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Influence of Plant Population and Weed Control Treatments on Associated Weeds, Growth, Yield and Quality of Faba Bean

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ABSTRACT

To investigate the effect of faba bean plant populations (80000, 96000 and 120000 plants/feddan) resulted from the difference between hill spacing (30, 25 and 20 cm) and the efficiency of eight weed control treatments (butralin, metribuzin, oxadiargyl, each previous herbicides followed by one hand hoeing, two hand hoeing and unweeded check) on associated weeds, growth, yield and its attributes as well as chemical analysis. Two field experiments were conducted at the Experimental farm of El-Serw Research Station, Agricultural Research Center, Damietta Governorate, Egypt during winter seasons of 2015/2016 and 2016/2017. Main findings showed that increasing plant population from 80000 to 120000 plants/fed significantly decreased the broadleaved, grassy and total weeds dry weight by 46.32, 33.44 and 43.77% in the first season and by 45.99, 38.10 and 44.32% in the second season, respectively after 70 days from sowing. Plant population of 120000 plants/fed produced the highest values of plant height, dry weight/plant and LAI in both seasons. Moreover, sowing faba bean at 120000 plants/fed increased seed yield/fed by 15.46 and 5.03% in the first season and 16.33 and 7.84% in the second season compared with 80000 and 96000 plants/fed, respectively. Two hand hoeing method significantly decreased the broadleaved, grassy and total weeds dry weight by 93.58, 99.24 and 95.68% in the first season and 92.62, 98.95 and 94.89% in the second season, respectively compared with the unweeded check. The results indicated that two hand hoeing method was the most superior treatment in increasing plant height, dry weight/plant and leaf area index at 70 and 90 days from sowing as well as yield, yield attributes and chemical composition of faba bean seeds followed by applying oxadiargyl herbicide with one hand hoeing treatment. It could be recommended that growing faba bean at plant population 120000 plants/fed integrated with two hand hoeing or oxadiargyl herbicide with one hand hoeing maximized seed yield per unit area.

Keywords: Faba bean, weed control, butralin, metribuzin, oxadiargyl, hoeing, growth, yield, yield attributes, chemical analysis.

INTRODUCTION

Faba bean (*Vicia faba*, L.) is consider one of the most vital seed legumes in Egypt in terms of area, total production and consumption. Its green and dry seeds are consumed in human nutrition due to it's contain a high protein content of 28%, carbohydrates 58%, and many other vitamins. Beside play a good role in improving the properties of soil and increasing its fertility by adding about 20-30% nitrogen/fed after harvest for the benefit of the next crop. Increasing seed yield could achieved by applying the best agricultural treatments *i.e.* weed control and growing the optimum population density. Weeds are considered a major problem in faba bean crop causing great losses in seed yield due to direct weed plant be consumption for environmental factors such as light, space and nutrients. Unrestricted weed growth and delayed weeding reduced seed yield of faba bean by up to 80% (Mohamed *et al*., 2004). Dawood (1989) indicated that four weeks from sowing is the most critical period, in determining weed competition in faba bean. In spite of the efficiency of manual hand hoeing in controlling weeds, but using herbicides is one of the best methods to control weeds, especially after the high cost of the hand weeding. Pre-emergence herbicide application can help weed control, to some extent, during the early crop growth stage. Moreover, application of two hand hoeing method is the more effective in suppressing weeds and increasing faba bean seed yield (Abd El-Razik, 2006). Abdelhamid and El-Metwally (2008) reported that oxadiargyl was the superior treatment for improving plant productivity as compared with the unweeded treatment.

Plant population affected plant growth, yield and yield attributes of legumes (Thalji, 2006 and Bakry *et al*., 2011). Applying the agriculture recommendations by using the optimal number of plants in unit area is consider the most important factor that lead to obtaining the best productivity per unit area (Khalil *et al*., 2011). The increase in the seed rate lead to lodging plants, high rates of moisture around, which encourages injury diseases and increase the proportion of precipitation and thus the reduction of the crop. However, decreasing seed rate leads to a decrease in yield due to increased distance between the furrow and leaving free spaces to allow growth of weeds that compete with crop plants. Consequently, regulating plant density is consider a vital instrument for enhancing faba been growth and the time essential for canopy closure and to maximizing biomass and seed yield (Liu *et al.*, 2008). There are several reports suggested that increasing population density up to 33.3 or 44.4 plant/m^2 led to a pronounced increase in the plant height (El-Douby *et al*., 1996 and Abdel-Aziz and Shalaby, 1999). On the other hand, Kakiuchi and Kobata (2004) revealed that lower plant density increased faba bean yield attribute *i.e.* pod number/plant while, the higher plant population decreased the pods number/plant.

This investigation aimed to study the possible integration between plant populations and weed control treatments on associated weeds, growth, yield and yield attributes as well as chemical composition of faba bean.

MATERIALS AND METHODS

Two field experiments were conducted during the winter growing seasons of 2015/2016 and 2016/2017 at El-Serw Research Station of Agricultural Research Centre, Damietta Governorate, Egypt, to estimate the role of three plant populations and efficiency of eight weed control treatments on associated weed, growth, yield, its attributes and chemical composition of faba bean plants.

The experiments were laid out in split plot design with four replicates. The main plots were allocated for three plant population as follows:

D1- Planting both sides of the ridge (70 cm width) in double seeded per hill and 30 cm between hills which resulted 80000 plants/fed.

D2- Planting both sides of the ridge (70 cm width) in double seeded per hill and 25 cm between hills which resulted 96000 plants/fed.

D3- Planting both sides of the ridge (70 cm width) in double seeded per hill and 20 cm between hills which resulted 120000 plants/fed.

Whereas the sub-plots were occupied with the eight weed control treatments as follows:

1-Butralin [Amex, 820, 4-(1, 1dimethylethyl)-N- 1-methyl propyl)-2, 6-dinitrobenzenamine] at the rate of 1200 g active ingredient (a.i) per fed.

2-Metribuzin [Sencor 70% WP (4-amino-6-tert-butyl-3-(mrthylthio) 1,2,4-triazine-5(4H) one] at 245 g active ingredient (a.i) per fed.

3-Oxadiargyl [Topstar 400 SC, 3-[2, 4-dicloro-5-(2-Propynyloxy) phenyl]-5- (1, 1-dimethylethyl)-1, 3, 4, oxdiazol-2(3H)-one] at the rate of 100 g active ingredient (a.i) per fed.

4-Butralin followed by one hand hoeing after 35 days from sowing.

5-Metribuzin followed by one hand hoeing after 35 days from sowing.

6-Oxadiargyl followed by one hand hoeing after 35 days from sowing.

7-Two hand hoeing after 21 and 42 days from sowing.

8- Unweeded check.

Herbicides were sprayed as pre-emergence by using Knapsack sprayer with one nozzle boom (200-liter water/ fed) on the soil surface immediately after planting and before irrigation.

Experimental soil was a clay with organic matter 0.8%, pH 7.9, EC 2.4 dSm^{-1}, available N 34.35 ppm, available P 7.7 ppm and available potassium 221 ppm over both seasons. Each sub experimental plot included five ridges, each of 70 cm width and 3.0 m long, lead to an area of 10.5 m^2 (1/400 fed). The preceding summer crop was rice (*Oryza sativa* L.) in both seasons.

Calcium superphosphate (15.5 % P_2O_5) was applied during soil preparation at the rate of 100 kg/fed. Nitrogen fertilizer was added in the form of ammonium nitrate (33.0 % N) at the rate of 15 kg N/fed as starter dose before the first irrigation. Potassium sulphate (48 % K_2O) at the rate of 50 kg/fed was added before the first irrigation to the soil.

Faba bean seeds Giza 843 was obtained from Food Legumes Research Department, Field Crops Research Institute, Agricultural Research Center, Giza, Egypt and seeds were inoculated with the specific rhizobium strain and immediately sown. Planting date was conducted on 15th of November and plants were harvested at the last week of April in both seasons. Normal cultural practices of growing faba bean plants were followed excluding the factors under study.

Studied characters:

1. Weed assessments:

Randomly weed samples were collected from one square meter from each plot at 70 days from sowing during both seasons. Biomass dry weight of weeds was determined after oven drying at 70 °C until reaching the weight constant. Common weeds in both growing seasons were: Greater ammi (*Ammi majus* L.), Wild beet (*Beta vulgaris* L.), Dock (*Rumex dentatus* L.) lambsquarters (*Chenopodium album* L.) and Bur clover (*Medicago hispida* L.) as broadleaved weeds and Ryegrass (*Lolium temulentum* L.), Beard grass (*Poplypogon monspeliensis* L.) and Canary grass (*Phalaris minor,* Retz.) as grassy weeds.

2. Growth parameters:

Ten uniform plants were randomly selected from the outer ridges of each sub-plot at 70 and 90 days after sowing to determine the growth parameters *i.e.* plant height (cm), dry weight (g/plant) and LAI. Leaf area (cm^2) were measured by applying the dry-weight method as described by Roads and Bloodwoath (1964).

3. Yield attributes:

At faba bean plant harvest (150 days from planting), ten guarded plants were taken from the outer ridges of each sub-plot to estimate the following characters *i.e.* number of pods/plant, pod weight/plant (g), seed yield/plant (g), 100-seed weight (g). Seed yield (ton/fed) were estimated by harvesting all plants in the three inner ridges of each sub-plot and left for air drying, then they were threshed and the seeds (12 % moisture) were weighed (kg), then converted to ton/fed.

4. Chemicals analysis:

- **Photosynthetic pigments (carotenoids, chlorophyll a and chlorophyll b)** were calorimetrically determined at 90 days from planting by using spectrophotometer. To extract photosynthetic pigments, about 250 mg of fresh leaves were homogenized using acetone (80%), centrifuged at 4000 rpm for 5 minutes and the optical density was determined at 480, 510, 645, 652 and 663 nm wavelength. The chlorophyll contents were calculated by the formulae given by Arnon, (1949), which are expressed below:

Chl. 'a' mg/g =12.7 (OD663) – 2.69 (OD645) x V/1000 x W
Chl. 'b' mg/g = 22.9 (OD645) – 4.68 (OD663) x V/1000 x W
Carotenoid mg/g = 7.6 (OD 480) – 1.49 (OD 510) x v/1000 X W
Where OD = Optical density, V = Final vol. of 80% acetone (25 ml) and W = Wt. of sample taken (0.25 g).

- **Total soluble carbohydrates and total carbohydrate % in seeds** were determined as described by Bogdan *et al*. (1993).

Protein percentage: it was determined in oven-dried samples of faba bean seeds which were ground in a mill using a 50-mesh screen and digested in H_2SO_4 concentrated and H_2O_2 30 (%), according to Yash (1998). Nitrogen content was determined by using the micro-kjelldhll method, according to Jackson (1967). Protein content in faba bean seeds was estimated by multiplying total nitrogen percent by 6.25 as defined by Bolton (1962).

Statistical analysis:

Using MSTAT statistical package (MSTAT-C with MGRAPH version 2.10, Crop and Soil Sciences Department, Michigan State University, USA), data in a split plot design was statistically analyzed based on the

technique of analysis of variance (ANOVA) as published by Gomez and Gomez (1984). Least Significant Difference (LSD) was calculated at probability level of 5% as defined by Snedcor and Cochran (1980).

RESULTS AND DISCUSSION

A. Weed growth:

According to the results in Table 1 the dry weights of broadleaved, grassy and total weeds associated faba bean plants after 70 days from sowing were significantly affected by plant population. Increasing plant population from 80000 to 120000 plants/fed significantly decreased the broad leaved, grassy and total weeds dry weight by 46.32, 33.44 and 43.77% in the first season and by 45.99, 38.10 and 44.32% in the second season, respectively. The highest plant population density caused a reduction in weeds growth due to quicker row closure, which decreased the light penetration to the weeds emerging below the crop canopy. Consequently, a greater photosynthetic photon flux density interception with a lower weed aboveground dry matter were recorded with narrow row arrangement. Similar results were reported by (Farghaly, 2002; El-Hindi *et al.*, 2008 and Abd El-Rahman, 2014)

The results presented in Table 1 clearly showed that the dry weights of broadleaved, grassy and total weeds were significantly reduced due to studied weed control treatments as compared with the unweeded check. Two hand hoeing method recorded the highest weed depression expressed in the lowest dry matter of the mentioned weed groups. After 70 days from sowing, the broadleaved, grassy and total weeds were reduced in weeds dry matter recorded amounted by 93.58, 99.24 and 95.68% in the first season and by 92.62, 98.95 and 94.98% in the second season, respectively compared with unweeded check. The results showed that herbicide application reduced significantly the dry weight of broadleaved, grassy and total weeds, compared to the unweeded check. Using oxadiargyl with one hand hoeing came in the second rank after two hand hoeing followed by that of butralin and metribuzin in controlled broadleaved and total weeds. While, metribuzin with one hand hoeing came in the second rank after two hand hoeing in controlled grassy weeds. There are numerous investigations suggested that hoeing twice considers the most effective weed control practice for reducing weed dry matter accumulation in faba bean plants (Kushwah and Vyas, 2005; El- Metwally and Abdelhamid, 2008 and El-Metwally, 2016).

Statistical analysis revealed that there were significant interactions between plant population and weed control treatments on dry weight of broadleaved, dry weight of grassy and total dry weight of weeds g/m^2 after 70 days from sowing as illustrated in Figs. 1, 2 and 3. It could noticed that two hand hoeing succeeded in controlling of the broadleaved, grassy and total weeds with the lowest dry weight under plant population at 120000 plants/fed by 98.21 and 97.58 % (total weeds) in the first and second seasons, respectively as compared with the unweeded check. On the other hand, unweeded treatment with sowing faba bean at plant population of 80000 plant/fed recorded the highest values of dry total weight of weeds g/m^2 after 70 days from sowing. These results may be due to growing 120000 plants/fed resulted earlier canopy closure, increased shading of weeds, increased crop competitiveness and reduced weed growth. These results are in good agreement with those reported by Sary *et al*., 1989 and Ferydon *et al.,* 2014.

Table 1. Dry weights of broadleaved, grassy and total weed (g/m^2) after 70 days from sowing as affected by plant population and weed control treatments during 2015/2016 (1st) and 2016/2017 (2nd) seasons.

Characters	Dry weight of broadleaved		Dry weight of grassy		Total dry weight of weed	
Treatments	1st season	2nd season	1st season	2nd season	1st season	2nd season
A- Plant population						
80000 plant fed^{-1}	61.33	64.96	15.19	17.40	76.53	82.36
96000 plant fed^{-1}	41.29	50.88	13.06	13.10	54.35	63.97
120000 plant fed^{-1}	32.92	35.08	10.11	10.77	43.03	45.85
LSD 0.05	2.08	2.08	0.44	0.80	2.25	2.19
B- Weed control treatments						
Butralin 1200 g fed^{-1}	41.22	48.67	2.62	3.51	43.84	52.18
Metribuzin 240 g fed^{-1}	54.22	55.33	1.41	1.76	55.63	57.09
Oxadiargyl 100 g fed^{-1}	35.89	44.33	2.19	3.02	38.08	47.36
Butralin with One hand hoing	20.22	26.89	1.28	1.70	21.50	28.59
Metribuzin with One hand hoing	30.11	32.56	0.90	1.12	31.01	33.68
Oxadiargyl with One hand hoing	14.00	19.89	0.99	1.14	14.99	21.03
Two hand hoing	10.00	12.00	0.70	1.01	10.70	13.01
Unweeded check	155.78	162.78	92.22	96.78	248.00	259.56
LSD at 0.05	3.17	2.10	1.62	1.88	2.95	2.84
A×B (F. test)	*	*	*	*	*	*

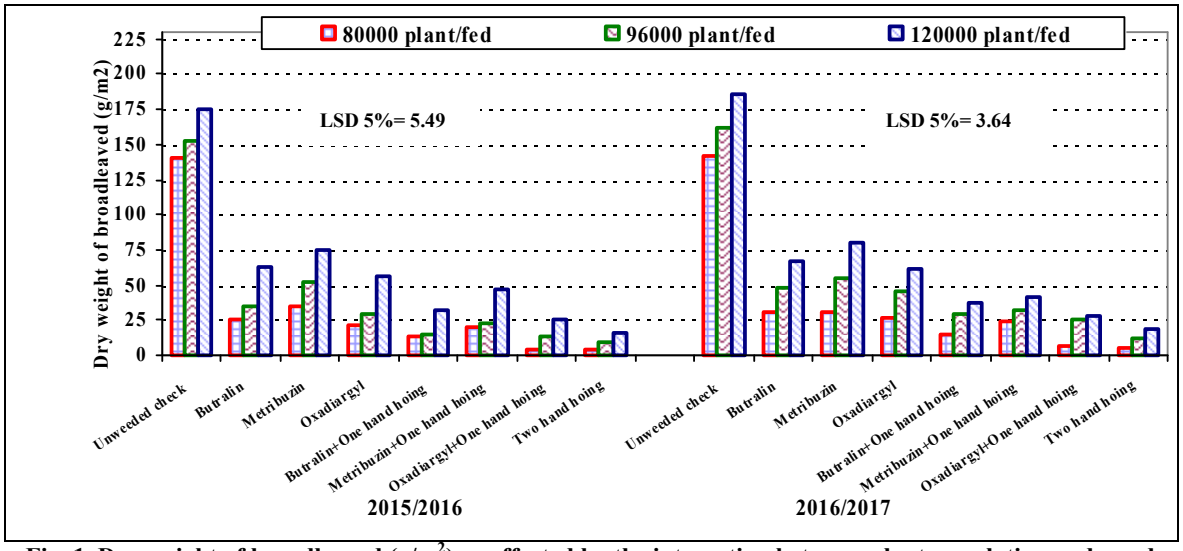

Fig. 1. Dry weight of broadleaved (g/m^2) as affected by the interaction between plant population and weed control treatments after 70 days from sowing date during 2015/2016 and 2016/2017 seasons.

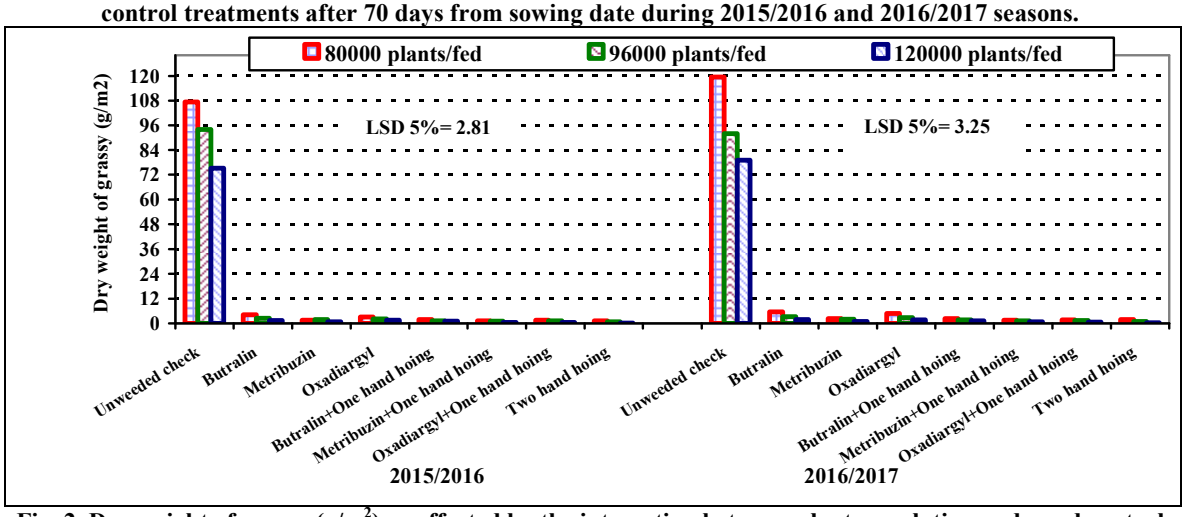

Fig. 2. Dry weight of grassy (g/m^2) as affected by the interaction between plant population and weed control treatments after 70 days from sowing date during 2015/2016 and 2016/2017 seasons.

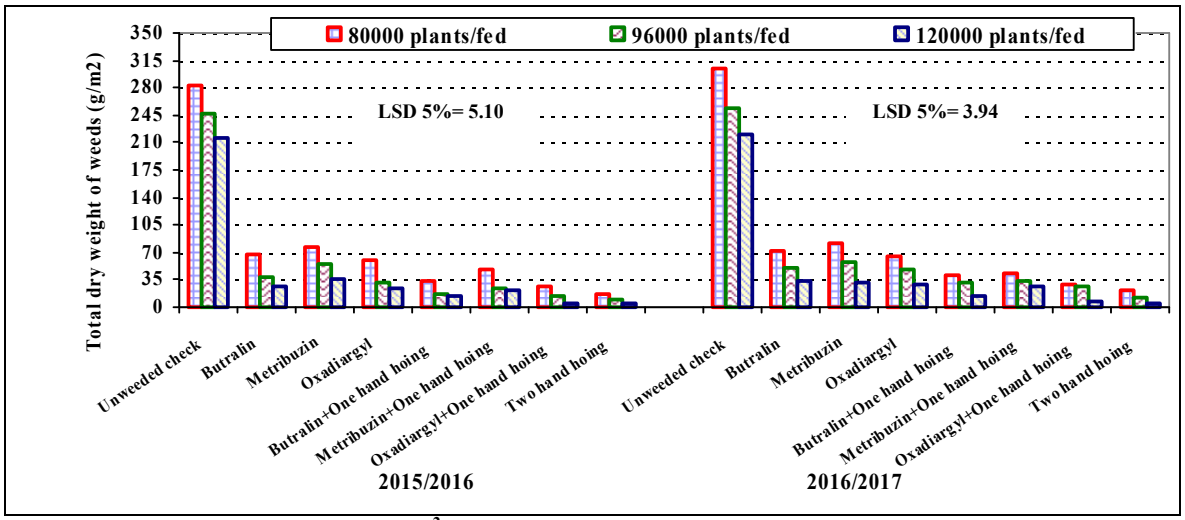

Fig. 3. Total dry weight of weeds (g/m^2) as affected by the interaction between plant population and weed control treatments after 70 days from sowing date during 2015/2016 and 2016/2017 seasons.

B. Growth characters:

According to the results in Table 2, the results showed that growth of faba bean plants were significantly affected by plant population. Plant population at the rate of 80000 plants/fed produced shortest plants and the highest values of dry weight/plant and LAI. While, planting faba bean at plant population of 120000 plants/fed resulted the lowest values of dry weight and LAI and tallest plants. Farghaly (2002) mentioned that increasing plant densities from 16.7 to 50 plants per m^2 significantly increased plant height. Also, El-Hindi *et al*. (2008) indicated that increasing plant population from 11 to 22 plants per m^2 significantly increased plant height. These results are in harmony with those obtained by Bakry *et al*. (2011) and Abd El-Rahman (2014).

Plant height, dry weight/plant and LAI were significantly affected by different weed control treatments as listed in Table 2 . The results indicated that hoeing twice was superior treatment for increasing aforementioned characters. Moreover, oxadiargyl with one hand hoeing treatment were statistically leveled for improving each of plant height, dry weight/plant and LAI. Such enhancements due to weeded treatments might be attributed to their high efficiency in inhibition of weeds (Table 1) and consequently, decreased their competitive with faba bean plants. In addition, the hand hoeing method led to improve soil physical characteristics including hydraulic conductivity, porosity and soil aeration, which favored the nutrient availability in soil. These results are in good agreement with those reported by El-Metwally (2016) and El-Metwally and Dawood (2016).

Table 2. Plant height, shoot dry weight/plant and leaf area index (LAI) after 70 (1st sample) and 90 (2nd sample) days from sowing date as affected by plant population and weed control treatments during 2015/2016 (1st) and 2016/2017 (2nd) seasons.

Characters / Treatments	Plant height				Dry weight (g/plant)				Leaf area index (LAI)			
	1st sample		2nd sample		1st sample		2nd sample		1st sample		2nd sample	
	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
A- Plant population												
80000 plant fed^{-1}	77.75	77.33	103.75	103.83	11.40	11.15	19.65	20.58	2.69	2.80	4.78	4.86
96000 plant fed^{-1}	83.75	83.67	113.54	111.67	10.80	10.00	19.60	19.04	2.61	2.58	4.68	4.77
120000 plant fed^{-1}	87.79	85.88	120.25	131.38	9.20	9.80	18.62	18.76	2.37	2.35	4.64	4.71
LSD 0.05	2.80	2.61	5.34	5.23	0.1 4	0.11	0.23	0.33	0.10	0.14	0.09	0.05
B- Weed control treatments												
Butralin 1200 g fed-1	80.78	79.33	107.78	109.33	10.05	9.80	18.69	18.65	2.50	2.51	4.63	4.72
Metribuzin 240 g fed-1	77.00	77.89	104.11	104.00	9.70	9.20	17.15	17.64	2.47	2.48	4.58	4.67
Oxadiargyl 100 g fed^{-1}	83.67	83.44	109.56	108.44	10.60	10.05	19.32	19.88	2.54	2.56	4.63	4.76
Butralin with One hand hoing	88.78	85.56	121.67	118.56	11.10	11.30	21.07	18.83	2.69	2.68	4.87	4.90
Metribuzin with One hand hoing	85.78	85.33	116.67	120.11	10.80	10.75	20.02	20.16	2.65	2.67	4.81	4.88
Oxadiargyl with One hand hoing	91.44	90.33	127.78	152.33	11.60	11.50	21.63	21.84	2.73	2.74	4.89	5.00
Two hand hoing	93.33	92.44	132.78	131.33	11.90	12.30	22.75	23.87	2.82	2.85	5.01	5.10
Unweeded check	64.00	64.00	79.78	80.89	8.00	1.55	13.37	14.49	2.08	2.11	4.14	4.19
LSD at 0.05	2.30	2.54	4.76	3.39	0.31	0.35	0.41	0.52	0.14	0.15	0.16	0.18
A×B (F. test)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

C. Yield and its attributes:

Results in Table 3 revealed that the plant population had marked effects on number of pods/plant, pods dry weight/plant, seeds weight/plant, 100- seed weight and seed yield ton/fed. It is obvious that plant population at 96000 plants/fed produced the highest values of yield attributed criteria studied (number of pods/plant, pods weight/plant, seeds weight/plant and 100-seed weight) in both seasons. However, the highest seed yield/fed resulted from sowing faba bean at plant population 120000 plants/fed which exhibited increments of seed yield by 18.30 and 5.30% in the first season as well as 19.53 and 8.51 % in the second season than that of 80000 and 96000 plants/fed, respectively (Table 3). These results are in agreement with thus reported by El-Hindi *et al*., 2008 and Abd El-Rahman, 2014). Narrow ridges spacing may increase crop access to available soil moisture because of the more equidistant distribution of crop plants and increases light interception by the crop, particularly in the early growing season, thereby leading to increased crop growth rates and earlier canopy closure, Dalley *et al*. (2004).

Weed control treatments practices significantly affected on yield and its attributes as presented in Table 3. Two hand hoeing treatments provided the maximum values in number of pods/plant, pods dry weight /plant, seeds weight /plant, 100- seed weight and seed yield ton/fed as compared to the unweeded check. In addition, oxadiargyl with on hand hoeing was the best treatment to promote seed yield followed by that of butralin with one hand hoeing and metribuzin with one hand hoeing. Such superiority of these weeded treatments may be related with minimizing weed-crop competition Table 1 this in turns increased faba bean growth Table 2 and reflected on increasing the yield of faba bean. The positive effect of weeded practices on faba bean yields and its attributes have been confirmed by Abd El-Razik (2006), Abdelhamid and El-Metwally (2008), El-Metwally (2016) and El-Metwally and Dawood (2016).

Table 3. Averages number of pods/plant, pods dry weight, seed yield/plant, 100-seed weight and seed yield (t/fed) as affected by plant population and weed control treatments during 2015/2016 (1st) and 2016/2017 (2nd) seasons.

Treatments	No. of pods/plant		Pods dry weight /plant		Seed weight/plant		100-seed weight		Seed yield (t/fed)	
	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
A- Plant population										
80000 plant fed^{-1}	19.02	19.22	45.35	44.99	30.85	29.82	60.89	60.14	2.35	2.56
96000 plant fed^{-1}	19.02	19.65	50.29	53.56	33.23	32.32	62.60	61.87	2.64	2.82
120000 plant fed^{-1}	15.60	16.88	43.16	46.03	27.57	28.15	57.57	57.38	2.78	3.06
LSD 0.05	1.63	1.52	1.51	1.30	1.03	1.03	1.32	0.46	0.17	0.08
B- Weed control treatments										
Butralin 1200 g fed^{-1}	16.78	17.56	40.26	43.83	27.00	26.37	58.99	57.99	2.26	2.40
Metribuzin 240 g fed^{-1}	16.14	16.99	37.94	40.98	24.59	24.86	57.93	57.00	2.06	2.30
Oxadiargyl 100 g fed^{-1}	17.30	18.42	42.74	43.92	28.90	27.41	59.79	59.29	2.46	2.50
Butralin with One hand hoing	18.48	20.16	51.38	54.29	35.29	35.12	63.00	62.79	3.00	3.30
Metribuzin with One hand hoing	18.53	19.59	53.00	59.01	33.30	34.33	61.06	60.93	2.83	3.20
Oxadiargyl with One hand hoing	20.68	20.88	55.94	55.78	37.80	36.96	63.93	63.58	3.25	3.47
Two hand hoing	21.83	21.83	60.83	61.12	39.37	38.03	65.49	64.50	3.43	3.63
Unweeded check	13.53	13.26	28.03	26.60	18.17	17.68	52.61	52.28	1.43	1.70
LSD at 0.05	1.60	1.25	1.91	1.72	1.44	1.53	1.71	1.62	0.18	0.17
A×B (F. test)	NS	NS	*	*	NS	NS	NS	NS	*	*

The data graphically in Figs 4 and 5 clearly showed that there was a significant interaction between plant populations of faba bean and weed control treatments on pod dry weight/plant and seed yield/fed. The highest values of pods dry weight/plant were recorded with plant population 96000 plant/fed with two hand hoeing treatment. While, seed yield/fed was recorded from sowing faba bean at plant population of 120000 plants/fed with two hand hoeing method treatment followed by the same plant population combined oxadiargyl with one hand hoeing without significant difference among these treatments. These results may be due to reducing competition for space, light, water and nutrients through limiting weeds infestation with herbicidal treatments; thus, increasing the uptake of different nutrients, which reflected on growth parameters and yield per unit area. On the other hand, the lowest seed yield/fed was recorded from the unweeded treatment with sowing faba bean at the lowest plant population of 80000 plants/fed. Similar results were reported by (Sary *et al*., 1989 and Ferydon *et al.,* 2014).

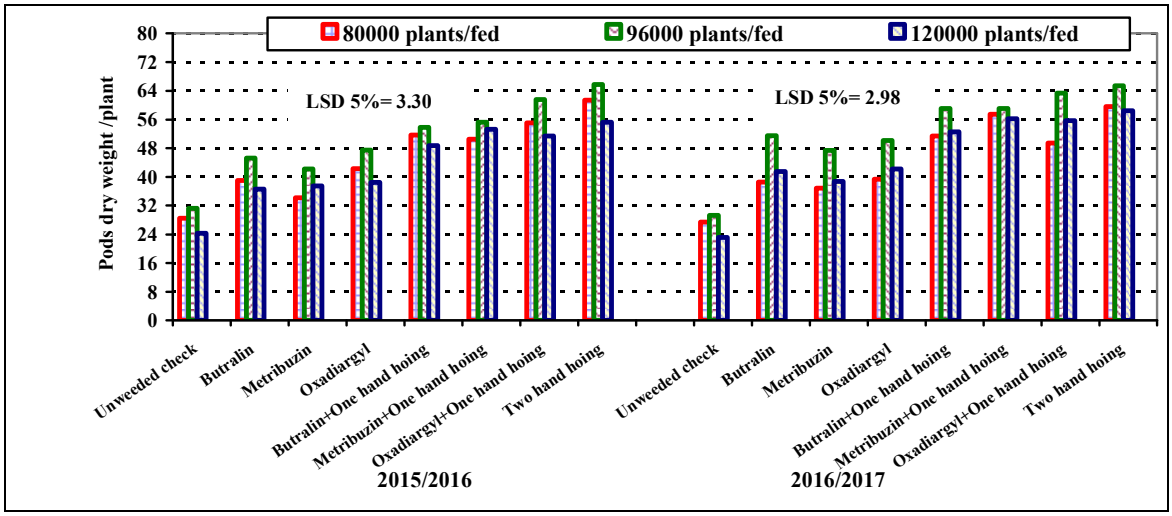

Fig. 4. Pods dry weight /plant as affected by the interaction between plant population and weed control treatments during 2015/2016 and 2016/2017 seasons.

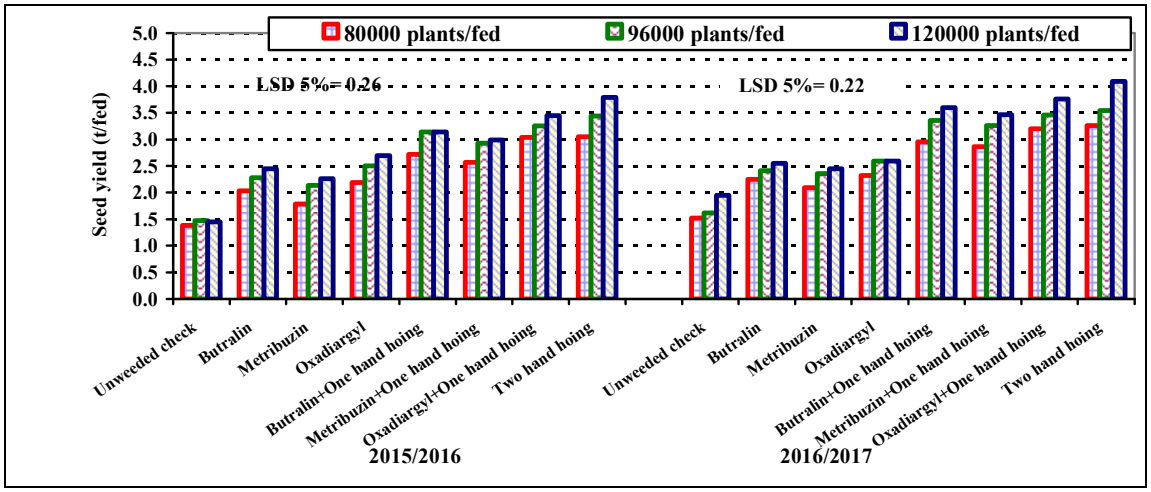

Fig. 5. Seed yield (ton/fed) as affected by the interaction between plant population and weed control treatments during 2015/2016 and 2016/2017 seasons.

D. Chemical analysis:-

Results presented in Table 4 indicated that the different plant population densities significantly influenced carotenoids, chll.a and chll.b. The maximum values of a previous characters were recorded with 80000 plants/fed followed by 96000 plants/fed and 120000 plants/fed. The carotenoids, chll.a and chll.b were significantly affected by different weed control treatments as shown in Table 4. Two hand hoeing treatment significantly increased all the previous mentioned parameters. Using oxadiargyl with one hand hoeing treatment came in the rank after two hand hoeing followed by that of butralin with one hand hoeing and metribuzin with one hand hoeing. These findings may be due to the role of hand hoeing in controlling weeds. Consequently, the competition was limited thus light, water and nutrients are being available to faba bean growth.

Table 4. Averages of carotenoids, chlorophyll a and chlorophyll b contents (mg/g dry weight) after 70 days from planting as affected by plant population and weed control treatments during 2015/2016 (1st) and 2016/2017 (2nd) seasons.

Treatments	Carotenoids		Chlorophyll a		Chlorophyll b	
	1st season	2nd season	1st season	2nd season	1st season	2nd season
A- Plant population						
80000 plant fed^{-1}	0.43	0.42	1.64	1.62	1.39	1.50
96000 plant fed^{-1}	0.40	0.40	1.55	1.51	1.28	1.40
120000 plant fed^{-1}	0.36	0.34	1.42	1.33	1.24	1.31
LSD 0.05	0.02	0.01	0.14	0.06	0.08	0.06
B- Weed control treatments						
Butralin 1200 g fed^{-1}	0.39	0.37	1.48	1.43	1.21	1.29
Metribuzin 240 g fed^{-1}	0.38	0.36	1.44	1.40	1.16	1.26
Oxadiargyl 100 g fed^{-1}	0.40	0.38	1.49	1.45	1.26	1.33
Butralin with One hand hoing	0.43	0.42	1.64	1.59	1.39	1.51
Metribuzin with One hand hoing	0.42	0.41	1.64	1.57	1.37	1.51
Oxadiargyl with One hand hoing	0.44	0.42	1.66	1.63	1.45	1.57
Two hand hoing	0.46	0.44	1.80	1.76	1.52	1.64
Unweeded check	0.29	0.26	1.14	1.07	1.07	1.12
LSD at 0.05	0.02	0.02	0.12	0.11	0.10	0.10
A×B (F. test)	NS	NS	NS	NS	NS	NS

Results showed in Table 5 indicated that there was insignificant effect on the contents of soluble carbohydrate and total carbohydrates percentage of faba bean seeds due to plant populations in both seasons. However, different plant population had a significant effect on protein percentage as shown in Table 5 in both seasons. The highest percentage of protein was obtained from sowing faba bean at 80000 plants/fed. While, the lowest protein percentage was recorded from sowing faba bean at 120000 plants/fed.

Concerning to the effect of weed treatments, as shown in Table 5, two hand hoeing treatment increased significantly total carbohydrate and protein percentages compared with other treatments. The increments in pervious characters exceeded the unweeded check by 7.23 and 14.54% in the first season and 7.23 and 13.58 % in the second season, respectively. These results may be due to less competition for environmental factors, nutrients, water and light through limiting weeds infestation with herbicidal treatments due to increasing the uptake of different

nutrients and reflected on carbohydrate and protein percentages of faba bean seeds.

It could be noticed that two hand hoeing method or oxadiargyl with one hand hoeing method integrated with 120000 plants/fed produced the maximum values of seed yield per unit area under the environmental conditions of Damietta Governorate, Egypt.

Table 5. Averages of soluble carbohydrate, total carbohydrates, protein percentages as affected by plant population and weed control treatments during 2015/2016 (1st) and 2016/2017 (2nd) seasons.

Treatments	Soluble carbohydrate %		Total carbohydrate %		Protein%	
	1st season	2nd season	1st season	2nd season	1st season	2nd season
A- Plant population						
80000 plant fed^{-1}	7.01	6.93	54.49	54.39	24.67	25.48
96000 plant fed^{-1}	6.53	6.41	54.07	53.80	24.37	24.30
120000 plant fed^{-1}	6.21	6.17	53.66	53.55	23.13	24.22
LSD 0.05	NS	NS	NS	NS	1.02	0.88
B- Weed control treatments						
Butralin 1200 g fed^{-1}	6.21	6.23	53.94	53.94	24.69	24.69
Metribuzin 240 g fed^{-1}	6.43	6.37	53.92	53.92	22.77	23.69
Oxadiargyl 100 g fed^{-1}	6.50	6.43	54.34	54.34	23.64	24.51
Butralin with One hand hoing	6.65	6.62	54.56	54.56	24.42	25.87
Metribuzin with One hand hoing	6.85	6.68	54.47	54.47	24.04	24.73
Oxadiargyl with One hand hoing	7.02	6.85	54.55	54.55	25.22	25.30
Two hand hoing	7.11	7.00	54.74	54.74	25.71	26.03
Unweeded check	5.89	5.93	50.78	50.78	21.97	22.50
LSD at 0.05	NS	NS	0.94	0.71	1.46	0.80
A×B (F. test)	NS	NS	NS	NS	NS	NS

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تأثير الكثافة النباتية ومعاملات مكافحه الحشائش على الحشائش المصاحبة والنمو والمحصول وجودة الفول البلدي

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لدراسه تأثير الكثافات النباتية (٨٠٠٠٠، ٩٦٠٠٠ و١٢٠٠٠٠ نبات/فدان) الناتجة عن إختلاف المسافة بين الجور (٣٠، ٢٥ و٢٠ سم) وكفاءة استخدام بعض معاملات مكافحه الحشائش (أمكس، سينكور، توبستار، إستخدام كل مبيد من المبيدات السابقة على حدة بالإضافة إلى عزقة واحدة، العزيق مرتين ومعاملة الكنترول) والتفاعل بينهما على الحشائش المصاحبة والنمو والمحصول ومكوناته وبعض صفات الجوده لنباتات الفول البلدى. أجريت تجربتان حقليتان خلال موسمي ٢٠١٦/٢٠١٥ و٢٠١٧/٢٠١٦ بمحطة البحوث الزراعية بالسرو محافظة دمياط حيث نفذت التجارب في تصميم القطع المنشقة في أربعة مكررات حيث احتلت الكثافات النباتية القطع الرأسية بينما خصصت القطع الشقية لمعاملات مكافحه الحشائش المختلفة.أظهرت النتائج المتحصل عليها أن زيادة الكثافة النباتية من ٨٠٠٠٠ إلى ١٢٠٠٠٠ نبات/فدان قد ادى الى إنخفاض معنوي فى الوزن الجاف للحشائش العريضة والضيقة الاوراق وكذلك الحشائش الكليه بنسبة ٤٦.٣٢ و٣٣.٤٤ و٤٣.٧٧٪ في الموسم الأول و٤٥.٩٩ و٣٨.١٠ و٤٤.٣٢٪ في الموسم الثاني على التوالي وذلك بعد ٧٠ يوما من الزراعة. بينما أدى زراعة ١٢٠٠٠٠ نبات /فدان إلى الحصول على أعلى القيم لكل من طول النبات، الوزن الجاف/نبات ودليل مساحة الأوراق في كلا موسمي الزراعة. كما أشارات النتائج المتحصل عليها أن زراعة ١٢٠٠٠٠ نبات/فدان سجل زيادة في كمية محصول البذور بنسبة ١٥.٤٦ و٥.٠٣٪ في الموسم الأول و١٩.٥٣ و٧.٨٤٪ في الموسم الثاني بالمقارنة بزراعة ٨٠٠٠٠ و٩٦٠٠٠ نبات/فدان. أظهرت النتائج المتحصل عليها أن معاملات مكافحه الحشائش أظهر ت تأثيرا معنويا على الحشائش المصاحبة، النمو والمحصول ومكوناته وبعض صفات الجوده لنباتات الفول البلدى. أدى إجراء العزيق مرتين إلى إنخفاض معنوي في الوزن الجاف للحشائش العريضة، الضيقة الاوراق وكذلك الحشائش الكليه تحت الدراسة بنسبة ٩٣.٥٨ و٩٩.٢٤ و٩٥.٦٨٪ في الموسم الأول و٩٢.٦٢ و٩٨.٩٥ و٩٤.٨٩٪ في الموسم الثاني على التوالي مقارنة بمعاملة الكنترول (بدون مقاومة)، كما أظهرت النتائج تفوق معاملة إجراء العزيق مرتين على بقيه المعاملات تحت الدراسه في الحصول على أعلى القيم لصفات إرتفاع النبات والوزن الجاف/النبات ودليل مساحة الأوراق عند ٧٠ و ٩٠ يوما من الزراعة بالإضافة إلى المحصول مكوناته وصفات التحليل الكيميائي يليها إستخدام معاملة الرش بمبيد توبستار مع إجراء عزقة واحدة معاً. توصى نتائج الدراسة بأنه لتقليل التأثير الضار الناتج عن نمو الحشائش مع نباتات الفول البلدى وتعظيم صفات النمو والمحصول ومكوناته وكذلك صفات الجودة فإنه يوصى بزراعة نباتات الفول البلدى بكثافة النباتات ١٢٠٠٠٠ نبات/فدان (المسافه بين الجور ٢٠ سم) مع إجراء العزيق اليدوى مرتين أو الرش بمبيد توبستار مع إجراء عزقة واحدة وذلك تحت ظروف محافظة دمياط، مصر.