry weight of grassy, broad-leaved and total weeds, while, increased plant height, 100-green seeds weight and seed yield (kg fed.$^{-1}$) compared with unweeded treatment. **Khaffagy and Kasem (2016)** indicated that weed control treatments (butralin at 2.0 L fed.$^{-1}$ + hand hoing) reduced dry weight of grassy, broad-leaved and total weeds, and increased pea yield by 76.9 % as compared with untreated control. **Mekky et al. (2002)** indicated that the interaction between sowing dates and Round up application was very effective on decreasing the number and dry weight of broomrape and increased seed yield in both seasons. The lowest number and dry weight of broomrape were obtained from the first sowing date (1st Nov.) and application of Round up three times, but the highest seed weight (g plant^{-1}) and seed yield resulted from the second sowing date (15th Nov.) and Round up application three times.. **kenapar, (2003)** revealed that delay sowing date to November 15th significantly decreased number, fresh and dry weights of broomrape spikes. It also decreased spike length, spikes per faba bean plant and capsules per spike. Sowing faba bean on November 15th produced the highest dry weight of pods, plant height, fresh and dry weights of plant and bean seed yield.

The aim of the present study was to estimate the role of sowing dates, weed control treatments and their integration in control of broomrape, annual weeds and pea productivity under Kafr El-Sheikh Governorate conditions.

MATERIALS AND METHODS

Two field experiments were conducted at Sakha Agricultural Research Station, Kafer El- Sheikh Governorate Egypt, during 2022/2023 and 2023/2024 winter seasons. Table (a) shows the monthly average of maximum and minimum air temperature, relative humidity and Precipitation (mm/day) during the growing seasons. Data of practical size distribution and some chemical soil analysis, according to **Jackson (1973)**. The experiments soil was clay in both seasons as shown in Table (b).

This experiment was done to study the effective of sowing dates and some weed control treatments on broomrape, annual weeds, pea growth and yield. The local seed pea (Pisum sativum, L.) variety Indian Master B at rate 48 kg fed.$^{-1}$, The previous crop was rice. The pea was sowing 25th October and 25th November 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 at 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 P_2O_5 Fed.$^{-1}$, during sowing. Nitrogen fertilizer was added in 40 units N Fed.$^{-1}$, on three equal doses, the first one was added at planting in the form of ammonium sulphate and potassium fertilizer was added in 48 units K_2O Fed.$^{-1}$, in the form of potassium sulphate, after 60 days from sowing.

Table (a): Data of weather conditions during 2022/2023 and 2023/2024 winter seasons.

Seasons	Months	Air Temperature		Relative Humidity (%)	Precipitation (mm/day)
		Max.	Min.		
2022/23	October	31.16	19.78	60.22	0.17
	November	26.27	15.60	61.04	0.24
	December	23.90	13.02	68.09	1.40
	January	21.08	10.51	73.86	0.92
	February	19.38	8.98	69.66	1.67
	March	25.18	11.79	61.15	0.60
2023/24	October	32.60	20.78	61.27	0.03
	November	28.68	17.28	60.84	0.13
	December	23.61	13.50	72.51	1.15
	January	20.93	9.56	67.07	0.34
	February	22.02	9.52	69.30	0.23
	March	26.36	11.50	58.97	0.21

Table (b): The chemical and physical analyses of the soil of the experimental.

Seasons	Organic Matter %	Soil Ph.	Sand %	Silt %	Clay %	Textural class	N ppm	P ppm	K Ppm
2022/23	0.53	8.14	19.83	30.93	49.24	Clay	17.35	6.83	259.36
2023/24	0.55	8.11	16.44	32.63	50.93	Clay	18.3	6.18	296.35

All other agricultural practices for pea production were carried out as common in this area. Treatments of each experiment were coordinated in a split plot design with four replicates. The sowing dates were arranged at random in the main plots and weed control treatments were randomly arranged in the sub plots as follows:

Main plots: (Sowing dates):

1- 25th October

2- 25th November

Sub plots: (Weed control treatments):

1. Stomp Extra 45.5 % CS (pendimethalin) at the rate of 1.7 L fed.$^{-1}$ applied after sowing and before irrigation + Fusilade forty 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. Alpha Top 48% AS (bentazon) at the rate of 0.5 L fed.$^{-1}$ applied at 21 (DAS) + Fusilade forty 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. Basagran 48% AS (bentazon) at the rate of 0.5 L fed.$^{-1}$ applied at 21 (DAS) + 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).
4. Hand hoeing twice to annual weeds at 30 and 50 (DAS) and hand pulling to broomrape twice at 70 and 90 (DAS).
5. Weedy check (control).

The herbicides were applied by using knapsack sprayer CP3 with volume of 200 L fed.$^{-1}$ of water. Table (c) shows the trade, common and chemical names of the herbicides.

Table (c): 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
Fusilade forty 15 % EC	fluazifop-p-butyl	butyl(R)-2-[4-[[5-(trifluoromethyl)-2-pyridinyl]oxy]phenoxy] propanoate
Alpha Top 48 % AS	bentazon	3-(1-methylethyl)-1H-2,1,3-benzothiadiazin-4(3H)-one 2,2-dioxide
Basagran 48 % AS	bentazon	3-(1-methylethyl)-1H-2,1,3-benzothiadiazin-4(3H)-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:

On broomrape:

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

1- Broomrape spike length (cm).

2- Number and dry weight (g) of broomrape spikes plant^{-1}

3- Number and dry weight (g) of broomrape spikes m^{-2}.

Dry weight was determined after drying broomrape in a forced draft oven at 70 ^{o}C for 48 hours.

On annual weeds:

Weeds were hand pulled at random from one square meter in each plot at 70 and 90 days after pea sowing. The annual weeds were identified into species and classified to broad-leaved, grassy, and total weeds. The fresh weight of each species was determined as (g m^{-2}).

On yield and its components:

At harvest, 10 guarded pea plants were hand pulled randomly from each sub plot to determine:

1- Plant height (cm).

2- Dry Weight of plant branch (g).

3- Number of pods plant^{-1}.

4- Dry weight of pods plant^{-1} (g).

5- Number of seeds pod^{-1}.

6- 100-seed weight (g).

7- Seed yield (ton/ fed.) from whole plot.

On NPK uptake:

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

Correlation study:

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

Statistical analysis :

Data were subjected to the statistical analysis using analysis of split plot design according to procedure outlined by **Snedecor and Cochran (1980).** Means were compared at 5% level of significance by the least significant different (L.S.D) test. All statistical analysis was performed by using analysis of variance technique of (COSTAT) computer software package.

RESULTS and DISCUSSION

1. Effect of Sowing dates:

1.1. On broomrape:

Data in Table (1) showed the differences between the two pea sowing dates in Orobanche infection which reached the level of significant at 5% level and showed that lately sowing date 25th November recorded the highest reduction parentages on both length, number and dry weight of broomrape spikes plant^{-1} or per m^{-2} in both sowing seasons by 31.0, 40.7, 44.3, 44.2 and 51.5 %, in first season and by 26.5, 39.4, 39.5, 43.6 and 43.5 %, in second season, respectively as compared with 25th October. This decrease may be due to the delay of broomrape attachment to pea plants and its delay emergence above soil surface and consequently partially escaped from injury of broomrape. The data obtained in this study correspond to the results obtained (**kenapar, 2003).**

Table (1): Effect of sowing dates on broomrape growth in 2022/2023 and 2023/2024 seasons.

Sowing dates	Broomrape spike Length (cm)		No. Broomrape spike plant^{-1}		Dry weight of broomrape spike plant^{-1} (g)		No. Broomrape spike m^{-2}		Dry weight of broomrape (g m^{-2})	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
25th October	18.2	21.1	2.9	4.0	8.5	9.1	17.6	19.3	56.4	61.1
25th November	12.6	15.4	1.7	2.5	4.7	5.5	9.8	10.9	27.5	34.5
LSD 0.05	1.16	2.46	0.30	0.51	0.81	1.12	1.78	1.87	5.66	4.46

1st = first season 2nd = second season

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

Data in Table (2) indicate that the adopted sowing dates significantly influenced the fresh weight of grasses, broad- leaved and total weeds, and such trend was true in the two survey events and two growing seasons. The sowing date of 25th November resulted in reduced values of total annual weeds at 1st and 2nd surveys in first season, and reached 7.89 % and 11.50 % lower than that with 1st November, respectively. The corresponding reduction values at 1st and 2nd surveys in the second season comprised 11.36 % and 11.46 % in the same order of the treatments. Additionally, fresh weight of broad- leaved weeds exhibited similar trends, while reduction values, in fresh weight of grass in 1st and 2nd surveys, amounted to (31.07 %) and (29.08 %) in 1st season and (28.79 %) and (29.08%) in 2nd season respectively, under 25th November comparable with 25th October. The data obtained in this study are consistent with the results obtained by **(Khaffagy and Kasem 2016)**

Table (2): Effect of sowing dates on fresh weight of annual weeds (g m^{-2}) at 70 and 90 days after sowing in 2022/2023 and 2023/2024 seasons.

Sowing dates	fresh weight of annual weeds (g m^{-2})					
	At 70 days after sowing			At 90 days after sowing		
	Grassy weeds (gm^{-2})	Broad-leave weeds (gm^{-2})	Total weed (gm^{-2})	Grassy weeds (gm^{-2})	Broad-leave weeds (gm^{-2})	Total weeds (gm^{-2})

2022/2023 season						
25th October	68.2	375.8	444.1	433.7	1428.9	1862.6
25th November	99.7	310.8	410.5	604.6	1048.3	1652.9
LSD 0.05	8.15	32.49	35.61	19.51	211.03	210.24
2023/2024 season						
25th October	80.7	431.3	512.0	494.7	1629.3	2124.0
25th November	113.9	341.6	455.5	689.7	1195.9	1885.6
LSD 0.05	5.66	38.74	39.67	22.25	241.28	240.29

1.3 . yield and its components:

Results showed in Table (3) indicated that the two-sowing dates were slightly differed significantly. Concerning of peas plant height and dry weight of plant tended to increase with sowing on 25th November by (16.1 and 15.8%) and (17.0 and 16.6 %), respectively in both sowing seasons as compared with sowing on 25th October. The highest increased number of pods plant^{-1}, dry weight of pods plant^{-1} and number of seeds pod^{-1} peas belonged to the sowing on 25th November, by (17.9 and 18.7), (19.5 and 20.3) and (10.7 and 11.5 %) compared to the smallest it was which belonged to the sowing 25th October in both seasons, respectively. The heaviest 100-seed weight (g) of peas was the sowing 25th November, with values of 43.30 and 41.19 (g) in both seasons as compared to the lowest weight of 100 seeds which belonged to the sowing 25th October, with values of 39.04 and 36.74 (g) in both sowing seasons, respectively. The highest seed yield (ton fed^{-1}) of pea resulted from the sowing 25th November with values 1.46 and 1.40 (ton fed^{-1}) as compared to the lowest yield of seeds which belonged to the 25th October, with values of 1.17 and 1.11 (ton fed^{-1}) in first and second seasons, respectively. These results are in agreement with those obtained by (**Jacobsohn and Kelman 2017).**

Table (3): Effect of sowing dates on yield and its components in 2022/2023 and 2023/2024 seasons.

Sowing dates	Plant height (cm)	Dry weight of plant (g)	No. pods plant^{-1}	Dry weight of pods plant^{-1} (g)	No. seeds pods^{-1}	100-seed weight (g)	Seed yield (ton fed.$^{-1}$)
2022/2023 season							
25th October	48.41	15.87	11.33	45.46	5.80	38.61	1.11
25th November	57.60	15.56	13.86	56.82	6.51	42.79	1.38
LSD 0.05	6.08	1.47	1.75	8.06	0.28	1.52	0.20
2023 /2024 season							
25th October	45.49	14.97	10.69	42.93	5.46	36.27	1.04
25th November	54.71	17.68	13.21	54.17	6.20	40.62	1.32
LSD 0.05	5.76	2.83	1.65	7.65	0.27	1.45	0.19

1.4. On NPK uptake:

Data in Table (4) illustrated that the highest NPK uptake by pea was obtained from sowing date 25th November which increased pea to uptake largest nitrogen amount, increasing phosphate uptake and increasing potassium uptake. This results may be attributed to the response pea plants for organic manure in the absence of N fertilizer than in the presence **(Sharma et al., 1988**). On the other hand, the relative prices and availability of fertilizer and organic manure, in the amounts needed at the place and time of requirement, will determine the economic benefits and any cost savings (**Sharma and Sharma, 1988)**

Table (4): Effect of sowing dates on NPK uptake kg fed.$^{-1}$ in pea seeds (combined analysis in 2022/2023 and 2023/2024 seasons).

Sowing date	N %	P %	K %	NPK uptake (kg fed.$^{-1}$)		
				N	P	K
25th October	5.48	0.343	3.04	62.47	3.91	34.66
25th November	5.64	0.357	3.26	80.65	5.11	46.62
LSD 0.05	0.11	0.05	0.12	13.03	1.02	4.52

1.2. Effect of weed control treatments:

1.2.1. On broomrape: Data recorded in Table (5) 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 forti at 1.4 L fed.$^{-1}$ + Round up at 0.04 L fed^{-1}), (Alpha Top at 0.5 L

fed.$^{-1}$ + fusilade forti at 1.4 L fed.$^{-1}$ + Round up at 0.04 L fed^{-1}), (Basagran + Select super at 0.25 L fed.$^{-1}$ + Round up at 0.04 L fed^{-1}) and (Hand pulling twice) decreased dry weight of spike (g m^{-2}) of broomrape by 82.5, 81.8, 82.8 and 75.9 % in the first season and by 81.9, 81.5, 82.2 and 75.3 %, in the second season respectively, as compared with weedy check treatment. This effect is due to that Round up translocate to tubercles of broomrape during underground stage, so it makes early effects. On the other hand, size treatments little effect increased the broomrape characters as compared to Round up treatment. This results are in agreement with those of **(Jacobsohn and Kelman 2017) and** (**Dawood et. al., 2019).**

Table (5): Effect of weed control treatments on broomrape growth in 2022/2023 and 2023/2024 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}		Dry weight of broomrape (g m^{-2})	
		1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Stomp+Fusilade forti +Round up	1.7+1.4+0.04	9.3	10.2	1.4	2.0	3.8	4.5	7.3	8.1	20.7	24.1
AlphaTop+Fusilade forti +Round up	0.5+1.4+0.04	9.6	10.5	1.4	2.0	3.9	4.6	7.6	8.4	21.6	24.8
Basagran+Select super +Round up	0.5+0.25+0.04	9.2	10.1	1.3	1.9	3.5	4.3	7.1	8.0	20.4	23.7
Hand pulling	twice	10.9	11.8	1.8	2.5	5.0	5.8	10.0	11.1	28.5	32.9
Weedy check	-	37.8	48.7	5.4	7.6	16.6	17.4	36.2	39.8	118.4	133.4
LSD $_{0.05}$		2.57	2.52	0.46	0.62	1.26	1.41	2.65	2.82	8.46	8.21

1st = first season 2nd = second season

1.2.2. On fresh weight of annual weeds (g m^{-2}):

Data in Table (6) showed that all weed control treatments gave significant reduction on 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 (Basagran + Select Super + Round up), (AlphaTop + Fusilade forti + Round up), (Stomp + Fusilade forti + Round up) and hand hoeing twice were 89.2, 88.4, 87.4, 87.1 and 81.4 %, and 81.3, 80.6, 81.9 and 77.8% respectively as compared with the weedy cheek plots in 1st and 2nd surveys. Additionally, fresh weight of grassy and broad-leaved weeds exhibited similar trend. In the first and second season, that corresponds to both **(Wágner and Nádasy 2006**).

Table (6): Effect of weed control treatments on fresh weight of annual weeds (g m^{-2}) at 70 and 90 days after sowing in 2022/2023 and 2023/2024 seasons.

Weed control 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 (gm^{-2})	Broad-leave weeds (gm^{-2})	Total weeds (gm^{-2})	Grassy weeds (gm^{-2})	Broad-leave weeds (gm^{-2})	Total weeds (gm^{-2})
2022/2023 season							
Stomp+fusilade forti+Round up	1.7+1.4+ 0.04	27.8	147.0	174.8	252.4	640.6	893.0
AlphaTop+Fusilade forti +Round up	0.5+1.4+0.04	44.7	117.2	161.9	283.7	671.9	955.6
Basgran+Select super+Round up	0.5+0.25+0.04	35.8	114.9	150.7	268.3	653.8	922.1
Hand hoeing	Twice	49.7	208.8	258.5	366.3	727.5	1093.8
Weedy check		261.7	1128.8	1390.5	1425.1	3499.2	4924.3
LSD $_{0.05}$		8.47	9.18	14.54	13.80	172.92	169.66
2023/2024 season							
Stomp+fusilade forti+Round up	1.7+1.4+0.04	31.1	164.7	195.8	282.7	717.5	1000.2
AlphaTop+Fusilade forti +Round up	0.5+1.4+0.04	50.1	135.4	185.5	317.7	752.5	1070.2
Basgran+Select super+Round up	0.5+0.25+0.04	40.2	123.9	164.1	300.4	732.2	1032.6
Hand hoeing	Twice	57.1	240.1	297.2	421.2	836.6	1257.8

Weedy check		308.1	1268.0	1576.1	1638.9	4024.1	5663.0
LSD $_{0.05}$		8.75	15.45	21.69	15.79	198.88	195.14

1.2.3. On yield and its components:

Results presented in Table (7) indicated that weed control treatments (Stomp + Fusilade forti + Round up) gave the highest values of plant height and dry weight of plant branch (g) by (36.5 and 38.4) and (69.5 and 70.5 %) in the first and second seasons respectively, as compared with weedy check treatments, followed by (Basagran + Select super + Round up) and (AlphaTop + Fusilade forti + Round up). Also, Basagran + Select super + Round up and Stomp + Fusilade forti + Round up increased number of pods plant^{-1}, dry weight of pods plant^{-1} and number of seed pods^{-1} peas by (72.9 and 72.8), (76.6 and 76.5) and (52.1and 52.0 %) in the first season and (73.8 and 73.6), (77.3 and 77.2) and (53.6 and 53.4 %) in the second season respectively, as compared with weedy check treatments. (Basagran + Select super + Round up) and (Stomp + Fusilade forti + Round up) increased weight of 100-seed and seed yield (ton/fed) by (19.7 and 20.1 %) and (74.4 and 74.0 %) in the first seasons and (22.2 and 23.3 %) and (75.0 and 74.7 %) in the second seasons, respectively, as compared with weedy check treatments. The increasing of seed yield/fed may be due to the increase of pea growth and yield components namely 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 above results are in agreement with those by **(Jacobsohn and Kelman 2017**)

Table (7): Effect of weed control treatments on yield and its components in 2022/2023 and 2023/2024 seasons.

Weed control treatments	Rate (L fed.$^{-1}$)	Plant height (cm)	Dry weight of plant (g)	No. pods plant^{-1}	Dry weight of pods plant^{-1}(g)	No. seeds pods^{-1}	100-seed weight (g)	Seed yield (ton fed.$^{-1}$)
	2022/2023 season							
Stomp + Fusilade+ Round up	1.7+1.4+0.04	60.98	25.57	16.53	68.25	7.71	44.64	1.77
AlphaTop +Fusilade+Roundp	0.5+1.4+0.04	56.64	18.76	15.88	66.32	7.17	42.80	1.43
Basagran+ Select+ Round up	0.5+0.25+0.04	57.37	21.20	16.63	68.66	7.73	44.02	1.80
Hand hoeing and hand polling	Twice	51.30	12.77	9.44	36.41	4.47	36.67	0.74
Weedy check		38.75	7.80	4.50	16.04	3.70	35.36	0.46
LSD $_{0.05}$		2.61	1.47	0.91	3.95	0.38	2.07	0.15
	2023/2024 season							
Stomp + Fusilade+ Round up	1.7+1.4+0.04	58.26	24.43	15.80	65.22	7.36	42.65	1.70
AlphaTop +Fusilade+Roundp	0.5+1.4+0.04	54.12	17.93	15.17	63.37	6.85	40.89	1.36
Basagran+ Select+ Round up	0.5+0.25+0.04	54.81	20.25	15.89	65.60	7.39	42.05	1.72
Hand hoeing and hand polling	Twice	47.47	11.82	8.74	33.70	4.14	33.93	0.69
Weedy check		35.87	7.22	4.17	14.87	3.43	32.72	0.43
LSD $_{0.05}$		2.44	1.41	0.86	3.73	0.36	1.95	0.14

1.2.4. On NPK uptake:

Data in Table (8) indicated that treated peas plants 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 permit a more available NPK elements uptake to treated plants compared to weedy check (untreated). So, all weses in pea yield (ton fed^{-1}) accompanied with significant increases in uptake of the three elements nutrients namely, nitrogen, phosphors and potassium.

Table (8): Effect of weed control treatments on NPK uptake kg fed.$^{-1}$ in pea seeds (combined analysis in 2022/2023 and 2023/2024 seasons).

Weed control	Rate L fed.$^{-1}$	Nutrient %			Nutrient uptake (kg fed.$^{-1}$)		
		N	P	K	N	P	K
Stomp + Fusilade+ Round up	1.7+1.4+0.05	5.72	0.346	3.36	99.53	6.02	58.46
AlphaTop +Fusilade+Roundp	0.5+1.4+0.05	5.47	0.334	3.00	76.58	4.68	42.00
Basagran+ Select+ Round up	0.5+0.25+0.05	5.52	0.335	3.06	92.18	5.59	51.10
Hand hoeing or hand poling	Twice	5.13	0.301	2.88	36.94	2.18	20.74
weedy check		4.57	0.271	2.32	20.57	1.22	10.44
LSD $_{0.05}$		0.17	0.16	0.16	17.14	1.82	9.26

(Stomp + Fusilade + Round up) and (Basagran + Select + Rund up) treatments increased pea (yield fed^{-1}) nitrogen uptake (kg fed^{-1}) by 79.33 and 77.68 %, phosphorus uptake (kg fed^{-1}) by 79.73 and 78.18 % and potassium uptake (kg fed^{-1}) by 82.14 and 79.57, respectively, than un-weeded treatment. Similar results were obtained by **Bainade and Patel (1991).**

3. INTERACTION BETWEEN SOWING DATES AND WEED CONTROL TREATMENTS:

3.1. On broomrape: Data in Table (9) showed that the effect of interaction sowing dates and weed control treatments were significant on broomrape spikes length (cm), number of broomrape spikes plant^{-1}, dry weight of broomrape spikes plant^{-1}, number of broomrape spikes m^{-2} and dry weight of broomrape (g m^{-2}) in the first and second seasons.

Table (9): Effect of interaction between sowing dates and weed control treatments on broomrape growth in 2022/2023 and 2023/2024 seasons.

Sowing date	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}		Dry weight of broomrape(g m^{-2})	
			1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
25th October	Stomp+fusilade+Round	1.7L+1.4+0.04	10.9	11.8	1.8	2.5	5.0	5.7	9.3	10.3	27.9	30.3
	AlphaTop +fusilade+Roun	0.5+1.4+0.04	11.2	12.0	1.7	2.4	4.9	5.5	9.8	10.8	29.4	31.8
	Basagran+Select +Round	0.5+0.25+0.04	10.8	11.6	1.6	2.3	4.5	5.2	9.3	10.3	27.9	30.3
	Hand pulling	Twice	12.9	13.7	2.3	3.1	6.4	7.1	12.8	14.0	38.5	41.4
	Weedy check	-	45.2	56.1	6.8	9.6	21.4	22.1	46.5	51.0	158.1	171.4
25th November	Stomp+fusilade+Round	1.7+1.4+0.04	7.8	8.6	1.1	1.5	2.7	3.4	5.3	6.0	13.4	17.8
	AlphaTop +fusilade+Roun	0.5+1.4+0.04	8.1	8.9	1.1	1.6	2.9	3.6	5.4	6.0	13.8	17.8
	Basagran+Select +Round	0.5+0.25+0.04	7.7	8.5	1.0	1.5	2.4	3.4	5.0	5.8	12.8	17.0
	Hand pulling	twice	9.0	9.8	1.4	2.0	3.6	4.5	7.3	8.3	18.6	24.4
	Weedy check	-	30.5	41.3	3.9	5.6	11.8	12.7	25.9	28.5	78.7	95.4
	LSD $_{0.05}$		7.26	7.12	1.31	1.75	3.55	4.01	7.52	7.99	23.92	23.22

1st = first season 2nd = second season

Response of Broomrape, Annual Weeds and Pea Crop to Some Weed Control Treatments under Different Sowing Dates

The results showed that 25th November and (Basagran 0.5 L fed^{-1}+ Select super 0.25 L fed^{-1} + Round up at 0.04 L fed^{-1}) was recorded the highest reduction of broomrape spikes length (cm), number of broomrape spikes plant^{-1}, dry weight of broomrape plant^{-1} , number of broomrape m^{-2} and dry weight of broomrape (g m^{-2}) by (82.9, 85.3, 88.8, 89.2 and 91.9 %) in the first season, and by (84.8, 84.4, 84.6, 88.6 and 90.1 %) in the second season, respectively as compared to weedy check 25th October. The results obtained were in agreement with those obtained by (**Jacobsohn and Kelman 2017 and Dawood et al., 2019**)

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

Data in Table (10) showed that concerned with the effect of interaction between peas sowing dates with weed control treatments significantly at 5 % level on the fresh weight of grasses, broad-leaves and total weeds at 70 and 90 DAS in 2022/2023 and 2023/2024 seasons.

Table (10): Effect of interaction between sowing dates and weed control treatments on fresh weight of annual weeds (g m^{-2}) at 70 and 90 days after sowing in 2022/23 and 2023/24 seasons.

Sowing dates	Weed control 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 (gm^{-2})	Broad-leaves weeds (gm^{-2})	Totals weeds (gm^{-2})	Grassy weeds (gm^{-2})	Broad-leave weeds (gm^{-2})	Totals weeds (gm^{-2})
	2022/2023 season							
25th October	Stomp + Fusilade + Round up	1.7+1.4+0.04	21.7	167.1	188.8	207.5	765.5	973.0
	AlphaTop + Fusilade + Roundup	0.5+1.4+0.04	39.8	136.2	176.0	235.3	791.6	1026.9
	Basgran + Select + Round up	0.5+0.25+0.04	32.2	134.3	166.5	229.2	762.8	992.0
	Hand hoeing	Twice	38.7	232.5	271.2	318.8	847.1	1165.9
	Weedy check		208.7	1209.1	1417.8	1177.5	3977.4	5154.9
25th November	Stomp + Fusilade + Round up	1.7+1.4+0.04	33.9	127.0	160.8	297.3	515.8	813.1
	AlphaTop +Fusilade + Roundup	0.5+1.4+0.04	49.7	98.1	147.8	332.1	552.1	884.2
	Basgran + Select + Round up	0.5+0.25+0.04	39.5	95.5	135.0	307.3	544.7	852.0
	Hand hoeing	Twice	60.6	185.1	245.7	413.8	607.8	1021.6
	Weedy check		314.8	1048.3	1363.1	1672.7	3021.0	4693.7
	LSD $_{0.05}$		23.96	25.97	41.12	39.05	189.09	479.87
2023/2024 season								
25th October	Stomp + Fusillade + Round up	1.7+1.4+0.04	24.3	187.2	211.5	232.4	857.3	1089.7
	AlphaTop + Fusilade + Roundup	0.5+1.4+0.04	44.5	161.0	205.5	263.5	886.7	1150.2
	Basgran + Select + Round up	0.5+0.25 +0.04	36.0	150.4	186.4	256.8	854.3	1111.1
	Hand hoeing	Twice	44.5	267.4	311.9	366.6	974.2	1340.8
	Weedy check		254.2	1390.5	1644.7	1354.1	4574.0	5928.1
25th Nove	Stomp + Fusillade + Round up	1.7+1.4+0.04	37.9	142.2	180.1	332.9	577.7	910.6

	AlphaTop +Fusillade+ Round up	0.5+1.4+0.04	55.7	109.9	165.6	371.9	618.4	990.3
	Basgran + Select + Round up	0.5+0.25+0.04	44.3	97.4	141.7	344.1	610.1	954.2
	Hand hoeing	Twice	69.7	212.8	282.5	475.8	699.0	1174.8
	Weedy check		361.9	1145.5	1507.4	1923.7	3474.1	5397.8
	LSD $_{0.05}$		24.74	43.70	61.34	44.67	562.53	551.93

The high efficiency of these herbicides' combinations against weeds in peas was attributed to widening weeds control spectrum by Basagran + Select Super + Round up, Basagran + Fusilade forti + Round up , Stomp + Fusilade forti + Round up and hand hoeing twice were 90.5, 89.6, 88.7 and 82.7% at 70 DAS, as compared to weedy check of 25th October. The results had the same trend in the second survey at 90 DAS and second season. Similar results were obtained by (**Khafagy and Kasem 2016)**.

3.3. On yield and its components: The results in Table (11) showed that the effect of interaction between sowing dates and weed control treatments were significant on yield and its components in both sowing seasons. The interaction between sowing 25th November with (Stomp + Fusilade forti + Round up) treatment gave the highest values of plant height and dry weight of plant (g), Which estimated by (47.1 and 75.8 %) in the first season and by (49.3 and 47.3 %) and (76.8 and 75.3 %) in the second season, respectively, as compared to 1st November with weedy check treatment.

Table (11): Effect of interaction between sowing dates and weed control treatments on yield and its components in 2022/2023 and 2023/2024 seasons.

Sowing dates	Weed control treatments	Rate (L fed.$^{-1}$)	Plant height (cm)	Dry weight of plant (g)	No. pods plant^{-1}	Dry weight of pods plant^{-1}(g)	No. seeds pods^{-1}	100-seed weight (g)	Seed yield (ton fed.$^{-1}$)
2022/2023 season									
25th October	Stomp + Fusilade + Round up	1.7+1.4+0.04	56.03	22.98	15.06	61.97	7.35	42.41	1.61
	AlphaTop +Fusilade+Round up	0.5+1.4+0.04	51.55	17.77	14.56	59.83	6.91	39.97	1.33
	Basagran + Select + Round up	0.5+0.25+0.04	52.03	20.46	15.19	62.50	7.39	41.98	1.64
	Hand hoeing and hand polling	Twice	47.55	11.35	8.39	32.06	4.00	34.89	0.59
	Weedy check		34.91	6.81	3.44	10.93	3.34	33.81	0.35
25th November	Stomp + Fusilade + Round up	1.7+1.4+0.04	65.93	28.16	18.00	74.54	8.06	46.89	1.94
	AlphaTop +Fusilade+Round up	0.5+1.4+0.04	61.73	19.75	17.19	72.81	7.44	45.64	1.53
	Basagran + Select + Round up	0.5+0.25+0.04	62.71	21.93	18.06	74.81	8.07	46.06	1.95
	Hand hoeing or hand polling	Twice	55.05	14.18	10.50	40.76	4.94	38.45	0.89
	Weedy check		42.60	8.78	5.56	21.16	4.06	36.91	0.58
LSD $_{0.05}$			7.37	4.17	2.57	11.17	1.08	5.84	0.43
2023/2024 season									
25th October	Stomp + Fusilade + Round up	1.7+1.4+0.04	53.22	21.83	14.31	58.87	6.98	40.28	1.53
	AlphaTop +Fusilade+Round up	0.5+1.4+0.04	48.97	16.88	13.83	56.84	6.56	37.97	1.26

	Basagran + Select + Round up	0.5+0.25+0.04	49.42	19.43	14.43	59.38	7.02	39.88	1.56
	Hand hoeing or hand polling	Twice	43.75	10.44	7.72	29.49	3.68	32.10	0.55
	Weedy check		32.11	6.27	3.16	10.06	3.07	31.11	0.32
25th November	Stomp + Fusilade + Round up	1.7+1.4+0.04	63.29	27.03	17.28	71.56	7.74	45.01	1.86
	AlphaTop +Fusilade+Round up	0.5+1.4+0.04	59.26	18.96	16.50	69.90	7.14	43.81	1.47
	Basagran + Select + Round up	0.5+0.25+0.04	60.20	21.06	17.34	71.82	7.75	44.22	1.87
	Hand hoeing or hand polling	Twice	51.20	13.19	9.77	37.91	4.59	35.76	0.84
	Weedy check		39.62	8.17	5.17	19.67	3.78	34.32	0.55
LSD 0.05			6.90	3.99	2.42	10.54	1.02	5.53	0.41

Also, (Stomp + Fusilade forti + Round up) and (Basagran + Select super + Round up) treatments gave the highest values of number of pods plant^{-1}, dry weight of pods plant^{-1}, number of seeds pod^{-1}, 100-seed weight (g) and seed yield (ton fed^{-1}.) Which estimated by (80.9 and 81.0), (85.3and 85.4), (58.6 and 58.6), (27.9 and 26.6) and (82.0 and 82.1 %) in the first season and by (81.7 and 81.8), (85.9 and 86.0), (60.3 and 60.4), (30.9 and 29.6) and (82.8 and 82.9 %) in the second season, respectively, as compared to 25th October with weedy check treatment. The obtained results were in agreement with those obtained by **(El-Metwally et al. 2013)**

3.4.On NPK uptake:

Data indicated that the effect of interaction between sowing dates and weed control treatments on NPK uptake by pea seeds was not statistically significant. Thus the data were not discussed.

4. Correlation among studied characters and peas yield: Data presented in Table (12) indicated clearly that simple correlation coefficients between broomrape spikes length, number of broomrape spikes plant^{-1}, number of broomrape spikes m^{-2}, Broomrape dry weigh (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.

Table 12. Correlation coefficient between all studied characters analysis between peas yield and its components in 2022/2023 and 2023/2024 seasons.

Studied characters	No. broomrape spikes plant^{-1}	No. broomrape spikes m^{-2}	Broomrape dry weight (g m^{-2})	Fresh weight of total Weeds (g m^{-1}) at 70 DAS	Plant height (cm)	Dry weight of plant (g)	No. pods Plant^{-1}	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**
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**
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**
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**

This means that pervious broomrape characters were more aggressive in their parasite to seed yield (ton fed^{-1}) of peas. Also, correlation analysis revealed that the yield increases were positively contributed to the increases in growth characters and yield components.

REFERENCE

1) Abdallah I.S.; K.F. Abdelgawad , M.M. El-Mogy, M. B. El-Sawy, H.A. Mahmoud and M. A. M. Fahmy (2021) Weed Control, Growth, Nodulation, Quality and Storability of Peas as Affected by Pre- and Post emergence Herbicides, Horticulturae, 7, 307-325.
2) Bainade, S.S. and Z.G. Patel (1991). Nutrient losses the rough weeds in irrigated wheat as influenced by weed control methods and nitrogen level. Indian J. Agron., 36 (1): 67 - 71.
3) Cottenie, A.; M. Wrloo; L. Kiekens; G. Velghe and R. Camerlynik (1982). Chemical analysis of plant and soils. Lab. of Analytical and Agrochemistry State uni. Ghent, Belgium, P., 15 - 17.

4) Dawood Eman, M.; A.A. Zein, I. E. Soliman, Amany M. Hamza and A.A.H. Sharshar (2019). Irrigation periods, broomrape control treatments and the growth performance of peas (Pisum sativum) Indian Journal of Agricultural Sciences 89 (1): 00–10.
5) Dawood Eman, M.; I.E. Soliman; S.A. Hamed; A.Y. Keratum and A. Kishk (2022). Evaluations of Weed Control Treatments on Broomrape, Annual Weeds, and Productivity of Pea CropJ. of Plant Prot. and Path., Mansoura Univ., 13 (12) : 329 -335.
6) El-Metwally, I.M.; T.A. El-Shahawy and M.A. Ahmed (2013). Effect of Sowing Dates and some Broomrape Control Treatments on Faba bean Growth and yield. Journal of Applied Sciences Research, 9 (1): 197–204.
7) El-Dakkak, A.A.A.; A.A. Shalaby and A.M.A. Rashwan (2010). The role of nutrient fertilizers and weed control on pea yield and associated weeds. Egypt, J. of Appl. Sci., 25 (88): 555 – 569.
8) Fawad, M., Khan, M. A., Wahid, F., Khan, H., Gul, B., Khattak, A. M., and Mastinu, A. (2022). Irrigation Scheduling and Weed Management: A Sustainable Approach for Managing Broomrape and Other Weeds in Tomato Crop. Horticulturae, 8(8), 676.
9) Hassanien, E.E.; H. M. Ibrahim and Z. R. Yehia (1998). The efficiency of new herbicides against broomrape and other annual weeds in faba bean. Nile Valley Regional Program for wild oats control in cereal and some other winter crops 6th Annual Meeting 6-11 Sept., Cairo, Egypt, PP. 210-212.
10) Ismail, A.E.A. and A.A.O. Fakkar (2008). Faba bean Yield losses due to Orobanche infestation and effect of plant density and weed control on annual weeds and Orobanche and faba bean productivity. Minia J. of Agric. Res. Develop., 28(4): 627-646.
11) Jacobsohn, R. and Y. Kelman (2017). Effectiveness of Glyphosate in Broomrape (Orobanche spp.) Control in Four Crops. Published online by Cambridge University Press: 6 (28): 692-699.
12) Jackson, M.L. (1958). Soil chemical analysis, constable and Co, Ltd. London, UK.
13) Jackson, M.L. (1973). Soil chemical analysis. Prinkice Hall Inc., Englewood Cliffs., New Jersey U.S.A.
14) Kenapar, M. E. Z. (2003). Comparative Studies of Chemical and Biological Control for Broomrape (Orobanche crenata) in Faba Bean. MSC. Thesis, Fac. Agric. Kafr EL-Sheikh, Tanta univ., Egypt.
15) Khafagy, Azza, E. and M.H. Kasem (2016). Effect of rhizobial inoculation and weed species, Bactria nodulation and pea yield. J- plant production, Mansoura Univ., 7 (12): 1419-1429.
16) Korashi, A.A.; M.M. El-Borollosy, E.A. Hassa, M.R.Abo El-Suoud, Zain El-Deen and A. Koraim (1996). Hosts of (Orobanche spp.) and yield losses in Delta and upper Egypt in Advances Parasitic Plant Research. Proceedings International Symposium on Parasitic Weeds (eds M.T. Moreno, J.I. Cubero, D. Berner, D.m Joel, L.J Musselman & C. Parker), Cordoba, Spain, 487-493.
17) Mekky, M.S.; Z.R. Yehia and and A.N.M. Nassar (2003). Effect of sowing dates, varieties and glyphosate application on broomrape (Orobanche crenata, Forsk), and yield of faba bean (Vicia faba, L.). Bull. Fac. Agric., Cairo Univ., 54 (1): 55-76.
18) Mohamed, S.A. (2004). Effect of basagran herbicide and indol acetic acid (IAA) on growth, yield, chemical composition and associated weeds of soybean plants, Egypt. J. App. Sci., 19 (10): 79-91.
19) Ranganna, S. (1979). Manual of analysis of fruit and vegetable products. Tata Mc Graw Hill publishing Comoany Limited, New Delhi, 364 pp.
20) Sharma, R.C. and H. C. Sharma (1988). Use fullness of organic manures and their nitrogen fertilizer equivalents. J. Agric. Sci. camb., 111 : 193 – 195.
21) Sharma,R.C.; P. M. Govindakrishnan, P.P. Singh and H. C. Sharma (1988). Effect of farmyard manure and green manures on crop yield and nitrogen needs of potato-based cropping systems in punjab. J. Agric. Sci. Camb., 110 : 490 – 504.
22) Snedecor, W.G. and Cochran, W.G. (1980). Statistical Methods, Seventh Edition, low state Univ. Press Ames, Iowa USA.
23) Stell, R.G.D. and Jour, H. Torrie (1980). Principles and procedures of statistics MC.Graw Hill Book Company, Inc. New York, 48 pp.
24) Wagner, G. and E. Nadasy (2006). Effect of pre-emergence herbicides on growth parameters of green pea. Agric. APPI. Biol. Sci., 71 (3): 809-813.