

Effect of Planting Distances and Weed Control Treatments on Faba Bean Yield and Associated Weeds

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Abstract

Two field experiments were carried out in the Farm of Agricultural Research and Experimental Center of Agriculture Faculty at Moshtohor, Benha University, Qalyubia Governorate, Egypt, during 2017/18 and 2018/19 seasons. The study were investigated the effect of three planting distances, *i.e.* 20, 25 and 30 cm between hills with six weed control treatments, *i.e.* acetochlor at rate of 840 g active ingredient (a.i)/fed (Harness 84 % EC), pendimethalin at rate of 773.5 g a.i./fed (Stomp extra 45.5 % CS), metribuzin at rate of 210 g a.i./fed (Sencor 70 % WP), bentazon at rate of 240 g a.i./fed (Basagran 48 % AS) + clethodum at rate of 62.5 g a.i./fed (Select super 12.5 % EC), hand hoeing twice and the unweeded check on growth, seed yield/fed and its yield components of faba bean *cv.* Giza 843 as well as associated weeds. Faba bean planted at narrow planting distance (20 cm between hills) gave the lowest values of weed biomass compared with the other two planting distances (25 and 30 cm between hills) at 70 days after sowing as well as produced the greatest values of leaf area index, plant height and seed yield/fed during the both seasons. While, the highest values of No. of branches, No. of pods, No. of seeds and seed weight/plant as well as 100-seed weight were obtained from planting faba bean at wide planting distance (30 cm between hills) in the both seasons. The main findings show that experimental field was infested by annual weeds for the unweeded check by 659.9 and 1041.8 kg dry weight of weeds/fed, exhibited seed yield loss of 74.82 and 79.65 % faba bean yield/fed compared with the best treatment (hand hoeing twice) in 2017/2018 and 2018/2019 seasons, respectively, planting faba bean under hand hoeing twice or using bentazon + clethodum surpassed the other weed control treatments in depressing weed biomass at 70 days after faba bean sowing. On the other hand, the two treatments gave the greatest values of all faba bean traits without significant difference between them. The highest depression in weed biomass and the maximum values of plant height and seed yield/fed were recorded from planting faba bean at 20 cm between hills and weed control by hand hoeing twice or using bentazon + clethodum. While, the greatest values of No. of pods/plant, No. of seeds/plant and seed weight/plant in both seasons which obtained from planting faba bean at wide planting distance (30 cm between hills) under weed control by hand hoeing twice or using bentazon + clethodum. Analyzing the faba bean seeds found that there was no residual detected of herbicides used. The economic analysis indicate that planting faba bean at 20 cm between hills and weed control by hand hoeing twice gave the net benefit valued 10435 and 8465 L.E./fed in the first and second seasons, respectively without herbicides residues. It could be summarized that planting faba bean *cv.* Giza 843 at planting distance 20 cm between hills with using hand hoeing twice or chemical control by bentazon + clethodum depression weed biomass and maximized seed yield/fed accompanied with the highest values of gross income, net benefit and benefit/cost and without herbicides residues.

Keywords: Faba bean - planting distances- weed control - herbicides - residual effect- Economic evaluation

Introduction

Faba bean (*Vicia faba* L.) is one of the most important legume crops for human consumption in Egypt as a protein source. It plays an essential role in enhancing soil fertility. Also, production of faba bean is still limited and falls to face the increasing local consumption especially, the low cultivated area, which decreased dramatically in last decades due to the strong competition between faba bean and other strategic winter crops such as wheat and clover in Nile valley, Delta and Upper Egypt. Furthermore is affected by different factors such as planting distances, weeds competition and pest attack.

Planting faba bean at wide distance between plants may result in low yield/unit area by leaving

free spaces to more weed infestation (Alizadeh *et al.* 2014 and El-Metwally *et al.* 2017) and poor light-use efficiency. However, narrow distance between plants can cause lodging, less light penetration in the crop canopy, reduced photosynthetic efficiency and consequently seed yield reduction. Many studies on the effect of planting distances on faba bean traits were conducted by various researchers such as (Dahmardeh *et al.* 2010; Bakry *et al.* 2011; Khalil *et al.* 2011; Al-Suhaibani *et al.* 2013; Yucel 2013; Abd El-Rahman 2014; Derogar and Mojaddam 2014; Abou-El-Seba *et al.* 2016 and El-Metwally *et al.* 2017), they indicate that with increases in planting distances increased No. of branches, No. of pods, No. of seeds and seed weight/plant as well as 100-seed

weight. Meanwhile, leaf area index, plant height and seed yield/fed were significantly decreased.

Weeds are considered a major problem in faba bean crop causing great losses in seed yield due to direct competed for environmental factors such as light, space and nutrients (**Kavurmaci *et al.* 2010**). Unrestricted weed growth and delayed weeding reduced seed yield of faba bean up to 46 %. So, weed control in the critical time for weed removal until 45 days after sowing. If the weed control is delayed further than the indicated stages, the yield losses would be much higher, especially under drought conditions and higher weed densities. Several investigators show that weed control by acetachlor and /or pendimethalin herbicides (**El-Metwally and Dawood 2016 and Alemu and Sharma 2018**), metribuzin herbicides (**Abd El-Razik 2006; and El-Metwally *et al.* 2017**), bentazon + clethodium herbicides (**Aldhabi *et al.* 2018 and Fakkar and Khelifa 2018**) and hand hoeing twice (**Alizadeh *et al.* 2014; Alemu and Sharma 2018 and Fakkar and Khelifa 2018**) were significantly depressed dry weight of weeds compared to the unweeded check and then increased all faba bean yield and its components. In Egypt, until now there are no herbicides were recommended for weed control in faba bean.

So, this study aimed to investigate the effect of planting distances and weed control treatments on productivity of faba bean *cv.* Giza 843 and associated annual weeds.

Materials and Methods

Two field experiments were conducted in the Farm of Agricultural Research and the Experimental Center of Faculty of Agriculture at Moshtohor, Benha Univ., Qalyubia Governorate, Egypt, during 2017/18 and 2018/19 seasons. Each experiment included eighteen treatments which were the combinations between three distances between hills and six weed control treatments. The treatments in each experiment were arranged in a split plot design with four replications. The three planting distances were arranged at random in the main plots and the six weed control treatments were assigned at random in the sub plots, as follows:

A. Planting distances:

- 1) 20 cm distance between hills on both sides of the ridges with 2 plants/hill (140000 faba bean plants/fed).
- 2) 25 cm distance between hills on both sides of the ridges with 2 plants/hill (112000 faba bean plants/fed).
- 3) 30 cm distance between hills on both sides of the ridges with 2 plants/hill (93333 faba bean plants/fed).

B. Weed control treatments:

- 1) Acetochlor (Harness 84 % EC): 2-chloro-N-(ethoxymethyl)-N-(2-ethyl-6-methylphenyl) acetamide, applied as post sowing and before planting irrigation at rate of 840 g active ingredient (a.i)/fed.
- 2) Pendimethalin (Stomp extra 45.5 % CS): N- (1-ethylpropyl) -3,4- dimethyl -2,6- dinitro benzenamine, applied as post sowing and before planting irrigation at rate of 773.5 g a.i/fed.
- 3) Metribuzin (Sencor 70 % WP): 4-amino-6-(1,1-dimethylethyl) -3- (methylthio) -1,2,4-triazin-5(4H)-one, applied as post sowing and before planting irrigation at rate of 210 g a.i/fed.
- 4) Bentazon (Basagran 48 % AS): 3-(1-methylethyl)-(1H)-2,1,3-benzothiadiazin-4(3H)-one 2,2-dioxide, applied as post emergence at 25 days after sowing at rate of 240 g a.i/fed + clethodium (Select super 12.5 % EC): (E,E) -(6)-2- [1- [[(3- chloro - 2 -propenyl)oxy]imino] propyl]-5-[2-(ethylthio) propyl] -3-hydroxy -2-cyclohexen -1- one, applied as post emergence at 32 days after sowing at rate of 62.5 g a.i/fed.
- 5) Hand hoeing twice: at 21 and 45 days after sowing.
- 6) Unweeded check.

All herbicides were sprayed with volume of 200 liters water/fed. Seeds of faba bean cultivar *cv.* Giza 843 were obtained from Food Legumes Research Department, Field Crops Research Institute, Agricultural Research Center, Giza, Egypt. Faba bean seeds were inoculated with *Rhizobium leguminosarum* before planting on November 7 and 6 and thinned to double plants/hill before the first irrigation during 2017 and 2018 seasons, respectively. The preceding crop was maize in both seasons. The sub plot area was 12.6 m² and contained seven ridges of 3 m length and 60 cm apart. Phosphorous fertilizer was applied in form of calcium super phosphate (12.5 % P₂O₅) at a rate of 200 kg/fed during soil preparation in each season. Nitrogen fertilizer was applied in form of urea (46 % N), according to the recommended rate 20 kg N/fed at one dose before the first irrigation in each season. The normal cultural practices for growing faba bean plants were done as recommended.

Soil texture of the experimental sites was clay of pH nearly of 8.15. The chemical and mechanical properties analysis of the experimental soil were determined according to the standard procedures described by **Black and Evans (1965)** and presented in **Table (1)**.

Table 1. Chemical and mechanical properties of the experimental soil units before planting faba bean during 2017/18 and 2018/19 seasons.

Properties	Season	
	2017/18	2018/19
Chemical analysis		
E.C.	2.19	2.21
pH (1 :2.5)	8.15	8.13
CaCO ₃ %	3.51	3.00
O.M %	2.16	2.23
N % (total)	0.170	0.173
N (ppm) (available)	52.08	53.64
P % (total)	0.110	0.115
P (ppm) (available)	19.5	20.67
K % (total)	0.61	0.62
K (ppm) (available)	939.78	997.34
Soluble cations and anions (ppm) or (mmoL_e L⁻¹)		
Ca ⁺⁺	186.6 (9.33)	191.6 (9.58)
Mg ⁺⁺	41.04 (3.42)	42.84 (3.57)
K ⁺	45.63 (1.17)	46.80 (1.20)
Na ⁺	190.44 (8.28)	192.28 (8.36)
Cl ⁻	221.88 (6.25)	250.28 (7.05)
Co ₃ ⁻	0.00	0.00
H Co ₃ ⁻	346.48 (5.68)	364.17 (5.97)
So ₄ ⁻	492.96 (10.27)	465.12 (9.69)
Particle size distribution (mechanical analysis)		
Course sand %	7.26	6.59
Find sand %	26.91	27.64
Silt %	13.85	12.60
Clay %	51.98	53.17
Texture grade	Clay	Clay

Data recorded:-**A. Weed measurements:-**

Weeds were manually pulled in a central area of one square meter area randomly placed from each sub plot after 70 days from sowing of faba bean in each season, identified and classified into annual

broad-leaved and annual grassy weeds, then dried on an airforced drying oven at 70 °c for 72 h., and dry weights of weeds were recorded in g/m². The annual weeds existing in the experimental plots during the two seasons are presented in **Table (2)**.

Table 2. The dominant annual weeds species in faba bean during 2017/18 and 2018/19 seasons.

English name	Scientific name
Broadleaf weeds	
wild beet	<i>Beta vulgaris</i> , L.
bishop's weed	<i>Ammi majus</i> , L.
bur clover	<i>Medicago hispida</i> , Gaertn
sun spurge	<i>Euphorbia helioscopia</i> , L.
wild mustard	<i>Brassica nigra</i> , (L.) Kock
fat hen	<i>Chenopodium album</i> , L.
scarlet pimpernel	<i>Anagallis arvensis</i> , L.
swine cress	<i>Coronopus squamatus</i> (Forrskål) Ascherson
Grassy weeds	
wild oat	<i>Avena fatua</i> , L.
canary grass	<i>Phalaris minor</i> , Retz.

B. Faba bean characters:-

At 50 % podding stage, leaf area index were recorded as an average of five random plants from each sub-plot, as described by **Roads and Bloodwoath (1964)**. At harvest, sample of ten guarded plants were taken at random to determine plant height (cm), No. of branches, No. of pods, No. of seeds and seed weight/plant (g) as well as 100-seed weight (g). While, seed yields/fed (kg) were calculated from the three middle ridges of each plots.

C - Herbicide residues in faba bean seeds.

In the second season, the herbicides residues for acetochlor (Harness), pendimethalin (Stomp extra), metribuzin (Sencor), bentazon (Basagran) and clethodium (Select super) in faba bean seeds were analyzed by using the Gas Liquid Chromatography method according to **Nguyen *et al.* (2008)** in Central Agri. Pesticides Lab. A.R.C., Dokki, Giza, Egypt.

D - 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.).

Gross margin (L.E.) = gross income - total cost (L.E.).

Benefit/cost ratio = gross income/total cost.

Statistical analysis:

The analysis of variance was carried out according to the procedure described by **Gomez and Gomez (1984)**, and using the MSTAT-C Statistical Software Package (**Freed, 1991**). The least significant differences (L.S.D.) test at 5 % level was used to compare the treatments mean.

Results and Discussion

A- Weed measurements:-

The annual weeds presented in the experimental plots during the two seasons were wild beet (*Beta vulgaris*, L.), bishop's weed (*Ammi majus*, L.), bur clover (*Medicago hispida*, Gaertn), sun spurge (*Euphorbia helioscopia*, L.), wild mustard (*Brassica nigra*, L.) Kock), fat hen (*Chenopodium album*, L.), scarlet pimpernel (*Anagallis arvensis*, L.) and swine cress (*Coronopus squamatus* (Forsskål) Ascherson as broad leaf weeds with infestation rates 425.4 and 656.6 kg dry weight/fed in the first and second seasons, respectively, while, wild oat (*Avena fatua*, L.) and canary grass (*Phalaris minor*, Retz.) as grassy weeds with infestations rates 234.5 and 385.2 kg dry weight/fed in both seasons, respectively (**Table 3**). Wild beet, wild oat, bishop's weed and bur clover were prevalent weeds, while the other annual weeds were less existing.

1- Effect of planting distances:-

Dry weights of annual broad-leaved, grassy and total weeds at 70 days after sowing were significantly

increased with increasing in planting distances up to 30 cm in both seasons (**Table 3**). No significance differences were shown between planting distance of 25 and 20 cm on dry weight of annual broad-leaved weeds in both seasons as well as between planting distances of 30 and 25 cm on dry weight of annual grassy weeds in the second seasons. The greatest reduction in weed biomass was achieved by sowing faba bean at 20 cm between hills, where it decreased dry weight of annual broad-leaved weeds reached to (16.43 % and 14.44 %), annual grassy weeds (28.82 % and 12.06 %) and total annual weeds (20.63 % and 13.61 %) compared with planting faba bean at 30 cm between hills in the first and second seasons, respectively. The gradual depression in weed biomass at narrow distance between hills may be due to no leaving free spaces to more weed infestation as well as increased inter-specific competition between faba bean plants and weeds for environmental factors. These results are in agreement with those reported by **Alizadeh *et al.* 2014** and **El-Metwally *et al.* 2017**.

2- Effect of weed control treatments:-

Results in **Table 3** indicate that, all weed control treatments significantly decreased the dry weight of the two categories of weeds at 70 days after sowing compared to the unweeded check in both seasons. Hand hoeing twice was the best treatment on reducing the dry weight of annual broad-leaved weeds by 97.80 % and 94.60 %; annual grassy weeds by 95.59 % and 93.52 % as well as total annual weeds by 97.02 % and 94.20 %, followed by bentazon 240 g a.i./fed + clethodium 62.5 g a.i./fed herbicides by 91.50 & 92.30 %; 94.73 & 91.90 % and 92.65 & 92.15 % without significant different between them compared with unweeded check in both seasons, respectively. The following treatments on reducing dry weight of annual broad-leaved weeds were acetochlor, metribuzin and pendimethalin in both seasons respectively; on dry weight of annual grassy weeds were pendimethalin, metribuzin and acetachlor in both seasons respectively; and on dry weight of the total annual weeds were acetachlor, metribuzin and pendimethalin respectively, in the first season and were metribuzin, acetachlor and pendimethalin respectively, in the second season. No significantly difference was shown between bentazon + clethodium and hand hoeing twice as well as among metribuzin and acetochlor on all weeds measurements under study in both seasons. Similar results were obtained by **Abd El-Razik 2006**; **Agegnehu and Fessehaie 2006**; **El-Metwally and Abdel hamid 2008**; **El-Metwally 2016**; **El-Metwally and Dawood 2016**; **El-Metwally *et al.*, 2017**; **Aldhahi *et al.*, 2018**; **Alemu and Sharma, 2018** and **Fakkar and Khelifa 2018**, they found that weed control by hand hoeing twice or herbicides were significantly depressed dry weight of weeds compared to the unweeded check.

Table 3. Effect of planting distances and weed control treatments on dry weight of annual weeds (g/m²) at 70 days from sowing faba bean during 2017/18 and 2018/19 seasons.

Treatment	Season	Dry weight (g/m ²)					
		Broad-leaved weeds		Grassy weeds		Total weeds	
		2017/18	2018/19	2017/18	2018/19	2017/18	2018/19
Planting distance							
20 cm		26.40	44.07	11.61	24.58	38.01	68.64
25 cm		28.09	46.92	14.34	26.52	42.43	73.44
30 cm		31.59	51.51	16.31	27.95	47.89	79.45
L.S.D at 5%		3.11	3.32	1.21	1.82	3.92	4.11
Weed control treatment (g a.i/fed)							
Acetochlor 840 g		13.24	23.37	9.96	23.06	23.20	46.43
Pendimethalin 773 g		31.33	57.94	5.55	11.32	36.88	69.26
Metribuzin 210 g		15.43	26.85	7.78	18.61	23.21	45.47
Bentazon 240 g + Clethodium 62.5 g		8.61	12.04	2.94	7.43	11.55	19.47
Hand hoeing twice		2.23	8.45	2.46	5.94	4.69	14.39
Unweeded check		101.29	156.34	55.83	91.71	157.12	248.05
L.S.D at 5%		6.45	11.32	2.63	3.97	8.37	14.35

B- Faba bean characters:-

1- Effect of planting distances:-

Results presented in **Table 4** revealed that the differences between the studied three planting distances, *i.e.* 30, 25 and 20 cm were significant on most growth characteristics, seed yield/fed and its components and during 2017/18 and 2018/19 seasons. Data revealed that planting faba bean at 20 cm between hills gave the greatest values of leaf area index (4.48 and 4.07), plant height (106.3 and 101.7 cm) and seed yield/fed (713.90 and 579.33 kg), in both seasons, respectively. Planting faba bean at 20 cm between hills increased seed yield/fed by 4.20 and 14.47 % in the first season and 5.26 and 16.76 %, in the second season compared with the growing at 25 and 30 cm between hills respectively. The increases in value of plant height at narrow planting distance (20 cm) is mainly due to increase intra-specific competition among faba bean plants for light penetration, interception and photosynthetic efficiency as well as higher dense of plants excessive shade exist which help to produce more content of gibberellin in tissues and consequently higher plants formed. The greatest values of No. of branches/plant (3.63 and 3.12 branches), No. of pods/plant (16.67 and 14.57 pods), No. of seeds/plant (28.28 and 27.17 seeds), seed weight/plant (17.12 and 16.23 g) and 100-seed weight (60.88 and 61.83 g) in the first and second seasons, respectively were obtained from planting faba bean at wide distance between hills (30 cm). This trend could be explained on the fact that in case of wide distance between hills resulted in low competition between faba bean plants for nutrient elements, soil moisture and sun light, plants would have better opportunity to produce more metabolite

contents and positive effect on plant growth and productivity as well as increased translocation and consequently accumulation of metabolites through seeds and gave the maximum values of plant traits and yield components. No. significance differences were shown among planting faba bean at 20 and 25 cm between hills. Many investigators obtained similar results as **Badran and Ahmed 2010; Dahmardeh et al. 2010; Bakry et al. 2011; Khalil et al. 2011; Al-Suhaibani et al. 2013; Yucel 2013; Abd El-Rahman 2014; Derogar and Mojaddam 2014; Abou-El-Seba et al. 2016 and El-Metwally et al. 2017.**

2- Effect of weed control treatments:-

All weed control treatments caused significant increasing in studied growth traits at podding stage, seed yield/fed and its components of faba bean in both seasons as presented in **Table 4**. Hand hoeing twice gave the highest increasing percentage of No. of pods/plant by 115.60 & 118.51 %; No. of seeds/plant by 164.96 & 186.48 %; seed weight/plant by 193.91 & 273.18 %; 100-seed weight (g) by 25.11 & 43.03 % and seed yield/fed by 297.18 & 391.45 % compared to unweeded check in both seasons, respectively. Meanwhile, bentazon 240 g a.i/fed + clethodium 62.5 g a.i/fed treatment was superioered hand hoeing for leaf area index, plant height (cm) and No. of branches/plant and the next treatment increased leaf area index by 79.03 & 80.43 %; plant height by 34.98 & 36.46; No. of branches/plant by 129.44 & 138.00; No. of pods/plant by 103.51 & 111.76 %; No. of seeds/plant by 140.24 & 154.88 %; seed weight/plant by 175.65 & 258.63 %; 100-seed weight (g) by 23.86 & 41.54 % and seed yield/fed by 285.57 & 370.66 % compared to

unweeded check in both seasons, respectively. The following herbicidal treatments effect on increasing the plant growth and seed yield/fed of faba bean characteristics were in a descending order: acetachlor, metribuzin and pendimethalin for plant height, No. of seeds/plant and seed yield/fed in the both seasons, leaf area index and weight of seeds/plant in the second seasons as well as No. of pods/plant in the first season. Meanwhile, metribuzin, acetachlor and pendimethalin for No. of branches/plant and 100-seed weight in seasons, leaf area index and weight of seeds/plant in the first seasons as well as No. of pods/plant in the second season. No significantly difference was shown between bentazon + clethodium and hand hoeing twice as well as among metribuzin and acetochlor on

all faba bean characters under study in both seasons. The increases in seed yield/fed may be due to the good role of hand hoeing and the best herbicides treatments in improving and increasing yield attributes, *i.e.* No. of branches/plant, No. of pods/plant, No. of seeds/plant and seed yield/plant. These results are in harmony with those reported by **Abd El-Razik 2006; Agegnehu and Fessehaie 2006; El-Metwally and Abdelhamid 2008; El-Metwally 2016; El-Metwally and Dawood 2016; El-Metwally *et al.*, 2017; Aldhahi *et al.*, 2018; Alemu and Sharma, 2018 and Fakkar and Khelifa 2018**, who found that seed yield of faba bean and some yield components characters were increased as a result of using hand hoeing twice or some herbicidal treatments as bentazon + clethodium.

Table 4. Effect of planting distances and weed control treatments on growth, seed yield/fed and its components of faba bean during 2017/18 and 2018/19 seasons.

Treatment	Character	Leaf area index	Plant height (cm)	No. of branches /plant	No. of pods /plant	No. of seeds /plant	Seed weight /plant (g)	100-seed weight (g)	Seed yield/fed (kg)
Planting distance		2017/18 season							
	20 cm	4.48	106.3	2.95	12.07	21.43	12.26	56.57	713.90
	25 cm	4.12	101.5	3.28	14.75	25.73	15.03	59.26	685.13
	30 cm	3.70	96.3	3.63	16.67	28.28	17.12	60.88	623.67
L.S.D at 5%		0.25	3.3	0.31	1.31	2.41	2.25	2.68	65.14
		2018/19 season							
	20 cm	4.07	101.7	2.53	10.40	17.95	10.42	57.71	579.33
	25 cm	3.67	96.6	2.85	12.78	23.73	13.53	60.14	550.37
	30 cm	3.28	90.5	3.12	14.57	27.17	16.23	61.83	496.18
L.S.D at 5%		0.26	3.7	0.29	1.12	2.56	2.05	2.73	51.36
Weed control treatment (g a.i/fed)		2017/18 season							
	Acetochlor 840 g	4.35	106.5	3.47	16.13	26.63	15.75	59.84	714.30
	Pendimethalin 773 g	3.87	91.6	2.67	12.10	18.80	12.43	56.94	548.37
	Metribuzin 210 g	4.38	106.3	3.80	15.80	26.37	16.62	60.98	704.13
	Bentazon 240 g + Clethodium 62.5 g	4.78	112.3	4.13	16.83	31.40	18.11	62.35	907.90
	Hand hoeing twice	4.53	108.3	3.87	17.83	34.63	19.31	62.98	935.23
	Unweeded check	2.67	83.2	1.80	8.27	13.07	6.57	50.34	235.47
L.S.D at 5%		0.38	6.6	0.42	1.54	3.56	2.15	2.85	89.24
		2018/19 season							
	Acetochlor 840 g	3.99	101.5	3.07	13.57	25.73	15.43	63.07	610.70
	Pendimethalin 773 g	3.53	86.9	2.30	9.10	15.77	10.02	56.80	387.80
	Metribuzin 210 g	3.96	98.7	3.27	13.60	24.57	14.89	63.51	567.70
	Bentazon 240 g + Clethodium 62.5 g	4.15	107.8	3.57	15.67	28.47	17.25	64.77	746.93
	Hand hoeing twice	4.10	103.7	3.30	16.17	32.00	17.95	65.45	779.93
	Unweeded check	2.30	79.0	1.50	7.40	11.17	4.81	45.76	158.70
L.S.D at 5%		0.31	5.9	0.37	1.51	3.11	1.99	3.11	80.45

3- Interaction effect between planting distances and weed control treatments:-

3.1. Weed measurements:-

Results in **Table 5** show a significant interaction effect between planting distances and weed control treatments on dry weights of annual broad-leaved, grassy and total weeds in 2017/18 and 2018/19 seasons at 70 days after sowing faba bean. Results indicate that planting faba bean at narrow distance between hills (20 cm) gave the greatest depression in all weed biomass under all weed control treatments. On the other hand, planting faba bean at wide distance between hills (30 cm) gave the lowest depression in all values with all weed control treatments in both growing seasons. Also, weed

control in faba bean fields by hand hoeing twice or using bentazon + clethodium gave the greatest depression in all weed biomass under all planting distances in both seasons. The highest depression in dry weights of annual broad-leaved (1.88 and 7.95 g), grassy (1.58 and 5.62 g) and total weeds (3.46 and 13.57 g) in the first and second seasons respectively, at 70 days after sowing faba bean was recorded from narrow distance between hills (20 cm) and treated with hand hoeing twice. These results are in agreement with those obtained by **Sary *et al.* 1989; Ismail and Fakkar 2008; Alizadeh *et al.* 2014 and El-Metwally *et al.* 2017; Abou-El-Seba *et al.* 2016 and El-Metwally *et al.* 2017.**

Table 5. Effect of the interaction between planting distances and weed control treatments on dry weight of annual weeds (g/m²) at 70 days from sowing faba bean in 2017/18 and 2018/19 seasons.

Planting distance	Weed control treatments (g a.i./fed)	Dry weight (g/m ²)					
		Broad-leaved weeds		Grassy weeds		Total weeds	
		2017/18	2018/19	2017/18	2018/19	2017/18	2018/19
20 cm	Acetochlor 840 g	12.36	21.38	8.76	21.98	21.12	43.36
	Pendimethalin 773 g	28.64	55.59	4.43	10.26	33.07	65.85
	Metribuzin 210 g	13.63	25.65	6.95	17.35	20.58	43.00
	Bentazon 240 g + Clethodium 62.5 g	7.25	11.02	1.79	6.98	9.04	18.00
	Hand hoeing twice	1.88	7.95	1.58	5.62	3.46	13.57
	Unweeded check	94.62	142.82	46.15	85.26	140.77	228.08
25 cm	Acetochlor 840 g	12.74	23.09	9.85	22.86	22.59	45.95
	Pendimethalin 773 g	31.15	55.86	5.49	11.42	36.64	67.28
	Metribuzin 210 g	15.02	26.35	7.83	18.62	22.85	44.97
	Bentazon 240 g + Clethodium 62.5 g	9.04	11.87	3.15	7.27	12.19	19.14
	Hand hoeing twice	2.06	7.86	2.48	5.98	4.54	13.84
	Unweeded check	98.50	156.51	57.26	92.97	155.76	249.48
30 cm	Acetochlor 840 g	14.63	25.63	11.26	24.35	25.89	49.98
	Pendimethalin 773 g	34.21	62.37	6.72	12.29	40.93	74.66
	Metribuzin 210 g	17.65	28.56	8.56	19.87	26.21	48.43
	Bentazon 240 g + Clethodium 62.5 g	9.53	13.24	3.89	8.04	13.42	21.28
	Hand hoeing twice	2.76	9.54	3.32	6.23	6.08	15.77
	Unweeded check	110.75	169.70	64.08	96.89	174.83	266.59
L.S.D at 5%		15.80	27.73	6.44	9.72	20.50	35.15

3.2. Faba bean plant characters:-

Results in **Table 6** show that there were significant effect of the interaction between the three planting distances and the six weed control treatments on faba bean plant traits: plant height (cm), No. of pods/plant, No. of seeds/plant, seed weight/plant (g) and seed yield/fed (kg). That is true in both seasons. In the first season, the interaction among 20 cm between hills and either hand hoeing twice and/or bentazon 240 g a.i./fed + clethodium 62.5 g a.i./fed gave the highest increasing percentage for plant height (43.07 & 46.53 %) and faba bean

seed yield/fed (367.58 & 339.82 %), respectively compared with the interaction between unweeded check with 30 cm between hills. Also, the interaction among 30 cm between hills and both the same previous treatments gave the highest increasing percentage for No. of pods/plant (181.08 & 162.16 %), No. of seeds/plant (273.79 & 246.60 %) and seed weight/plant (329.25 & 306.98 %) respectively, compared with the interaction among unweeded check with 20 cm between hills. While, in the second season the interaction among 20 cm between hills and either hand hoeing twice and /or bentazon 240 g

a.i/fed + clethodium 62.5 g a.i/fed gave the highest increasing percentage for plant height (47.09 & 52.38%) and faba bean seed yield/fed (547.99 & 489.80 %), respectively compared with the interaction among unweed check with 30 cm between hills. Also, the interaction among 30 cm between hills and both the same previous treatments gave the highest increasing percentage for No. of pods/plant (200.00 & 187.69 %), No. of seeds/plant (336.05 & 284.88 %) and seed weight/plant (454.64 & 452.32 %) respectively, compared with the interaction among unweed check with 20 cm between hills (El-Metwally *et al.* 2017). Meanwhile, the interaction

among 25 cm between hills and both the previous treatments were the second after the interaction among 20 cm between hills and both the previous treatments for the values of plant height (108.7 & 112.9 cm) and faba bean seed yield/fed (935.5 & 926.5 kg), respectively and after the interaction among 30 cm between hills and both the previous treatments of the values of the rest previous plant characteristics. Also, there was no significant effect of the interaction between the three planting distances and all the six weed control treatments on leaf area index, No. of branches/plant and 100-seed weight.

Table 6. Effect of the interaction between planting distances and weed control treatments on values of growth, seed yield/fed and its components of faba bean during 2017/18 and 2018/19 seasons.

Treatment	Character	Leaf area index	Plant height (cm)	No. of branches /plant	No. of pods /plant	No. of seeds /plant	Seed weight /plant (g)	100-seed weight (g)	Seed yield /fed (kg)
Planting distance	Weed control treatment (g a.i/fed)	2017/18 season							
20 cm	Acetochlor 840 g	4.69	110.5	3.2	13.5	23.4	13.89	58.25	764.5
	Pendimethalin 773 g	4.32	94.5	2.4	10.2	16.8	10.21	54.61	571.8
	Metribuzin 210 g	4.72	112.5	3.4	13.2	21.6	14.23	58.94	763.9
	Bentazon 240 g + Clethodium 62.5 g	5.23	118.4	3.7	13.6	26.3	14.03	60.19	933.3
	Hand hoeing twice	4.97	115.6	3.5	14.5	30.2	15.87	60.50	992.2
	Unweeded check	2.93	86.0	1.5	7.4	10.3	5.30	46.92	257.7
25 cm	Acetochlor 840 g	4.45	106.3	3.5	16.2	26.8	15.44	59.73	752.3
	Pendimethalin 773 g	3.77	92.1	2.6	12.3	18.9	12.88	57.65	544.0
	Metribuzin 210 g	4.53	106.4	3.9	15.8	27.8	16.88	61.43	716.0
	Bentazon 240 g + Clethodium 62.5 g	4.79	112.9	4.1	17.5	32.2	18.73	62.97	926.5
	Hand hoeing twice	4.52	108.7	3.8	18.2	35.2	19.32	63.54	935.5
	Unweeded check	2.64	82.8	1.8	8.5	13.5	6.90	50.25	236.5
30 cm	Acetochlor 840 g	3.92	102.7	3.7	18.7	29.7	17.93	61.54	626.1
	Pendimethalin 773 g	3.51	88.2	3.0	13.8	20.7	14.21	58.55	529.3
	Metribuzin 210 g	3.88	100.1	4.1	18.4	29.7	18.76	62.57	632.5
	Bentazon 240 g + Clethodium 62.5 g	4.32	105.6	4.6	19.4	35.7	21.57	63.89	863.9
	Hand hoeing twice	4.11	100.5	4.3	20.8	38.5	22.75	64.89	878.0
	Unweeded check	2.44	80.8	2.1	8.9	15.4	7.52	53.86	212.2
L.S.D at 5%		N.S.	16.2	N.S.	3.8	8.7	5.27	N.S.	218.6
2018/19 season									
20 cm	Acetochlor 840 g	4.28	106.5	2.8	11.5	20.5	11.99	60.45	665.2
	Pendimethalin 773 g	4.01	90.5	2.0	8.2	11.5	7.31	53.60	406.5
	Metribuzin 210 g	4.32	104.2	3.0	11.2	18.7	11.58	61.52	624.4
	Bentazon 240 g + Clethodium 62.5 g	4.65	115.2	3.2	12.4	22.5	12.99	63.76	763.2
	Hand hoeing twice	4.62	111.2	3.0	12.6	25.9	14.78	64.25	838.5
	Unweeded check	2.51	82.6	1.2	6.5	8.6	3.88	42.65	178.2
25 cm	Acetochlor 840 g	4.13	102.5	3.1	13.8	26.6	15.87	63.77	636.5
	Pendimethalin 773 g	3.31	86.9	2.3	9.3	15.6	10.21	57.10	392.4
	Metribuzin 210 g	4.05	100.3	3.3	13.7	26.1	15.21	63.88	584.5
	Bentazon 240 g + Clethodium 62.5 g	4.15	107.5	3.6	15.9	29.8	17.34	64.55	751.5
	Hand hoeing twice	4.11	103.5	3.2	16.4	32.6	17.56	65.88	768.8
	Unweeded check	2.26	78.9	1.6	7.6	11.7	4.98	45.68	168.5
30 cm	Acetochlor 840 g	3.55	95.6	3.3	15.4	30.1	18.43	64.99	530.4
	Pendimethalin 773 g	3.28	83.2	2.6	9.8	20.2	12.55	59.70	364.5
	Metribuzin 210 g	3.52	91.5	3.5	15.9	28.9	17.87	65.12	494.2
	Bentazon 240 g + Clethodium 62.5 g	3.66	100.6	3.9	18.7	33.1	21.43	65.99	726.1
	Hand hoeing twice	3.56	96.5	3.7	19.5	37.5	21.52	66.23	732.5
	Unweeded check	2.12	75.6	1.7	8.1	13.2	5.57	48.96	129.4
L.S.D at 5%		N.S.	14.5	N.S.	3.7	7.6	4.87	N.S.	197.1

4- Correlation studies between studded traits: -

Table (7) show that the correlation coefficients between weed biomass {dry weight of broadleaf, grasses and total weeds (g/m²)}, faba bean seed yield and its components were highly significant at 1% level during 2017/18 and 2018/19 seasons.

There were negative correlation coefficients between weed biomass (dry weight of broadleaf, dry weight of grasses and dry weight of total weeds) and seed yield/fed and yield components in both seasons.

Table 7. Correlation coefficients between dry weight of broad -leaved, grassy and total weeds, yield and yield components during 2017/18 and 2018/19 seasons.

Characters	Dry weight (g/m ²)			Leaf area index	Plant height (cm)	No. of branches /plant	No. of pods /plant	No. of seeds /plant	Seed weight /plant (g)	100-seed weight (g)	Seed yield /fed (kg)
	Broad-leaved	Grassy weeds	Total weeds								
2017/18 season											
Dry weight of broad-leaved weeds (g/m ²)	1										
Dry weight of grassy weeds (g/m ²)	0.965**	1									
Dry weight of total weeds (g/m ²)	0.995**	0.986**	1								
Leaf area index	-0.902**	-0.863**	-0.896**	1							
Plant height (cm)	-0.848**	-0.748**	-0.818**	0.956**	1						
No. of branches/plant	-0.850**	-0.750**	-0.821**	0.695**	0.735**	1					
No. of pods/plant	-0.792**	-0.690**	-0.761**	0.532*	0.574*	0.945**	1				
No. of seeds/plant	-0.803**	-0.683**	-0.766**	0.619**	0.670**	0.949**	0.960**	1			
Seed weight/plant (g)	-0.839**	-0.754**	-0.815**	0.603**	0.623**	0.965**	0.985**	0.970**	1		
100-seed weight (g)	-0.861**	-0.775**	-0.837**	0.667**	0.682**	0.966**	0.944**	0.947**	0.969**	1	
Seed yield/fed (kg)	-0.930**	-0.857**	-0.911**	0.927**	0.922**	0.843**	0.739**	0.840**	0.803**	0.834**	1
2018/19 season											
Dry weight of broad-leaved weeds (g/m ²)	1										
Dry weight of grassy weeds (g/m ²)	0.944**	1									
Dry weight of total weeds (g/m ²)	0.992**	0.978**	1								
Leaf area index	-0.897**	-0.845**	-0.889**	1							
Plant height (cm)	-0.847**	-0.711**	-0.808**	0.933**	1						
No. of branches/plant	-0.882**	-0.774**	-0.853**	0.661**	0.704**	1					
No. of pods/plant	-0.754**	-0.621**	-0.715**	0.458	0.552*	0.934**	1				
No. of seeds/plant	-0.771**	-0.643**	-0.734**	0.485*	0.568*	0.932**	0.983**	1			
Seed weight/plant (g)	-0.826**	-0.724**	-0.799**	0.530*	0.577*	0.961**	0.975**	0.981**	1		
100-seed weight (g)	-0.937**	-0.859**	-0.920**	0.757**	0.743**	0.964**	0.863**	0.894**	0.927**	1	
Seed yield/fed (kg)	-0.931**	-0.823**	-0.903**	0.887**	0.937**	0.849**	0.759**	0.779**	0.784**	0.879**	1

C - Herbicide residues in faba bean seeds.

Data in Table 8 and Figs (1-10) demonstrate that the stability of the three herbicides as post sowing and before planting irrigation (acetochlor, pendimethalin and metribuzin) and two herbicides as post emergence (bentazon) and (clethodium). The residues levels of the five herbicides were

rapidly degraded in open field by sunlight, many species of microorganisms and different levels of acidity and alkalinity in the soil. So, the residues of faba bean seeds were less than the allowable level according to European Food Safety Authority (EFSA, 2012).

Table 8. Residues for acetochlor, pendimethalin, metribuzin, bentazon and clethodium in seeds of faba bean in 2018/19 season.

Herbicide	Rate of active ingredient (g/fed)	Residual in faba bean seeds (mg/ kg)	Maximum allowable residues level (mg/ kg)
Acetochlor	840	ND*	0.01
Pendimethalin	773.5	ND	0.05
Metribuzin	210	ND	0.1
Bentazon	120	ND	0.3
Clethodium	62.5	ND	0.5

* No detected

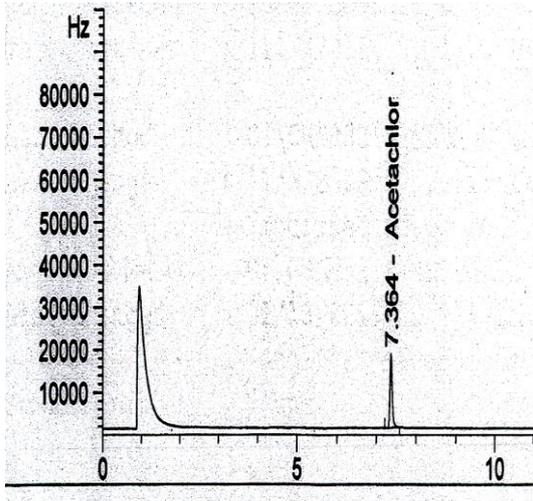


Fig (1)
Chromatogram of standard of acetochlor
(Harness 84 % EC)

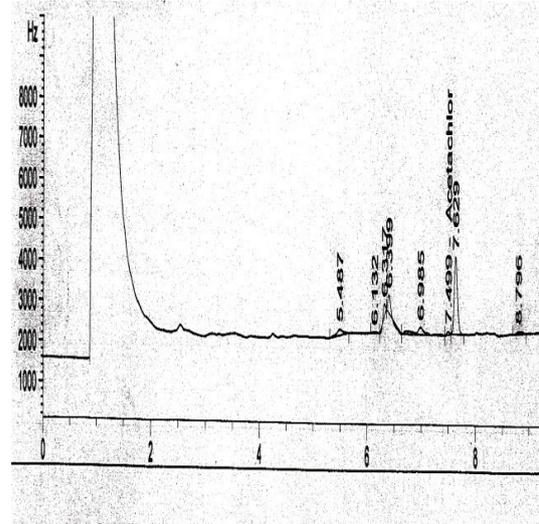


Fig (2)
Chromatogram of sample acetochlor (Harness 84 %
EC) at 840 g a.i./fed in faba been seeds

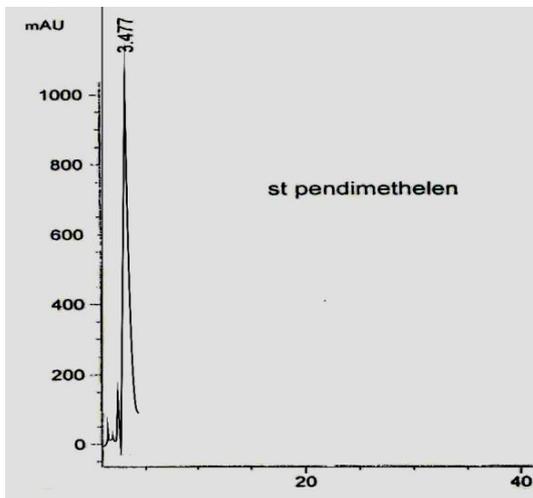


Fig (3)
Chromatogram of standard of pendimethalin
(Stomp extra 45.5 % CS)

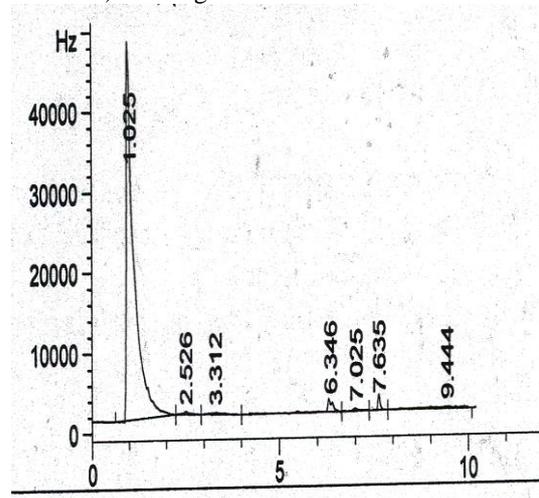


Fig (4)
Chromatogram of sample pendimethalin (Stomp
extra 45.5 % CS) at 773 g a.i./fed in faba been seeds

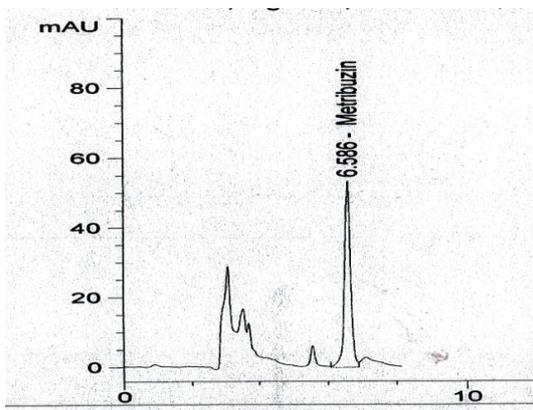


Fig (5)
Chromatogram of standard of metribuzin
(Sencor 70 % WP)

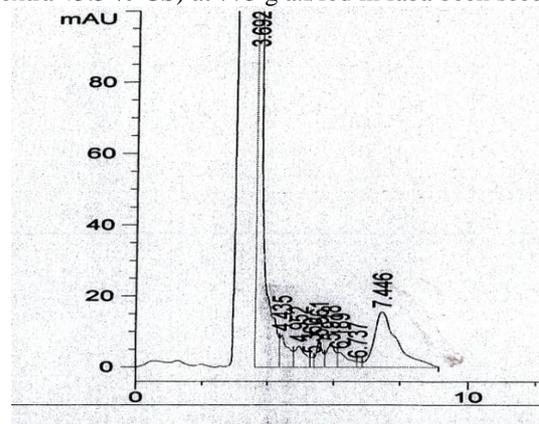


Fig (6)
Chromatogram of sample metribuzin (Sencor 70 %
WP) at 210 g a.i./fed faba in been seeds

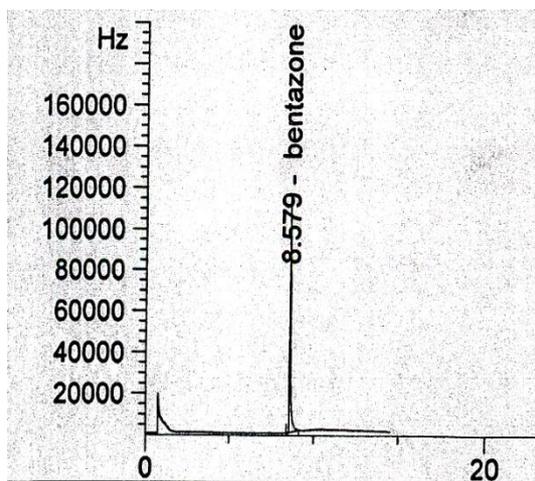


Fig (7)

Chromatogram of standard of bentazon
(Basagran 48 % AS)

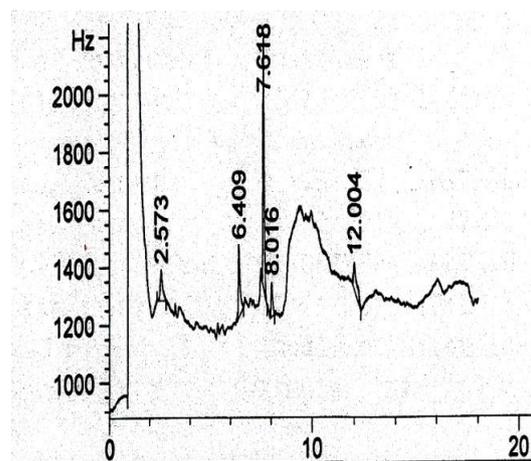


Fig (8)

Chromatogram of sample bentazon (Basagran 48 %
AS) at 240 g a.i./fed in faba bean seeds

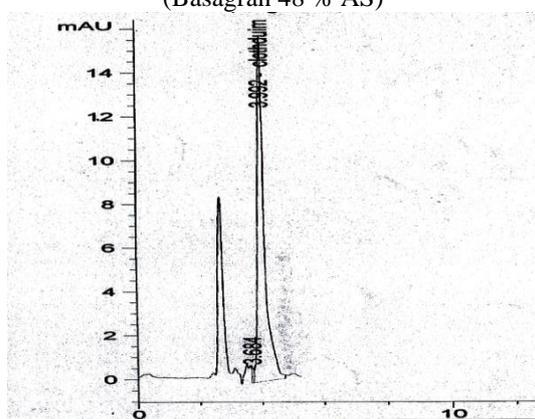


Fig (9)

Chromatogram of standard of clethodium
(Select super 12.5 % EC)

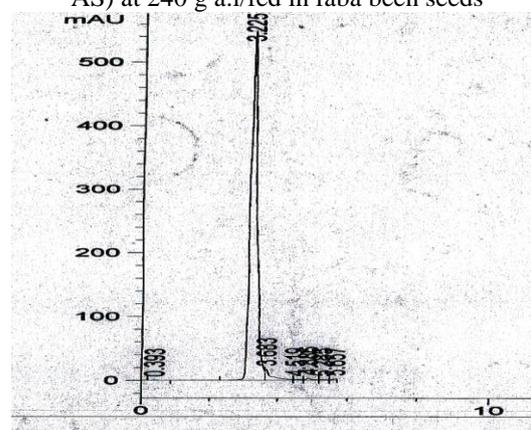


Fig (10)

Chromatogram of sample clethodium (Select super
12.5 % EC) at 62.5 g a.i./fed in faba bean seeds

D - Economic evaluation:

Total fixed costs including values of production inputs such as land rent, soil preparation, plant sowing, fertilizers, irrigation, insect control, harvesting and other miscellaneous costs were 8840 and 8975.6 L.E. in the first and second seasons, respectively. The price of one kilogram seeds (Giza 843) was 25.00 and 27.00 L.E. in the first and second seasons, respectively. Decreasing distances from 30 to 25 and 20 cm between hills increased seed rates from 56.00 to 67.20 and 86.00 kg/fed, respectively. The costs of price herbicides and the spraying were 320.00 and 340.00 L.E. (acetochlor), 315.00 and 325.00 L.E. (pendimethalin), (230.00 and 240.00 L.E. (metribuzin) and 600.00 and 620.00 L.E. (bentazon + clethodium) as well as the cost of hand hoeing twice was 900.00 and 1200.00 L.E. in the first and second seasons, respectively.

Data in **Table 9** show that the total costs of faba bean production/fed as affected by the applied different treatments (average of 2017/18 and 2018/19 seasons). From such data, it is clear that the minimum total costs were obtained with faba

bean planting at wide distance between hills (30 cm) and unweeded check, being 10240 and 10488 L.E, respectively, and the maximum total costs were obtained from planting faba bean at narrow distance between hills (20 cm) and mechanical weed control by hand hoeing twice being 11890 and 12498 L.E./fed respectively.

The gross income of faba bean seed yield in L.E./fed as affected by the applied different treatments in both seasons presented in **Table (9)**. In this estimation the price of faba bean was 2250 and 2500 L.E./ton in the both seasons, respectively, as given by Extension service information. From such results, it is clear that the highest gross income of seed yield/fed were detected with planting faba bean at narrow distance between hills (20 cm) with mechanical weed control by hand hoeing twice which were 22325 and 20963 L.E./fed in first and second seasons, respectively. On the other hand, the lowest values of seed yield/fed were obtained from faba bean planting at 30 cm between hills under unweeded check which were 4775 and 3235 L.E./fed in the first and second seasons, respectively, with reduction of 17550 and 17728 L.E. or 78.61 and

84.57 % compared with the highest treatment in the first and second seasons, respectively.

Results in **Table 9** reveal that the highest net benefit was achieved from faba bean planting at 20 cm between hills and weed control by hand hoeing twice which were 10435 and 8465 L.E./fed making a B/C ratio of 1.88 and 1.68 % in the first and

second seasons, respectively. On the other hand, the lowest net benefit were -5466 and -7253 L.E./fed with the lowest B/C ratio of 0.47 and 0.31 % which were recorded by faba bean planting at wide distance between hills (30 cm) with no management to weed control in 2017/18 and 2018/19 seasons, respectively.

Table 9. Determination economic for the interaction between planting distances and weed control treatments during 2017/18 and 2018/19 seasons.

Planting distance	Weed control treatment (g a.i./fed)	Character							
		Total cost (L.E.)	Gross income (L.E.)	Net benefit (L.E.)	B/C	Total cost (L.E.)	Gross income (L.E.)	Net benefit (L.E.)	B/C
Season		2017/18				2018/19			
20 cm	Acetochlor 840 g	11310	17201	5891	1.52	11638	16630	4992	1.43
	Pendimethalin 773 g	11305	12866	1561	1.14	11623	10163	-1460	0.87
	Metribuzin 210 g	11220	17188	5968	1.53	11538	15610	4072	1.35
	Bentazon 240 g + Clethodium 62.5 g	11590	20999	9409	1.81	11918	19080	7162	1.60
	Hand hoeing twice	11890	22325	10435	1.88	12498	20963	8465	1.68
	Unweeded check	10990	5798	-5192	0.53	11298	4455	-6843	0.39
25 cm	Acetochlor 840 g	10840	16927	6087	1.56	11130	15913	4783	1.43
	Pendimethalin 773 g	10835	12240	1405	1.13	11115	981	-1305	0.88
	Metribuzin 210 g	10750	16110	5360	1.50	11030	14613	3583	1.32
	Bentazon 240 g + Clethodium 62.5 g	11120	20846	9726	1.87	11410	18788	7378	1.65
	Hand hoeing twice	11420	21049	9629	1.84	11990	19220	7230	1.60
	Unweeded check	10520	5321	-5199	0.51	10790	4213	-6578	0.39
30 cm	Acetochlor 840 g	10560	14087	3527	1.33	10827	13260	2432	1.22
	Pendimethalin 773 g	10555	11910	1354	1.13	108130	9113	-1700	0.84
	Metribuzin 210 g	10470	14231	3761	1.36	10728	12355	1627.	1.15
	Bentazon 240 g + Clethodium 62.5 g	10840	19438	8598	1.79	11108	18152	7044	1.63
	Hand hoeing twice	11140	19755	8615	1.77	11688	18312	6624	1.57
	Unweeded check	10240	4775	-5466	0.47	10488	3235	-7252	0.31

Conclusion

Results of this work demonstrated that faba bean performs better with the interaction between either at narrow distance between hills (20 cm) and hand hoeing twice or bentazon 240 g a.i./fed + clethodium 62.5 g a.i./fed. which gave the lowest values of weed biomass as well as produced the greatest values of seed yield/fed during both seasons, and be recommended to solve broad-leaved and grassy weeds problems through the first half life period of in faba bean residues. Furthermore, the above weed control treatments gave the highest values of gross income and net benefit.

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تأثير مسافات الزراعة و معاملات مقاومة الحشائش على محصول الفول البلدي و الحشائش المصاحبة

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أجريت تجربتان حقليتان في مزرعة مركز البحوث والتجارب الزراعية بكلية الزراعة بمشتهر جامعة بنها (مركز طوخ - محافظة القليوبية - مصر) خلال الموسمين الصيفيين 18/2017 و 19/2018 لدراسة تأثير ثلاثة مسافات زراعية بين الجور (20، 25 و 30 سم) وستة معاملات لمقاومة الحشائش وهي أسيتوكولور 840 جم مادة فعالة/فدان (هارنس 84 %)، بينديميثالين 773.5 جم مادة فعالة/فدان (ستومب 45.5 %)، ميتريبيوزين 210 جم مادة فعالة/فدان (سكور 70 %)، بنتازون 240 جم مادة فعالة/فدان (بازجران 48 %) + كليثوديم 62.5 جم مادة فعالة/فدان (سلكت سوبر 12,5 %)، العزيق اليدوي مرتين و عدم المقاومة (للمقارنة) على صفات النمو و مكونات المحصول و محصول البذور لصنف الفول البلدي جيزة 843 و الحشائش المصاحبة. ويمكن تلخيص أهم النتائج فيما يلي:-

أعطت نباتات الفول البلدي المنزرعة على أضييق مسافة (20 سم بين الجور) أفضل تأثير في تقليل الوزن الجاف للحشائش المختلفة عند عمر 70 يوم من زراعة الفول البلدي و حققت أفضل متوسط قيم لصفات دليل مساحة الأوراق، إرتفاع النبات و محصول البذور/فدان خلال موسمي التجربة. بينما أعلى متوسط قيم لصفات عدد الأفرع/نبات، عدد القرون/نبات، عدد البذور/نبات، وزن البذور/نبات و دليل البذرة تم الحصول عليها من زراعة نباتات الفول البلدي على أوسع مسافات (30 سم بين الجور) خلال موسمي التجربة.

أشارت النتائج أن الوزن الجاف الكلي للحشائش الحولية المنتشرة في حقول الذرة الشامية تحت معاملة بدون مقاومة (كنترول) كان 659.9 و 1041.8 كجم وأحدث نقص في محصول بذور الفول البلدي بمقدار 74.82 و 79.65 % مقارنةً بأفضل معاملة لمقاومة الحشائش (العزيق اليدوي مرتين) خلال موسمي التجربة على الترتيب. كما أوضحت النتائج أن إجراء العزيق اليدوي مرتين و استخدام المقاومة الكيميائية بمادتي بنتازون + كليثوديم تفوقا على باقي معاملات مقاومة الحشائش الأخرى في تقليل الوزن الجاف للحشائش المختلفة عند عمر 70 يوم من زراعة الفول البلدي و كذلك أعطوا معنوياً أفضل القيم في كل الصفات المدروسة للفول البلدي مع عدم وجود فروق معنوية بينهما خلال موسمي التجربة.

أشارت النتائج أن أفضل تأثير في تقليل الوزن الجاف للحشائش المختلفة تحقق من زراعة نباتات الفول البلدي بأضييق مسافة (20 سم بين الجور) مع إجراء العزيق اليدوي مرتين أو استخدام المقاومة الكيميائية بمادتي بنتازون + كليثوديم وتلك المعاملتان سجلت أفضل متوسط لقيم إرتفاع النبات و محصول البذور/فدان خلال موسمي التجربة. بينما أعلى متوسط قيم لصفات عدد القرون/نبات، عدد البذور/نبات و وزن البذور/نبات تم الحصول عليها من زراعة الفول البلدي على أوسع مسافة زراعية (30 سم بين الجور) مع إجراء العزيق اليدوي مرتين أو استخدام المقاومة الكيميائية بمادتي بنتازون + كليثوديم خلال موسمي التجربة.

أعلى صافي دخل مزرعي للفدان تحقق من زراعة نباتات الفول البلدي على مسافات 20 سم بين الجور ومقاومة الحشائش بالعزيق اليدوي مرتين حيث بلغ 10435 جنية و 8465 جنية/فدان دون وجود أي متبقيات للمبيدات تحت الدراسة في بذور الفول خلال موسمي الزراعة على التوالي .

توصي النتائج بزراعة صنف الفول البلدي جيزة 843 على مسافة 20 سم بين الجور مع إجراء العزيق اليدوي مرتين أو استخدام المقاومة الكيميائية بمادتي بنتازون + كليثوديم حيث أدى إلى تقليل الوزن الجاف للحشائش المختلفة و زاد محصول البذور/فدان.