RESEARCH | Egyptian Journal of Agricultural Research | Field Crops

Effect of weed control on performance of some faba bean cultivars in a broomrape naturally infested soil

Mohamed E. Z. Kenapar [1], Adel M. A. Ghalwash[1] and Azza F. El-Sayed[2]

Address:

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

[2] Food Legume Section, Field Crops Research Institute, Agricultural Research Center, Giza, Egypt.

*Corresponding author, ***Azza F. El-Sayed, e-mail:*** azza.fathy@yahoo.com

Received: 05-02-2023, **Accepted**: 29-08-2023, **Published:** 04-09-2023 **DOI:** 10.21608/ejar.2023.191959.1335

ABSTRACT

A field trial was executed on faba bean productivity under naturally infested soils with annual weeds and broomrape (*Orobanche crenata* Forsk.), at Sakha Agricultural Research Station, Agricultural Research Centre, Egypt, (31° 07' N latitude, 30° 05' E longitude) during 2020/21 and 2021/22 winter seasons. The aim of this study was to investigate the effect of three faba bean cultivars (Giza 843, Misr 3 and Giza 716) and eight weed control treatments on growth, yield components of faba beans 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 cultivar Misr 3 or Giza 843 with, Stomp extra 1 L fed^{-1} mixed with Round up Star at 100 $cm^3 fed^{-1}$ applied as post-sowing directly, followed by Round up Star at 75 cm^3 fed^{-1} (twice), at flowering stage and after 21 days, on controlling broomrape and on increasing faba bean yield and its components. The previous respective interactions gave the highest significant increasing values of faba bean yield and its components. Furthermore, these treatments gave the highest values of economic measures.

Keywords: Faba bean, Annual weeds, *Orobanche crenata*, Basagran, Hand bulling, Round up, Stomp Extra, Net income.

INTRODUCTION

Faba bean (*Vicia faba* L.) is one of the most food and feed legume crops worldwide. In Egypt, the cultivated area was shrunk dramatically, due to the competition between it and other strategic winter crops, attack with broomrape parasitic weed beside with the other weeds, in addition to some constrains of biotic and a biotic factors.The average cultivated area during 2015 to 2019 was 103667 fed, an average seed yield by 9.2 ardab/fed, and total production approximately 155 thousand metric tons which covers about 32.6 of the total national consumption (Mohamed *et al.,* 2021), from the source: Economic AFFairs Sector, Ministry of Agriculture and land reclamation, 2020.

Faba bean cultivars differ in their response to broomrape infestation. Gadalla *et al.* (2010) revealed that Giza3 was the susceptible cultivar and Giza 843 was tolerant, which had the lowest *Orobanche* tubercles/plant. Amer *et al*. (2012) showed that differences among Giza 3 and Giza 843 cultivars were significantly growth, number branches $plant^{-1}$, pod length, plant height and number of seed pod^{-1}. Ibrahim *et al.* (2014) found that Giza 843 cultivar decreased dry weight of weeds and increased seed yield. Fakkar *et al.* (2016) indicated that excelled cultivars of Nubaria1and 3 and Giza 843 than other cultivars and increase yield and its components by reducing the grassy and broad-leaved weeds, increased height of the plants, as well as increase the number of branches/plants compared with other cultivars. Giza 843 and Misr 3 cultivars were brief and partially resistant to broomrape infection, contrast Nubaria1 and 3, which were highly susceptible. Kharrat and Halila (1996) and EL-Metwally *et al.* (2013) found that application of glyphosate two or three times at rate of 75 cm^3 fed^{-1} gave broomrape controlled by 99.1 and 97.8% reduction of broomrape and increased seed yield by 149.5 and 141.5% as compared with the untreated plots in both seasons. El-Sherbeni *et al*. (2021) they reported that spraying with glyphosate followed by hand pulling significantly increased faba bean yield and its components as compared to untreated control. Kharrat and Halila (1996) indicated that hand weeding of broomrape is one of the most used techniques by farmers to control Orobanche, this method is inefficient especially in highly infested faba bean fields. Indeed, continuous hand pulling of broomrape had slightly increased faba bean yield. On the other hand, faba bean has little ability to compete with the annual weeds that are frequently found in faba bean fields because of its slow initial growth, which encourages the emergence and growth of annual weeds before the ground is covered by the crop canopy (Frenda *et al.,* 2013). Eid *et al*., (2017) revealed that there isn't sufficient single control measure to control this parasite. So that, adopting of integral effects of combination of tolerant cultivars and rationale chemical control measures and

suitable cultural practices is necessary. These weeds are significantly reducing seed yield due to their direct competition for environmental factors such as light, space, and nutrients (Kavurmaci *et al.,* 2010). Because of the high cost of labor as well as the high cost of energy for mechanical annual weed control, herbicide treatments continue appear to be the most effective, require the least amount of time, and the least expensive option in conventional agriculture (Garcia De Arevalo *et al.,* 1992; Gressel, 2000). Fakkar *et al.* (2016) indicated that weed control treatments significantly decreased the dry weight of grassy, broad-leaves and total weeds, numbers and weight of broomrape spikes and delayed broomrape emergence above soil surface and gave the highest values of yield and yield components. The best treatments were (Select-super +Basagran+ Roundup twice) and/or hand hoeing twice at 18, 30 DAS+ Hand pulling twice. Abasalt *et al*. (2014) showed that lowest both density and dry weight of weeds were obtained by Bentazon followed by hand weeding once accompanied with increased broad bean yield. Heath *et al.* (1991) noted that Bentazone controlled many broadleaf weeds applied post-em. with the full dose (1.44kg/ ha). El-Metwally & Ahmed (2001) indicated that the best control and highest seed yield of faba bean were achieved by application of Bentazon and Fluazifop-butyl. Saad El-Din (2003) noted that the best control of broad-leaved weeds and highest seed yield of faba bean were achieved by application of Bentazon. Abasalt *et al.* (2014) showed that the lowest dry weight of weed was obtained with Bentazon followed by hand weeding once accompanied with increased broad bean yield. Several investigators showed that weed control efficiency by pendimethalin herbicide (Alemu and Sharma 2018), bentazon + clethodium herbicides (Aldhahi *et al*., 2018; Fakkar and Khlifa 2018) and hand hoeing twice significantly depressed dry weight of weeds compared to the untreated check and increased faba bean yield and its components. El-Gedwy *et al.* (2020) treated cv. Giza 843 with six weed control treatments, i.e. pendimethalin at rate of 773.5 g a.i/fed (Stomp extra 45.5 % CS), bentazon at rate of 240 g a.i/fed (Basagran 48 % AS) + clethodium at rate of 62.5 g a.i/fed (Select super 12.5 % EC), hand hoeing twice compared to the unweeded check, recognized that weed control by hand hoeing twice or using bentazon + clethodium caused high depression in weed biomass and the maximum values of plant height, No. of pods, No. of seeds, seed weight/plant and seed yield/Fed accompanied with the highest values of gross income, net benefit and benefit/cost ratio. This research paper aims to find new combinations of different herbicides to control of both annual weeds and broomrape without harmful effect on faba bean and order to give high net benefit.

MATERIALS AND METHODS

The present investigation was carried out at Sakha Agricultural Research Station, Agricultural Research Center, Egypt, during the two successive growing seasons 2020 / 2021 and 2021/2022. The present study aimed to investigate the effective of cultivars, and weed control treatments on faba bean productivity under naturally infested soils with annual weeds and broomrape (*Orobanche crenata* Forsk) the sowing date at 2 and 6 November in both seasons, respectively. The preceding crop was maize in both seasons. The origin and pedigree of the studied cultivars are presented in Table (1).

Table 1. The pedigree and *Orobanche spp* reaction of the genotypes used in the study.

No.	Genotypes	Pedigree	*Orobanche spp* reaction
1	Giza 716	Individual plant selection from Giza 3	Susceptible
2	Misr 3	(G3 X 123A /45/76) X (62/1570/66 X G2) X Romi X Habashi	Tolerant
3	Giza 843	(561/2076/85 Skh X 461/485/83)	Tolerant

The mechanical and chemical analyses of the experimental site soil are presented in Table (2), according to (Jackson, 1973)

Table 2. Physical and chemical properties of the experimental soil (0-30 cm) in 2020/21 and 2021/22 seasons.

Seasons	Particle size distribution			Soil texture	Chemical analyses					
	Sand %	Silt %	Clay %		EC (dsm^{-1}) (1:5)	pH (1:1)	Organic matter %	Available (mg kg-1)		
								Total N (%)	P (ppm)	K (ppm)
2020/21	19.6	31.5	48.9	Clay	2.24	7.80	1.64	30	2.64	240
2021/22	18.2	26.6	55.2	Clay	2.28	8.05	1.36	33	2.43	244

The treatments were arranged in split plot design with four replications, the main plots were randomly devoted to three cultivars, and the sub plots were randomly devoted to weed control treatments.

Main plots: (Faba bean cultivars):

1- Giza 843 2- Misr 3 3- Giza 716

Sub plots: (weed control treatments):

1- Stomp Extra 45.5% CS at the rate of 1.25 Liter fed^{-1} applied as post sowing and before irrigation directly.
2- Round up Star 44.1% SL at the rate of 75 cm^3 fed^{-1} (twice) with three weeks interval, the first once applied at the beginning of faba bean flowering, dependent on the cultivar.
3- Stomp Extra 45.5% CS at the rate of 1 liter fed^{-1} with Round up Star 44.1% SL at the rate of 50 cm^3 fed^{-1} (Mixing in spray tank), applied as post sowing and before irrigation directly.
4- Stomp Extra 45.5% CS at the rate of 1 liter fed^{-1} with Round up Star 44.1% SL at the rate of 100 cm^3 fed^{-1} (Mixing in spray tank), applied as post-sowing and before irrigation directly.
5- Stomp Extra 45.5% CS at the rate of 1Liter fed^{-1} with Round up Star 44.1% SL at the rate of 150 cm^3 fed^{-1} (Mixing in spray tank), applied as post-sowing and before irrigation directly.
6- Basagran 48% AS at the rate of 500 cm^3 fed^{-1} applied at 21 days after planting (DAP) + hand hoeing once after other 21 days.
7- Hand hoeing twice for annual weeds at 30 and 45 days and hand pulling of broomrape spikes after emergence for 2-3 times.
8- Untreated weedy check.

The herbicides in both experiments were sprayed by CP3 knapsack sprayer with water volume of 200 liters feddan^{-1}.

The herbicides used and their common, trade, chemical names, family and site of action according to (Ashton and Crafts, 1981), were presented in (Table 3).

Table 3. Description nomenclature of herbicides in the present study.

Common name	Trade name	Chemical name	Fam	Site of action
Pendimethalin	Stomp Extra CS 45.5% (CS = Capsule Suspension)	[N-(1-ethylpropyl)-2, 6-dinitro-3, 4-xylidine]	Dinitroaniline	Cell division inhibition (microtubule assembly)
Glyphosate potassium	Round up Star SL 44.1% (SL= Soluble Concentrate)	Glycine,N-(phosphonomethyl)-, potassium salt	Glycine	Inhibition of EPSP syntheses
Bentazone	Basagran AS 332 48% (AS=Aqueous Soluble)	3-isopropyl-1H-2,1,3-benzothiadiazin-4(3H)-one 2,2-dioxide	Benzothiadiazinone	Inhibition of photosynthesis at PSI

The experimental plot consisted of five ridges 60 cm apart and 3.5 m long (3 x 3.5 m = 10.5 m^2). All the recommended agricultural practices for production of faba bean were applied on the proper time. Calcium superphosphate fertilizer was used at the rate of 15.0 kg P_2O_5/fad during land preparation.

Weed survey:

Weeds and broomrape spikes were hand pulled from one square meter chosen at randomly from each plot at 60 days after faba bean cv. sowing, and before harvesting time immediately, respectively. Weeds identified to species according to (Täckhalm, 1974) and divided into annual broadleaf weeds and grassy weeds.

Data recorded:

On annul weeds:

Fresh weight of broad-leaved weeds in m^{-2}.
Fresh weight of grassy weeds m^{-2}.
Fresh weight of total weeds in m^{-2}.

On broomrape:

Broomrape spike length (cm).
Number of broomrape spikes plant^{-1}.
Number of broomrape spikes in m^{-2}.
Dry weight of broomrape spikes in gm^{-2}.

On Yield and its components:

At harvest, the following traits were measured in a sample of 10 random guarded plants from each sub plot:
Plant height (cm).
Number of branches plant^{-1}.
Number of pods plant^{-1}.
Number of seeds plant^{-1}.
Seed yield (g plant^{-1}).
100-seed weight (g).
All plants were taken from each whole plot and the weight diverted into:
Seed yield (ardab fed^{-1}).
Straw yield (ton fed^{-1}).
Economic evaluation.

Economic evaluation due to weed control treatments was calculated according to (Heady and Dillon, 1961) as follows:
Gross income (L.E.) = (yield (ton/Fed) x price of ton (L.E.)) + (Straw yield (ton/Fed) x price of ton (L.E.))
Net benefit (L.E.) = gross income - total cost (L.E.).
Benefit/cost ratio = gross income/total cost.

The average of faba bean price from the Bulletin of Statistical Cost Production and Net Return (2021) were used to compute gross income. The faba bean price was 1878 LE /ardab of seed and 154 LE / Ton of the straw.

Statistical analysis:

All the collected data were statistically analyzed, according to the technique of analysis of variance (ANOVA) for the design, as published by (Gomez and Gomez, 1984). Least significant difference (LSD) at the (5 %) level was used to test the differences between treatment means at (5 %) of probability as described by (Snedecor and Cochran, 1980).

RESULTS

The dominant weed species in the experimental fields in the two seasons were: *Beta vulgaris* (wild beet, sea beet), *Chenopodium album* (lambsquarters), *Rumex dentatus* (curly dock), *Anagallis arvensis* (preinpernel), *Medicago polymorpha* (medic, toothed medik), *Coronopus didymus* (lesser swine-cress), and *Sonchus oleraceus* (annual sowthistle) Ackerson as broad-leave weeds with infestation rates 1395.4 and 1602.7 kg fresh weight/fed in the first and second seasons, respectively. *Lolium temulentum* (damel Ryegrass) and *Phalaris sp*. (canary grass) as grassy weeds with infestations rates 1201.8 and 1321.7 kg fresh weight fed^{-1} in both seasons, respectively. While, Orobanche *crenata* Forsk. (broomrape) as a parasitic weed with infestations rates 2634.9 and 2869.0 kg dry weight/fed in both seasons, respectively .

Effect of faba bean cultivars on annual weeds:

It was noticed that Giza 716 cultivar gave the highest significant reduction on the fresh weight of broadleaf and grassy weeds compared to Giza 843 and Misr 3 cultivars in both seasons. Giza716 gave the significant reduction percentage on broadleaf weeds by 14.6&7.0 % and on grassy weeds by 10.4 &3.1 % compared to Giza 843 and Misr 3, respectively, in first season. These results were identically obtained in the second season (Table 4).

Effect of weed control treatments on annual weeds:

Data in Table 4 indicated that, all weed control treatments significantly decreased the fresh weight of the two categories of weeds at 60 days after sowing compared to the untreated weedy check in both seasons. Stomp Extra at 1 L fed^{-1}, with Round up Star at 150 cm^3 fed^{-1}, Basagran at 500 cm^3 fed^{-1}+ Hand weeding, Stomp Extra at 1 L fed^{-1}, with Round up Star at 100 cm^3 fed^{-1} and Hand hoeing twice were the best treatments on reducing the fresh weight of annual broad-leaved weeds by 92.1, 86.9, 86.2 % and 81.9 %, respectively, compared with untreated weedy check in the first season, as well as the results took the same direction in the second season.

Table 4. Effect of faba bean cultivars and weed control treatments on fresh weight of annual weeds (gm-^{2}) during 2020/21 and 2021/22 winter seasons.

Cultivars	Fresh weight of annual weeds (g m^{-2})					
	Broad-leaved weeds		Grassy weeds		Total weeds	
	1st	2nd	1st	2nd	1st	2nd
Giza 843	142.3	153.7	109.0	119.9	251.3	273.6
Misr 3	130.6	141.1	100.8	110.9	231.5	252.0
Giza716	121.5	131.2	97.7	107.5	219.2	238.7
L.S.D.$_{0.05}$	4.01	4.33	9.05	9.96	11.48	12.57
Weed control treatments (rate fed^{-1})						
Stomp Extra 45.5% CS at (1.25 L)	111.7	120.6	51.7	56.8	163.3	177.4
Round up Star 44.1% SL at 75 cm^3 + 75 cm^3	318.3	343.8	271.1	298.2	589.4	642.0
Stomp Extra at (1 L) with Round up (50 cm^3)	81.7	88.2	41.7	45.8	123.3	134.0
Stomp Extra at (1 L) with Round up (100 cm^3)	48.9	52.8	31.1	34.2	80.0	87.0
Stomp Extra at (1 L) with Round up (150 cm^3)	27.8	30.0	22.2	24.4	50.0	54.4
Basagran 48%AS at (500 cm^3)+Hand hoeing once	46.1	49.8	56.7	62.3	102.8	112.1
Hand hoeing twice + Hand pulling	63.9	69.0	59.4	65.4	123.3	134.4
Untreated check	353.3	381.6	286.1	314.7	639.4	696.3
L.S.D.$_{0.05}$	5.56	6.01	10.05	11.05	12.67	13.87

Effect of faba bean cultivars on broomrape:

Data in Table (5) showed that the effect of differences between three faba bean cultivars were not significant on Broomrape spikes length (cm) in both seasons, showed the differences between Giza 843, Misr 3 and Giza 716 faba bean cultivars in No. of broomrape spikes m^{-2} were reached to the level of significant at 5%. Cultivars Giza 843 and Misr 3 recorded the highest reduction percentages on number of broomrape spikes plant^{-1}, per m^{-2} and dry weight of broomrape spikes m^{-2} in both seasons by (28.6and 17.1%), (25.4 and 16.8%) and (17.7 and 13.6 %), respectively, in the first season and by (25.0 and 13.6 %), (25.7 and 17.4 %) and (14.0 and 11.0 %), respectively, in the second season, comparing with the susceptible cultivar Giza 716.

Effect of weed control treatments on broomrape:

Data in Table (5) revealed that (Round up Star at 75 cm^3 fed^{-1}, Stomp Extra at 1 L fed^{-1}, with Round up Star at 150 cm^3 fed^{-1}, Stomp Extra at 1 L fed^{-1}, with Round up Star at 100 cm^3 fed^{-1} and Stomp Extra at 1 L fed^{-1}, with Round up Star at 50 cm^3 fed^{-1}) decreased the broomrape spikes length (cm), by (83.7, 83.2, 81.6 and 77.0 %), number of broomrape spikes plant^{-1}, by (82.9, 82.9, 81.4 and 72.9 %) number of broomrape spikes m^{-2} by (82.0, 82.3, 80.6 and 73.5 %) and dry weight of broomrape spikes m^{-2} by (85.5, 85.1, 83.5 and 80.2 %), respectively, as compared with untreated check in the first season. The results obtained in the second season approximately had the same trend.

Table 5. Effect of faba bean cultivars and weed control treatments on broomrape spikes during 2020/21 and 2021/22 winter seasons.

Cultivars	Broomrape							
	spikes Length (cm)		No spikes Plant^{-1}		No spikes m^{-2}		Dry weight spikes (g m^{-2})	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Giza 843	42.4	46.6	2.5	3.3	12.9	16.2	206.9	236.9
Misr 3	45.1	49.6	2.9	3.8	14.4	18.0	217.4	245.0
Giza716	49.2	54.1	3.5	4.4	17.3	21.8	251.5	275.4
L.S.D.$_{0.05}$	N.S	N.S	0.65	0.55	1.16	1.71	18.77	25.22
Weed control treatments (rate fed^{-1})								
Stomp Extra 45.5% CS at (1.25 l)	68.4	75.3	3.8	4.8	18.4	23.2	331.4	370.1
Round up Star 44.1% SL at 75 cm^3 + 75 cm^3	15.5	17.0	1.2	1.7	6.5	8.2	91.2	106.9
Stomp Extra at (1 L) with Round up (50 cm^3)	21.9	24.1	1.9	2.8	9.5	12.1	124.3	143.3
Stomp Extra at (1 L) with Round up (100 cm^3)	17.5	19.3	1.3	1.8	7.0	8.7	103.6	119.7
Stomp Extra at (1 L) with Round up (150 cm^3)	16.0	17.6	1.2	1.6	6.4	8.0	93.5	109.4
Basagran 48%AS at (500 cm^3) + Hand hoeing once	62.8	69.0	3.3	4.4	16.3	20.7	199.6	226.1
Hand hoeing twice + Hand pulling	67.0	73.6	3.8	4.8	18.4	23.2	231.2	260.8
Untreated check	95.2	104.7	7.0	8.9	36.1	45.2	627.3	683.1
L.S.D.$_{0.05}$	2.73	2.98	0.44	0.58	1.33	1.62	17.87	19.22

Effect of faba bean cultivars on yield and yield components characters:

Data recorded in Tables (6 and 7) illustrated that faba bean cultivars under study, significantly differed in yield and yield components in both seasons except with 100-seed weight (g) in first season. The tolerant cultivar Giza 843 recorded an increase in plant height (cm.) and 100-seed weight (g) (22.11 - 22.14 %) and (12.96 - 6.47%) in both seasons, respectively. While the tolerant cultivar Misr 3 had the highest mean value for the yield and other yield components except number of branches/plant in addition the susceptible cultivar Giza 716 possessed the highest mean value (21.41 – 20.90 %) as comparing to tolerant cultivar Misr 3 in both seasons, respectively.

Effect of weed control treatments on yield and yield components characters:

In general, all treatments under study had positive effects on morphological, yield and yield components traits as compared to untreated control in both seasons. Tables (6 and 7) showed that the best treatment which had the highest increasing was Stomp extra at 1 L fed^{-1} with Round up (100 cm^3 fed^{-1}) by (79.60 – 78.62 %) , (61.65 – 67.31 %) , (61.43 – 63.51 %) , (98.89 – 70.46%) , (32.21 – 31.28 %) , (52.48 – 52.69 %) , (63.37 – 65.92 %) for number of branches, number of pods, number of seed, seed yield (g) $plant^{-1}$,100-seed weight (g), straw yield ton fed^{-1} and seed yield ardab fed^{-1} in first and second season, respectively. It was better than round up Star 44.1 % SL which it is recommended to control broomrape infection, it increased with (74.36 – 73.32 %) , (59.75 – 65.54 %) , (58.06 – 60.15 %) , (98.64 – 63.52 %) , (28.59 – 28.58 %) , (47.54 – 47.93 %), (59.62 – 62.29 %) for number of branches, number of pods, number of seed, seed yield (g) $plant^{-1}$,100-seed weight (g), straw yield ton fed^{-1} and seed yield ardab fed^{-1}, in both seasons, respectively, it also recorded the highest increasing for plant height (cm.) (20.74 %) in both seasons. In the other hand, the worst treatments were Basagran 48% AS at 500 cm^3/ fed + Hand weeding followed by hand hoeing twice + hand pulling, they recorded the lowest increase for all characters under study as comparing to untreated treatment.

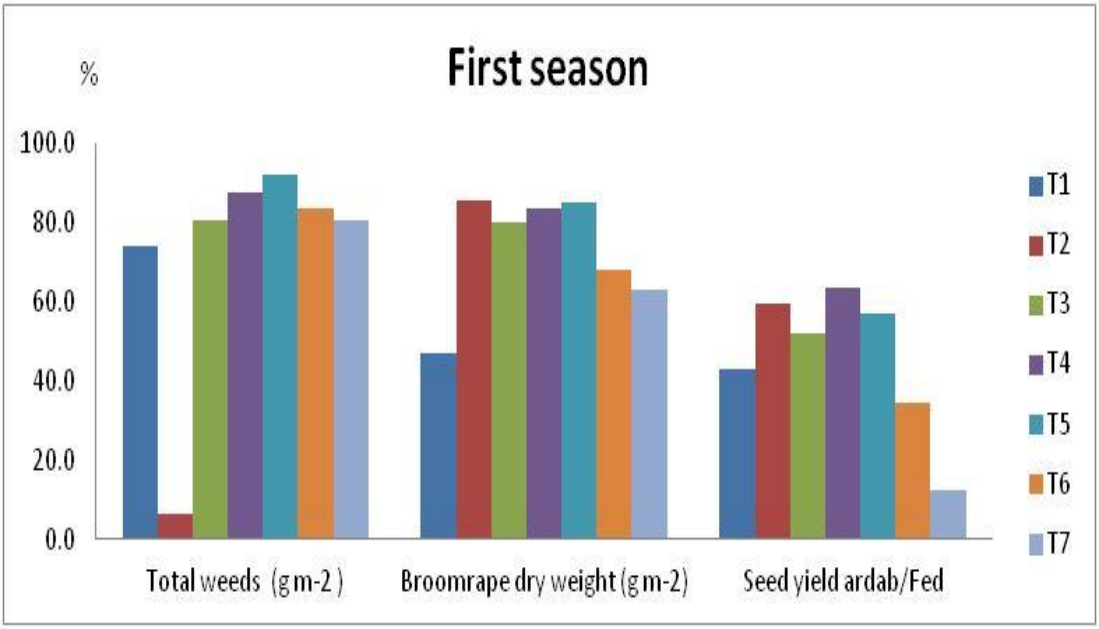
Table 6. Effect of faba bean cultivars and weed control treatments on plant height, number of branches /plant, number of pods/plant and number of seeds/plant during 2020/21 and 2021/22 winter seasons**.**

Cultivars	Plant height (cm.)		No. of branches $plant^{-1}$		No. of pods $plant^{-1}$		No. of seeds $plant^{-1}$	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Giza 843	89.08	83.75	2.46	2.12	8.08	7.04	23.58	22.58
Misr 3	87.63	82.37	2.92	2.50	10.38	9.38	31.58	30.00
Giza716	69.38	65.21	3.13	2.68	5.63	4.63	13.00	11.29
$L.S.D._{0.05}$	3.28	3.07	0.36	0.29	0.55	1.79	1.93	3.32
Weed control treatments (rate fed^{-1})								
Stomp Extra 45.5% CS at (1.25 L)	80.78	75.93	2.33	2.00	7.33	6.22	19.89	18.22
Round up Star 44.1% SL at 75 cm3 + 75 cm^3	93.78	88.16	4.33	3.71	11.33	10.33	31.78	30.11
Stomp Extra at (1 L) with Round up (50 cm^3)	88.67	83.36	3.22	2.77	8.22	7.22	23.78	22.11
Stomp Extra at (1 L) with Round up (100 cm^3)	83.89	78.86	5.44	4.63	11.89	10.89	34.56	32.89
Stomp Extra at (1 L) with Round up (150 cm^3)	83.56	78.54	2.78	2.40	8.44	7.44	24.11	23.56
Basagran 48%AS at(500 cm^3)+Hand hoeing once	75.78	71.23	1.89	1.61	6.78	5.78	18.33	16.78
Hand hoeing twice + Hand pulling	75.44	70.92	1.56	1.34	5.67	4.67	16.00	14.67
Untreated check	74.33	69.88	1.11	0.99	4.56	3.56	13.33	12.00
$L.S.D._{0.05}$	2.81	2.64	0.35	0.30	0.88	0.89	1.57	1.70

Table 7. Effect of faba bean cultivars and weed control treatments on seed yield/ plant, 100-seed weight, straw yield ton/fed and seed yield ardab/fed during 2020/21 and 2021/22 winter seasons

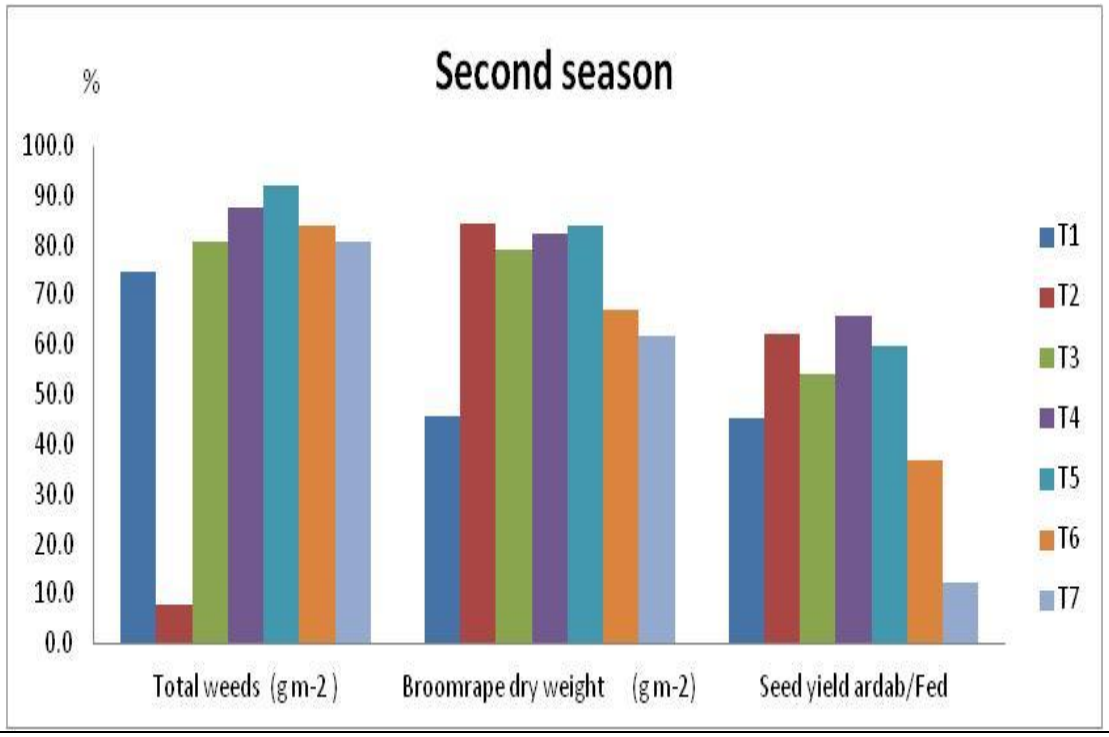
cultivars	Seed yield plant^{-1} (g)		100-seed weight (g)		Straw yield ton fed^{-1}		Seed yield ardab fed^{-1}	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Giza 843	18.08	16.01	75.99	74.96	1.63	1.50	10.85	9.97
Misr 3	24.48	22.43	75.24	73.77	1.96	1.80	12.56	11.66
Giza716	8.37	7.14	66.14	70.11	0.82	0.75	4.38	3.71
L.S.D.$_{0.05}$	2.26	2.12	N.S	1.98	0.17	0.15	1.35	1.30
Weed control treatments (rate fed^{-1})								
Stomp Extra 45.5% CS at (1.25 l)	14.37	12.60	71.64	72.31	1.29	1.19	8.61	7.81
Round up Star 44.1% SL at 75 cm^3 +75 cm^3	23.48	21.60	80.97	81.56	1.83	1.69	12.21	11.35
Stomp Extra at (1L) with Round up (50cm^3)	17.10	15.02	74.58	75.74	1.58	1.46	10.24	9.35
Stomp Extra at(1L) with Round up(100cm^3)	28.74	26.68	85.29	84.76	2.02	1.86	13.46	12.56
Stomp Extra at (1 L) with Round up(150 cm^3)	19.82	17.76	77.16	77.79	1.73	1.59	11.51	10.61
Basagran 48%AS at 500 cm^3+Hand hoeing once	12.51	11.01	68.82	68.33	1.27	1.17	7.50	6.75
Hand hoeing twice + Hand pulling	10.49	8.99	63.38	64.84	1.07	0.98	5.62	4.87
Untreated check	0.32	7.88	57.82	58.25	0.96	0.88	4.93	4.28
L.S.D.$_{0.05}$	1.67	1.70	5.23	5.56	0.15	0.14	0.99	0.98

Fig. 1 and 2. Illustrate Stomp Extra at 1 L fed^{-1} mixed with Round up star at 100 and 150 cm^{3}fed^{-1}, applied as post sowing directly followed Stomp Extra at 1.25 L fed^{-1} singly as post sowing directly and Hand hoeing twice + Hand pulling for 2-3 times, proved of effective on controlling annual weeds included broomrape associate with the efficacy on increasing faba bean yield.



T1- Stomp Extra 45.5% CS at (1.25 L) T2- Round up Star 44.1% SL at 75 cm^3 + 75 cm^3
T3- Stomp Extra at (1 L) with Round up (50 cm^3) T4- Stomp Extra at (1 L) with Round up (100 cm^3)
T5- Stomp Extra at (1 L) with Round up(150 cm^3) T6- Basagran 48%AS at (500 cm^3) + Hand hoeing
T7- Hand hoeing twice + Hand pulling

Fig. 1: Effect of weed control treatments on percentage of fresh weight of total weeds, dry weight of broomrape and seed yield of faba bean in 2020/21 season.



T1- Stomp Extra 45.5% CS at (1.25 L) T2- Round up Star 44.1% SL at 75 cm3 + 75 cm^3
T3- Stomp Extra at (1 L) with Round up (50 cm^3) T4- Stomp Extra at (1 L) with Round up (100 cm^3)
T5- Stomp Extra at (1 L) with Round up (150 cm^3) T6- Basagran 48%AS at (500 cm^3) + Hand hoeing
T7- Hand hoeing twice + Hand pulling

Fig. 2: Effect of weed control treatments on percentage of fresh weight of total weeds, dry weight of broomrape and seed yield of faba bean in 2021/22 season.

7- Interaction effect between faba bean cultivars and weed control treatments:

7. A - On weeds:

Results in Table (8) `indicated that the interactions between Giza 716 with all weed control treatments gave the highest significant depression of the two weeds categories compared to the interactions between Misr 3 and Giza 843 with all weed control treatments. The best interactions on reducing all weeds were Giza 716 with either Stomp Extra at 1 L fed^{-1} mixed with Roundup at 150 cm^3 fed^{-1} or Stomp Extra at 1 L fed^{-1} mixed with Roundup at 100 cm^3 fed^{-1}. The reduction percentage of the total two weeds categories by the respective above two interactions was 93.1% and 88.2% in average two seasons, respectively, compared to untreated control.

Table 8. Effect of the interaction between faba bean cultivars and weed control treatments on fresh weight of annual weeds (g m^{-2}) during 2020/21 and 2021/22 seasons.

Cultivars	Treatments (rate fed^{-1})	Fresh weight of annual weeds (g m^{-2})					
		Broad-leaved weeds		Grassy weeds		Total weeds	
		1st	2nd	1st	2nd	1st	2nd
Giza 843	Stomp Extra 45.5% CS at (1.25 L)	121.7	131.4	55.0	60.5	176.7	191.9
	Round up Star 44.1% SL at 75 cm^3 + 75 cm^3	338.3	365.0	293.3	322.7	631.7	688.1
	Stomp Extra at (1 L) with Round up (50 cm^3)	88.3	95.4	45.0	49.50	133.3	144.9
	Stomp Extra at (1 L) with Round up (100 cm^3)	55.0	59.4	33.3	36.67	88.3	96.1
	Stomp Extra at (1 L) with Round up (150 cm^3)	33.3	36.0	25.0	27.50	58.3	63.5
	Basagran 48%AS at (500 cm^3)+Hand hoeing once	51.7	55.8	55.0	60.50	106.7	116.3
	Hand hoeing twice + Hand pulling	70.0	75.6	58.3	64.17	128.3	139.8
	Untreated check	380.0	410.4	306.7	337.3	686.7	747.7
Misr 3	Stomp Extra 45.5% CS at (1.25 L)	113.3	122.4	51.7	56.8	165.0	179.2
	Round up Star 44.1% SL at 75 cm3 + 75 cm^3	316.7	342.0	261.7	287.8	578.3	629.8
	Stomp Extra at (1 L) with Round up (50 cm^3)	81.7	88.2	41.7	45.8	123.3	134.0
	Stomp Extra at (1 L) with Round up (100 cm^3)	48.3	52.2	31.7	34.8	80.0	87.0
	Stomp Extra at (1 L) with Round up (150 cm^3)	28.3	30.6	21.7	23.8	50.0	54.4
	Basagran 48%AS at (500 cm^3)+Hand hoeing once	45.0	48.6	60.0	66.0	105.0	114.6
	Hand hoeing twice + Hand pulling	61.7	66.6	63.3	69.7	125.0	136.3
	Untreated check	350.0	378.0	275.0	302.5	625.0	680.5
Giza716	Stomp Extra 45.5% CS at (1.25 L)	100.0	108.0	48.3	53.2	148.3	161.2
	Round up Star 44.1% SL at 75 cm3 + 75 cm^3	300.0	324.0	258.3	284.2	558.3	608.2
	Stomp Extra at (1 L) with Round up (50 cm^3)	75.0	81.0	38.3	42.2	113.3	123.2
	Stomp Extra at (1 L) with Round up (100 cm^3)	43.3	46.8	28.3	31.7	71.7	78.0
	Stomp Extra at (1 L) with Round up (150 cm^3)	21.7	23.4	20.0	22.0	41.7	45.4
	Basagran 48%AS at (500 cm^3)+Hand hoeing once	41.7	45.0	55.0	60.5	96.7	105.5
	Hand hoeing twice + Hand pulling	60.0	64.8	56.7	62.3	116.7	127.1
	Untreated check	330.0	356.4	276.7	304.3	606.7	660.7
L.S.D 0.05		8.74	9.44	N.S	N.S	19.91	21.79
C.V		5.37	5.37	12.43	12.43	6.87	6.91

7. B - On broomrape:

Results in **Table (9)** showed that the effect of the interaction between faba bean cultivars and broomrape control treatments was statistically not significant on broomrape spikes length, and number of broomrape spikes $plant^{-1}$ traits. Planting Giza 843 cultivar with (Stomp Extra at 1 L fed^{-1} with Round up 150 cm^3 fed^{-1}) gave the highest reduction percentage for number of broomrape spikes m^{-2}, and dry weight of broomrape (g m^{-2}) which were estimated by (86.5 and 87.8 %, respectively), in the first season, compared to untreated control treatment with Giza 716 cultivar, Misr 3 cultivar had the same direction in percentage of reduction of these characters with the same treatment. This result indicated that Stomp Extra at 1 L fed^{-1} with Round up 150 cm^3fed^{-1} possessed high positive effect in characters related to *Orobanche* tolerance as comparing to Round up 75 cm^3fed^{-1} which is recommended.

Table 9. Effect of interaction between faba bean cultivars and weed control treatments on broomrape spikes during 2020/21 and 2021/22 seasons.

Cultivars	Treatments (rate fed^{-1})	Broomrape							
		Spikes length (cm.)		No spikes Plant^{-1}		No spikes m^{-2}		Dry weight spikes (gm^{-2})	
		1st	2nd	1st	2nd	1st	2nd	1st	2nd
Giza 843	Stomp Extra 45.5% CS at (1.25 L)	65.6	72.1	3.3	4.3	16.3	20.7	302.8	342.8
	Round up Star 44.1% SL at 75 cm^3 + 75 cm^3	13.8	15.1	1.0	1.3	5. 7	7.0	84.4	102.8
	Stomp Extra at (1 L) with Round up (50 cm^3)	20.7	22.6	1.7	2.7	8. 7	11.0	120.3	142.1
	Stomp Extra at (1 L) with Round up (100 cm^3)	14.9	16.4	1.0	1.3	6.0	7.3	93.6	109.7
	Stomp Extra at (1 L) with Round up (150 cm^3)	14.6	16.0	1.0	1.3	5.7	7.0	85.9	104.3
	Basagran 48%AS at (500 cm^3)+Hand hoeing once	57.3	63.0	2.7	3.7	13.7	17.3	182.5	211.1
	Hand hoeing twice + Hand pulling	60.9	67.0	3.3	4.3	16.3	20.7	218.7	250.4
	Untreated check	91.3	100.3	6.0	7.7	30.7	38.7	566.6	632.2
Misr 3	Stomp Extra 45.5% CS at (1.25 L)	64.5	71.0	3.7	4.7	18.3	23.0	325.4	364.4
	Round up Star 44.1% SL at 75 cm^3 + 75 cm^3	16.1	17. 7	1.3	2.0	6.3	8.0	88.9	104.3
	Stomp Extra at (1 L) with Round up (50 cm^3)	21.2	23.3	2.0	2. 7	10.0	12. 7	124.69	143.8
	Stomp Extra at (1 L) with Round up (100 cm^3)	17. 7	19.5	1.3	2. 0	6.7	8.3	100.49	117.7
	Stomp Extra at (1 L) with Round up (150 cm^3)	16.3	18.0	1.3	1. 7	6.3	7. 7	89.9	105.6
	Basagran 48%AS at (500 cm^3)+Hand hoeing once	63.8	70.2	3.0	4.0	15.0	19. 0	187.0	212.0
	Hand hoeing twice + Hand pulling	65.6	72.1	3.3	4.3	17.0	21. 3	211.6	239.5
	Untreated check	95.4	104.9	7.0	9.0	35.3	44. 3	611.8	672.9
Giza716	Stomp Extra 45.5% CS at (1.25 L)	75.3	82.8	4.3	5.3	20. 7	26. 0	366.1	403.0
	Round up Star 44.1% SL at 75 cm^3 + 75 cm^3	16.6	18.3	1.3	1.7	7. 6	9. 7	100.4	113.7
	Stomp Extra at (1 L) with Round up (50 cm^3)	23.9	26.3	2.0	3.0	10.0	12. 7	128.0	144.1
	Stomp Extra at (1 L) with Round up (100 cm^3)	19.9	21.9	1. 7	2.0	8. 3	10.3	116.7	131.6
	Stomp Extra at (1 L) with Round up (150 cm^3)	17.0	18. 7	1.3	1.7	7. 3	9.3	104.7	118.4
	Basagran 48%AS at (500 cm^3)+Hand hoeing once	67.3	73.9	4.3	5.7	20. 3	25. 7	229.2	255.3
	Hand hoeing twice + Hand pulling	74.4	81.8	4. 7	5. 7	22. 0	27. 6	263.2	292. 7
	Untreated check	99.0	108.9	8.0	10.0	42.3	52. 7	703. 7	744.2
L.S.D.$_{0.05}$		N.S	N.S	N.S	N.S	2.08	2.55	28.08	N.S
C.V		7.60	7.55	18.83	19.16	11.32	11.03	10.07	9.66

7. C - On yield and yield components characters:

The effect of interaction between cultivars and weed control treatments on yield and yield components characters was presented in Tables (10 and 11). The data recorded showed that there was significant differentiation for all characters under study except 100- seed weight (g.) character was non-significant. The Round up Star 44.1 % SL with susceptible cultivar Giza 716 recorded the highest mean value for plant height (cm.) (95.00-89.30) in both seasons, respectively, it also had high mean value for No. of branches plant^{-1} (5.00-4.30) in both seasons, respectively. Meanwhile the treatment tolerant cultivar Misr 3 with stomp extra + round up (100 cm^3 fed^{-1}) recorded the highest increase in No. of branches, No. of pods, No. of seeds, seed yield (g plant^{-1}) , straw yield ton fed^{-1} and seed yield ardab fed^{-1} (84.20 - 83.33 %), (82.96 – 82.80 %), (90.63 – 92.62 %), (96.94 – 97.14 %), (80.77 – 80.47 %), (95.70 – 96.46 %) in both seasons, respectively, compared to untreated chick susceptible cultivar Giza 716.

Table 10. Effect of interaction between cultivars and weed control treatments on yield components characters during 2020/21 and 2021/22 winter seasons.

Cultivars	Treatments (rate fed^{-1})	Plant height (cm)		No. of branches plant^{-1}		No. of pods plant^{-1}		No. of seeds plant^{-1}	
		1st	2nd	1st	2nd	1st	2nd	1st	2nd
Giza 843	Stomp Extra 45.5% CS at (1.25 L)	89.0	83.7	2.3	2.0	8.3	7.1	23.7	22.7
	Round up Star 44.1% SL at 75 cm^3 + 75 cm^3	94.7	89.0	3.7	3.1	10.7	9.1	29.0	28.0
	Stomp Extra at (1 L) with Round up (50 cm^3)	94.3	88.7	3.0	2.6	9.7	8.2	27.3	26.3
	Stomp Extra at (1 L) with Round up (100 cm^3)	93.3	87.7	4.0	3.4	11.0	9.4	31.0	30.0
	Stomp Extra at (1 L) with Round up (150 cm^3)	92.3	86.8	2.7	2.3	9.0	7.7	27.3	26.3
	Basagran 48%AS at (500 cm^3)+Hand hoeing once	87.3	82.1	1.7	1.4	7.3	6.3	20.7	19.7
	Hand hoeing twice + Hand pulling	81.3	76.5	1.3	1.2	5.3	4.6	17.7	16.7
	Untreated check	80.3	75.5	1.0	0.9	3.3	2.9	12.0	11.0
Misr 3	Stomp Extra 45.5% CS at (1.25 L)	88.3	83.0	2.3	2.0	9.0	7.7	29.3	27.3
	Round up Star 44.1% SL at 75 cm^3 + 75 cm^3	91.7	86.2	4.3	3.7	13.3	11.4	41.3	39.3
	Stomp Extra at (1 L) with Round up (50 cm^3)	91.7	86.2	2.7	2.3	10.0	8.5	30.0	28.0
	Stomp Extra at (1 L) with Round up (100 cm^3)	88.3	83.0	6.3	5.4	13.7	11.6	42.7	40.7
	Stomp Extra at (1 L) with Round up (150 cm^3)	88.3	83.0	2.7	2.3	10.3	8.8	31.0	32.3
	Basagran 48%AS at (500 cm^3)+Hand hoeing once	85.0	79.9	2.0	1.7	9.7	8.2	28.3	26.3
	Hand hoeing twice + Hand pulling	85.0	79.9	1.7	1.4	9.0	7.7	26.0	24.0
	Untreated check	82.7	77.7	1.3	1.2	8.0	6.8	24.0	22.0
Giza716	Stomp Extra 45.5% CS at (1.25 L)	65.0	61.1	2.3	2.0	4.7	4.0	6.7	4.7
	Round up Star 44.1% SL at 75 cm^3 + 75 cm^3	95.0	89.3	5.0	4.3	10.0	8.5	25.0	23.0
	Stomp Extra at (1 L) with Round up (50 cm^3)	80.0	75.2	4.0	3.4	5.0	4.3	14.0	12.0
	Stomp Extra at (1 L) with Round up (100 cm^3)	70.0	65.8	6.0	5.1	11.0	9.4	30.0	28.0
	Stomp Extra at (1 L) with Round up (150 cm^3)	70.0	65.8	3.0	2.6	6.0	5.1	14.0	12.0
	Basagran 48%AS at (500 cm^3)+Hand hoeing once	55.0	51.7	2.0	1.7	3.3	2.9	6.0	4.3
	Hand hoeing twice + Hand pulling	60.0	56.4	1.7	1.4	2.7	2.3	4.3	3.3
	Untreated check	60.0	56.4	1.0	0.9	2.3	2.0	4.0	3.0
L.S.D.$_{0.05}$		4.41	4.15	0.55	0.48	1.37	1.39	2.47	2.67
C.V		4.34	4.34	15.80	15.82	13.83	16.03	8.77	10.14

Table 11. Effect of interaction between cultivars and weed control treatments on yield and yield components characters during 2020/21 and 2021/22 winter seasons.

Cultivars	Treatments (rate fed^{-1})	Seed yield (g) plant^{-1}		100-seed weight (g)		Straw yield ton Fed^{-1}		Seed yield ardab Fed^{-1}	
		1st	2nd	1st	2nd	1st	2nd	1st	2nd
Giza 843	Stomp Extra 45.5% CS at (1.25 L)	18.13	16.03	76.91	75.95	1.63	1.50	10.87	10.00
	Round up Star 44.1% SL at 75 cm^3 + 75 cm^3	23.20	21.13	84.14	83.00	2.09	1.92	13.91	13.06
	Stomp Extra at (1 L) with Round up (50 cm^3)	21.27	19.19	79.67	78.69	1.92	1.76	12.75	11.87
	Stomp Extra at (1 L) with Round up (100 cm^3)	23.90	21.82	86.62	85.59	2.16	1.98	14.35	13.48
	Stomp Extra at (1 L) with Round up (150 cm^3)	22.40	20.33	80.97	79.93	2.02	1.86	13.45	12.57
	Basagran 48%AS at (500 cm^3)+Hand hoeing once	15.90	13.82	76.52	75.46	1.43	1.31	9.53	8.66
	Hand hoeing twice + Hand pulling	10.27	8.25	69.17	68.14	0.92	0.85	6.16	5.24
	Untreated check	9.57	7.49	53.90	52.90	0.86	0.79	5.74	4.85
Misr 3	Stomp Extra 45.5% CS at (1.25 L)	21.37	19.29	73.16	72.11	1.92	1.76	12.81	11.89
	Round up Star 44.1% SL at 75 cm^3 + 75 cm^3	34.80	32.97	81.53	80.50	2.29	2.11	15.27	14.39
	Stomp Extra at (1 L) with Round up (50 cm^3)	21.73	19.65	77.36	76.19	1.96	1.80	13.03	12.14
	Stomp Extra at (1 L) with Round up (100 cm^3)	36.33	34.26	83.87	82.84	2.34	2.15	15.57	14.69
	Stomp Extra at (1 L) with Round up (150 cm^3)	25.97	23.89	80.24	79.21	2.16	1.99	14.40	13.47
	Basagran 48%AS at (500 cm^3)+Hand hoeing once	19.23	17.20	72.15	67.78	1.73	1.59	11.53	10.65
	Hand hoeing twice + Hand pulling	19.10	17.03	67.39	66.34	1.72	1.58	9.45	8.57
	Untreated check	17.27	15.17	66.23	65.19	1.56	1.43	8.37	7.47
Giza716	Stomp Extra 45.5% CS at (1.25 L)	3.60	2.47	64.86	68.86	0.32	0.30	2.16	1.53
	Round up Star 44.1% SL at 75 cm^3 + 75 cm^3	12.43	10.72	77.25	81.19	1.12	1.03	7.46	6.59
	Stomp Extra at (1 L) with Round up (50 cm^3)	8.20	6.21	66.70	72.33	0.88	0.81	4.92	4.03
	Stomp Extra at (1 L) with Round up (100 cm^3)	26.00	23.96	85.37	85.85	1.57	1.44	10.45	9.51
	Stomp Extra at (1 L) with Round up (150 cm^3)	11.10	9.06	70.27	74.23	1.00	0.92	6.66	5.78
	Basagran 48%AS at (500 cm^3)+Hand hoeing once	2.40	2.00	57.80	61.76	0.66	0.61	1.44	0.94
	Hand hoeing twice + Hand pulling	2.10	1.69	53.56	60.03	0.56	0.51	1.26	0.80
	Untreated check	1.11	0.98	53.32	56.66	0.45	0.42	0.67	0.52
L.S.D.$_{0.05}$		2.62	2.66	N.S	N.S	0.23	0.21	1.55	1.54
C.V		12.47	14.16	9.16	9.67	12.74	12.73	13.28	14.47

8 - Economic Evaluation:

Data in Table (12) demonstrate the total costs of faba bean production fed^{-1} as affected by the applied different treatments (average of 2020/21 and 2021/22 seasons). From such data, it is clear that the minimum total costs were obtained with all faba bean cultivars and untreated check, being 11.870 and 13.294 thousand L.E, respectively. The maximum total costs were obtained from all cultivars treated with mechanical weed control by Hand hoeing + Hand polling being 12.670 and 14.178 thousand L.E fed^{-1}, respectively, in the both seasons. The gross income of faba bean seed yield in L.E. fed^{-1} was affected by applying different treatments in both seasons, respectively.

From such results, it is clear that the highest gross income of seed yield fed^{-1} was detected with faba bean cultivar Misr 3 by Stomp Extra at (1 L fed^{-1}) with Round up (100 cm^3 fed^{-1}) which was 30.726 and 36.794 thousand L.E fed^{-1} with reduction 95.01 and 95.79 % in the first and second seasons, respectively, as comparing to faba bean cultivar Giza 716 under untreated check, which was 1.532 and 1.548 thousand L.E. fed^{-1}. Results reveal that the highest net benefit was achieved from faba bean cultivar Misr 3 and weed control by Stomp Extra at (1 L fed^{-1}) with Round up (100 cm^3 fed^{-1}) which was making a Benefit / Costs Ratio (B/C ratio) 2.48 and 2.65 in the first and second seasons, respectively. While the lowest B/C ratio was 0.13 and 0.12 which recorded by faba cultivar Giza 716 with no management to weed control in both seasons, respectively.

Table 12. Determination of economic performance for interaction between cultivars and weed control treatments during 2020/21 and 2021/22 winter seasons

Cultivars	Treatments (rate fed^{-1})	Gross income (Thousand L.E.)		Total costs (Thousand L.E.)		Net income (Thousand L.E.)		Benefit costs ratio (B/C)	
		1st	2nd	1st	2nd	1st	2nd	1st	2nd
Giza 843	Stomp Extra 45.5% CS at (1.25 L)	21.45	25.09	12.38	13.86	9.08	11.23	1.73	1.81
	Round up Star 44.1% SL at 75 cm^3 + 75 cm^3	27.44	32.73	12.11	13.54	15.33	19.19	2.27	2.42
	Stomp Extra at (1 L) with Round up (50 cm^3)	25.16	29.76	12.40	13.87	12.77	15.89	2.03	2.15
	Stomp Extra at (1 L) with Round up (100 cm^3)	28.31	33.77	12.41	13.89	15.90	19.89	2.28	2.43
	Stomp Extra at (1 L) with Round up (150 cm^3)	26.54	31.51	12.42	13.90	14.12	17.60	2.14	2.27
	Basagran 48%AS at (500 cm^3)+Hand hoeing once	18.81	21.73	12.44	13.92	6.37	7.81	1.51	1.56
	Hand hoeing twice + Hand pulling	12.15	13.18	12.67	14.18	-0.52	-0.99	0.96	0.93
	Untreated check	11.32	12.22	11.87	13.29	-0.55	-1.08	0.95	0.92
Misr 3	Stomp Extra 45.5% CS at (1.25 L)	25.27	29.81	12.38	13.86	12.89	15.96	2.04	2.15
	Round up Star 44.1% SL at 75 cm^3 + 75 cm^3	30.13	36.05	12.11	13.54	18.02	22.51	2.49	2.66
	Stomp Extra at (1 L) with Round up (50 cm^3)	25.72	30.44	12.40	13.87	13.32	16.57	2.07	2.19
	Stomp Extra at (1 L) with Round up (100 cm^3)	30.73	36.79	12.41	13.89	18.32	22.91	2.48	2.65
	Stomp Extra at (1 L) with Round up (150 cm^3)	28.42	33.75	12.42	13.90	15.99	19.85	2.29	2.43
	Basagran 48%AS at (500 cm^3)+Hand hoeing once	22.75	26.70	12.44	13.92	10.31	12.78	1.83	1.92
	Hand hoeing twice + Hand pulling	18.83	21.71	12.67	14.18	6.16	7.53	1.49	1.53
	Untreated check	16.70	18.96	11.87	13.29	4.83	5.67	1.41	1.43
Giza716	Stomp Extra 45.5% CS at (1.25 L)	4.26	3.89	12.38	13.86	-8.12	-9.97	0.34	0.28
	Round up Star 44.1% SL at 75 cm^3 + 75 cm^3	14.72	16.57	12.11	13.54	2.61	3.03	1.22	1.22
	Stomp Extra at (1 L) with Round up (50 cm^3)	9.80	10.26	12.40	13.87	-2.60	-3.62	0.79	0.74
	Stomp Extra at (1 L) with Round up (100 cm^3)	20.62	23.85	12.41	13.89	8.21	9.97	1.66	1.72
	Stomp Extra at (1 L) with Round up (150 cm^3)	13.14	14.54	12.42	13.90	0.72	0.64	1.06	1.05
	Basagran 48%AS at (500 cm^3)+Hand hoeing once	3.11	2.69	12.44	13.92	-9.33	-11.24	0.25	0.19
	Hand hoeing twice + Hand pulling	2.71	2.29	12.67	14.18	-9.96	-11.89	0.21	0.16
	Untreated check	1.53	1.55	11.87	13.29	-10.34	-11.75	0.13	0.12

DISCUSSION

The results indicate that faba bean cultivars Misr 3 and Giza 716, were more competitive to weeds that may due to their plants were taller and have more branches plant^{-1} compared to Giza 843. On other hand Giza 843 and Misr 3 had well growth with presented of broomrape as considered a tolerant against this parasitic weed. Similar results were obtained by Fakkar *et al.* (2016) indicated that excelled cultivars of Nubaria1and 3 and Giza 843 than other cultivars and increase yield and its components by reducing the grassy and broad-leaved weeds, increased height of the plants, as well as increase the number of branches plant^{-1} compared with other cultivars. Giza 843 and Misr 3 cultivars were brief and partially resistant to broomrape infection, contrast Nubaria1 and 3, which were highly susceptible. These results agreed with Attia *et al*. (2013), they reported that Misr 3 exceeded the tolerant cultivars Misr 1 and Giza 843 by 4 and 30%, respectively. Eldemery *et al*. (2016), used twenty-five faba bean (*Vicia faba* L.) genotypes for assess the effects of broomrape (*Orobanche crenata*) on their growth and productivity. For the yield traits, the genotypes “Giza843”, “Misr1” and “Misr3” obtained the best results for the traits number of pods plant^{-1} (15.1, 15.3 and 17.3, respectively), number of seeds pod^{-1} (4.1, 4.1 and 4.8, respectively) and number of seeds plant^{-1} (37.1 for “Misr3”). Furthermore, the herbicidal

treatment used (from 1 to 5) controlled efficacy broomrape tubers underground the soil and superiored hand pulling treatment which controlled broomrape spikes aboveground the soil after approximately 80 % of faba bean damage was done. Similar results were obtained by Abasalt *et al.* (2014) showed that the lowest dry weight of weed was obtained with Bentazon followed by hand weeding once accompanied with increased broad bean yield. Several investigators showed that weed control efficiency by pendimethalin herbicide (Alemu and Sharma 2018), bentazon + clethodium herbicides (Aldhahi *et al*., 2018; Fakkar and Khlifa, 2018) and hand hoeing twice significantly depressed dry weight of weeds compared to the untreated check and increased faba bean yield and its components. These results seem to have effect on increasing faba bean yield and its components in both seasons. This result was in agreement with El-Gedwy *et al*. (2020) treated cv. Giza 843 with six weed control treatments, i.e. pendimethalin at rate of 773.5 g a.i fed^{-1} (Stomp extra 45.5 % CS), bentazon at rate of 240 g a.i fed^{-1} (Basagran 48 % AS) + clethodium at rate of 62.5 g a.i fed^{-1} (Select super 12.5 % EC), hand hoeing twice compared to the unweeded check, recognized that weed control by hand hoeing twice or using bentazon + clethodium caused high depression in weed biomass and the maximum values of plant height, No. of pods, No. of seeds, seed weight $plant^{-1}$ and seed yield Fed^{-1} accompanied with the highest values of gross income, net benefit and benefit/cost ratio . Concerning of the interactions of the three faba bean cultivars and the previous weed control treatments gave the highest significant reduction on the annual weeds presented associated to control broomrape as parasitic weed and reflected that to give the highest yield and its components, addition to give the highest economic net gross in both seasons. These results are in agreement with those obtained by (Fakkar *et al*. 2016; Eid *et al*. 2017; El-Gedwy *et al*. 2020; El-Sherbeni *et al*., 2021) they reported that spraying with glyphosate followed by hand pulling significantly increased faba bean yield and its components as compared to untreated.

Finally: Roundup Star herbicide was the core of the present study. So, important to explain this mode of action. It inhibited 5-enolpyruvyl shikimate 3-phosphate (EPSP) synthase enzyme. EPSP inhibition lead to deplete of aromatic amino acids tryptophan, tyrosine and phenyl alanine, all needed for protein synthesis. Once protein production stops, the plant growth stops (Anonymous, 2019).

CONCLUSION

Results of this work revealed that the best interactions of faba bean cultivars and weed control treatments were between Misr 3 and/or Giza 843 with either Stomp Extra at 1 L fed^{-1} as post sowing or mixed Stomp Extra at 1 L fed^{-1} with Round up Star at 100 cm^3 fed^{-1} and/ or Round up Star at 150 cm^3 fed^{-1}, applied as post-sowing. These treatments gave strong broomrape control as well as gave the greatest values of faba bean seeds yield fed^{-1} accompanied to the gross income and the profitability in both seasons. On the other hand, the interactions between Giza 716 cultivar with either Stomp Extra at 1 L fed^{-1} mixed with Round up Star at 150 cm^3 fed^{-1} or at 100 cm^3 fed^{-1} each applied as post-sowing were superiority on controlling the other annual weeds, in both seasons. The previous results may be due to Misr 3 and Giza 843 had strong of the growth accompanied to special root structure beside the high efficacy of the weed control treatments used in this study. Remarkable: In future, must add Roundup herbicide in a single application as post-sowing with different rates and soils beside to mix with soil-herbicides.

REFRENCES

Abasalt, R.A., Morad S., Ghorban D.M. & Kamran, M. (2014). Effect of cultivation time & weed control on weed and some characteristics of broad bean (Vicia faba L). *International Journal of Plant, Animal and Environmental Sciences*, 4 (3), 271-275.

Aldhahi, H. H. K., Almtarfi, H. I. & Al-Sarraji, A. J. (2018). Evaluation of the effect of some herbicides on *Vicia faba*, L. growth traits. *Journal of Research Ecology*, 6 (2), 1808-1813.

Alemu, N. & Sharma J. (2018). Assessment of integrated weed management practices on weed dynamics, yield components and yield of faba bean (Vicia faba, L.) in Eastern Ethiopia. *Turkish Journal of Agricultural Food Sciences and Technology,* 6 (5), 570-580.

Amer, N. N. Kakahy, Ahmad D. & Abdullahi, A. S. (2012).The effect of planting distance on yield of beans (Vicia faba L.) under drip irrigation system. *African Journal of Agricultural Research*, 7(46), 6110-6114.

Anonymous,(2019). International Survey of Herbicides Resistant weeds.

Ashton, F. M. and Crafts, A. S. (1981). Mode of action of herbicides. Wiley-Interscience, New York, NY. 525 pp.

Attia, Sabah M. , El-Hady, M. M., Saber, H. A., Omer, M.A., Khalil, S.A., Mahmoud Samia, A. , Ashrei, A. A. M., Rehab, Abd-Elrahman, A. M., Ibrahim, M. A. M., Zeinab, Ghareeb, E., El-Marsafawy, T. S., El-Harty, E.H., El-Emam, E . A. A., Shalaby, F.H., Helal, A.G., El-Garhy, A.M., Rabie, E.M., Abdeen, M., El-Noby, M., Yamani, Kh. M. M., Abd El-Aal, H. T. , Ibrahim, M. A., Abo Mostafa, R.A., El-Rodeny W., Morsy, K. M., Noher, A. Mahmoud, Azza F. El-Sayed and Hend A. Ghannam (2013). Misr 3 a new Orobanche tolerant faba bean variety. *Egyptian Journal Plant Breed*, 17 (6), 143 – 152.

Bulletin of Statistical Cost Production & Net Return, (2021). Winter Field Crops & Vegetables and Fruit, Agriculture Statistics and Economic Sector, Ministry of Egyptian Agriculture and Land Reclamation, Part (1), Egypt.

Eid, S.D.M., Mobarak, O. M. M. & Abou Zied, Kh. A. (2017). Evaluation of integrated broomrape (*Orobanche crenata*) management packages under effect of varieties, seeding rates and roundup treatment in faba bean under sandy soil condition, *Alexandria Journal of Agriculture Sciences*, 62 (1), 31-44.

Eldemery , Samah, M.M. , Abdellatif, K.F., El-Absawy, E.A., Emara, H.A., El-Rodeny, W.M. & Zakaria, Asmaa, M. (2016). Gene expression induced in faba bean (*Vicia faba* L.) by *Orobanche crenata* & its impact on the field level. *Egyptian Journal Genet. Cytology*, 45, 279-259.

El-Gedwy E. M. M, Fadl-Allah A.M. and Hassanein A.M.A. (2020). Effect of Planting Distances and Weed Control Treatments on Faba Bean Yield and Associated Weeds. *Annals of Agriculture Sciences, Moshtohor*, 58(1), 1 – 14

El-Metwally, I.M. and Ahmed S.A. (2001) Growth, yield and yield components of mung bean as affected by phosphorus levels and some weed control treatments. *Annual of Agriculture Sciences Moshtoher,* 39(2), 787-803.

El-Metwally, I. M., El-Shahawy, T. A. & Ahmed, M. A. (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.

EL-Sherbeni A.E, Hamed S. A, Khaffagy Azaa E. and EL Kmash Ranya A. (2021) Effect of cultivars, intercropping and glyphosate herbicide on broomrape (*Orobanche crenata* Forsk) and faba bean productivity. *Archives of Agriculture Sciences Journal* 4(3), 235-250.

Frenda, A. S., Ruisi, P., Saia, S., Frangipane, B., Di Miceli, G., Amato, G. and Giambalvo, D. (2013). The critical period of weed control in faba bean and chickpea in Mediterranean areas. *Weed Science,* 61, 452–459.

Fakkar, A. A. O. & Khlifa, Y. A. M. (2018). Effect of corps rotation and sequence weed control treatments on weeds and faba bean productivity. *Egyptian Journal Agronomy*, 40 (2), 181-192.

Fakkar, A. A., Bakhit, M. A. and Ahmed A. F. (2016). Effect of Water Stress and Weed Control on Weeds, Broomrape & Yield in Some Faba Bean Varieties. *Journal Plant Production*, *Mansoura* University, 7(7), 695 -707.

Gadalla, N. O, Eman, M. Fahmy, Bahieldin, A., AbdElsattar, A., Naglaa A. Ashry & Magda A.M. ElEnany (2010). Evaluation of gene expression for Orobanche tolerance in faba bean (*Vicia faba* L.). *Journal of Genetic Engineering and Bio*. 8(1), 53-63.

Garcia De Arevalo, R. C., Lusarreta, C. A., Neyra, C. B., Sanchez, M. A. and Algarra, P. J. H. (1992). Chemical control of annual weeds in field beans (*Vicia faba*) in central Spain. *Weed Science*, 40, 96–100.

Gomez, K.A., and Gomez, A., NY A. (1984). Statistical Procedures for Agricultural Research. 2nd, (ed). John Wiley and Sons, U.S.A.

Gressel, J. (2000). Molecular biology of weed control. *Transgenic Research*, 9, 355–382.

Heath., M.C., Clarke, J.H. and Dgilvy, S.E. (1991). Comparison of pre- and post-emergence herbicides for the control of broadleaved and grass weeds in spring field beans. *Aspects of Applied Biology,* 27, 167-172.

Ibrahim, L.O., A.E. Aboulata, & Das, S.K. (2014). The response of yield components of faba bean to cultivar, plant density & weed control in climatic condition of Khuzestan. IJCLS, V (4), N (9), 2249-1465.

Jackson, M.L. (1973). Soil chemical analysis. Prinkice Hall Inc., Englewood Cliffs., New Jersey U.S.A.

Kharrat, M. & Halila, M.H. (1996). Control of *Orobanche foetida* on *Vicia faba*: comparison between different control measuresin *Advances in Parasitic Plant Research*, Pages 734-738.

Kavurmaci, Z., Karadavut, U., Kökten, K. and Bakoğlu, A. (2010). Determining critical period of weed-crop competition in faba bean (*Vicia faba*, L.). *International Journal of Agricultural Biology*, 12 (2), 318–320.

Mohamed, T.S., Sharshar A.A.H., & Hamada, S.H.E. (2021). Using water extracts of same allelopathic plants accompanied with a reduced rate of glyphosate for controlling broomrape in faba bean. *Menoufia Journal Plant Production*, 6, 199-209.

Saad El-Din, S.A. (2003). Efficiency of some weed control treatments on growth, yield and its components of broad bean (*Vicia faba* L). *Egyptian Journal of Applied Sciences,* 18(6B), 586-604.

Snedecor, G.W. & Cochran W.G. (1980). Statistical Methods. (7th ed.) Iowa State University, Iowa, U.S.A.

Täckhalm, V. (1974). Students' Flora of Egypt. Ed. II. Beirut. *Cairo University,* 888.

تأثير مكافحة الحشائش علي أداء بعض أصناف الفول البلدي في التربة ألمصابة طبيعيا بالهالوك

محمد عماد زكى قنيبر[1]، عادل مصطفى عبد العال غلوش[1] ، عزه فتحى السيد[2*]

[1]المعمل المركزى لبحوث الحشائش ، مركز البحوث الزراعية، جيزة، مصر

[2] قسم بحوث المحاصيل البقولية ، معهد بحوث المحاصيل الحقلية، مركز البحوث الزراعية، جيزة، مصر

*بريد المؤلف المراسل azza.fathy@yahoo.com

نفذت تجربه حقليه لإنتاج الفول البلدي تحت ظروف العدوى الطبيعية بالحشائش الحولية والهالوك (*Orobanche crenata* Forsk.) في محطة البحوث الزراعية بسخا، مركز البحوث الزراعية، مصر، عند (دائرة عرض 31.7° شمالاً ، وخط طول 30.5° شرقاً) خلال موسمي الشتاء 2021/2020 ، 2022/2021. تهدف التجربة لدراسة تأثير ثلاثة أصناف من الفول البلدي (جيزة 843 ، مصر 3 ، جيزة 716) و ثمانية معاملات لمكافحة الحشائش علي نمو ومكونات المحصول للفول البلدي وكذلك الحشائش المرتبطة بها. تم استخدام تصميم القطع المنشقة مرة واحدة في أربعة مكررات. كشفت النتائج الرئيسية أن العاملين المدروسين كان كلا منهما معتمدا على الآخر. وتم الحصول على أعلى نسبة انخفاض معنوية في مكافحة الحشائش الحولية الكلية والهالوك باستخدام اي من الصنف مصر 3 أو الصنف جيزة 843 مع ستومب اكسترا بمعدل 1 لتر / فدان مع راوند اب ستار بمعدل 100 سم3 / فدان مطبق بعد الزارعة مباشرة. يليها راوند أب ستار بمعدل 75سم3/ فدان (مرتين) ، في مرحلة التزهير وبعد 21 يومًا أعطت اعلي مكافحة للهالوك وزيادة في محصول الفول البلدي ومكوناته. أعطت المعاملات السابقة أعلى زيادة في قيم انتاجية الفول البلدي ومكوناته. علاوة على ذلك ، أعطت هاتين المعاملتين أعلى قيم للقياسات الاقتصادية.

الكالمات المفتاحية : الفول البلدي، الحشائش الحولية، هالوك كريناتا، بازجران، نقاوة يدوية، راوند اب، ستومب اكسترا، الدخل الصافي.