Egypt. J. Agric. Res., 80 (1), 2002.

EFFECT OF TILLAGE, PHOSPHORUS FERTILIZATION AND WEED CONTROL ON FABA BEAN AND ESTIMATION THE CONTRIBUTIONS OF YIELD COMPONENT STATISTICALLY

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(Manuscript received 2 July 2001)

Abstract

Two field experiments were carried out in Zarzoora Experimental Station at ElBeheira Governorate in 1998/99 and 1999/2000 seasons to studythe effect oftwo farming systems of land preparation (the conventional method of plowing and no tillage systems), four phosphorus fertilizer levels (zero, 15, 30 and 45 kg P_2O_5/ fed) and five weed control treatments (unweeded, Fusilade super 12.5 % EC, hand hoeing once, Fusilade + hand hoeing once and hand hoeing twice) under four statistical procedures(analysis of variance, correlation matrix, multiple linear regression, path coefficient and principal component analysis) on yield and its components of faba bean.

Results indicated that fresh weight of grassy weeds and dry weight of total weeds in both seasons, fresh weight of total weeds and dry weight of grassyweeds in the second season were significantly reduced with tillage system. On the opposite, seed and biological yields/ fed of faba bean in both seasons, plant height, number of branches/ plant, number of pods/ plant and weight of 100 seeds in one season significantly increased by tillage. Number of seeds/ plant and weight of pods and seeds/ plant were not significantly affected by tillage in both seasons .

Fresh and dry weights of weeds were significantly reduced by increasing P-fertilizer level in both seasons, except dry weight of total weedswhich was significantly reduced in the first season Growth, yield and yield components of faba bean were significantly increased by increasing P- fertilization in both seasons, except the number of seeds/ plant which was increased in the second season only. Whereas, number of branches/plant and 100 seeds weight were not significantly affected in both seasons.

Weed control treatments decreased significantly the biomass of weeds compared with the unweeded treatment in both seasons. Weed control treatments caused a satisfactory effect on all faba bean characters under study in both seasons. Hand hoeing twice aswell as hand hoeing once + Fusilade herbicide recorded the highest values for seed and biological yields/fed in both seasons.

The highest value of correlation coefficientwasfound between seed yield/ plant and number of seeds/ plant (0.991) in both seasons. Stepwise multiple linear regression and path coefficient analysis also

agreed upon number of seeds/ plant and weight of pods/ plant as the major contributors to seed yield/ plant. The principal component analysis grouped the studied variables into two major components which altogether accounted for 92.8% of the total variation. Thus, we recommend farmers to grow faba bean under tillage condition with phosphorus fertilization and controlling associated weeds manually or chemically.

INTRODUCTION

Faba bean is one of the most important legume crop in Egypt. It is used for human consumption as a good source of protein. It is very important to increase the vertical production of faba beans to face the increasing demand of the people by using different agricultural practices as tillage system, weed control and phosphorus fertilizer rate...etc.

Till or no-till was an issue of long controversy. No-tillage render help in erosion control, reduce fuel essential for land preparation, givesflexibility in planting and harvesting without waiting for sufficient drying time for tillage. Also, no-tilled soil increased land use and reduced labor requirement (McGregor and Curley 1975). On the other hand, still the majority of opinions are in favor of the conventional tillage(Philip and Philips 1984). Plowing is necessary to prepare good seed bed and emerging seedling in clean soil surface. Also, plowing is considered an effective weed control (Wilt,1981). Selim *et al.* (1994) stated that faba bean seed yield and its components were not significantly affected by tillage and no-tillage systems. Rizk *et al.*(1987) and El-Douby *et al.* (1996) reported that no-tillage system significantly decreased plant height and no. of branches/plant but significantly increased yield and its components of faba bean. On the other hand, Gomaa and El-Naggar (1995) indicated that tillage system increased faba bean yield and its component characters compared with no-tillage. Fresh weight of broadleaves and grassy weeds were reduced by the application of the conventional tillage compared with the check (Selim *et al.*,1994; and Gomaa and El-Naggar,1995). A tendency towards increasing yield and yield component characters of faba bean with increasing the rate of phosphorus fertilizer has bean reported by several investigators (Abo-Shetaia,1990; El-Habbak and El-Naggar,1991; El-Gazzar, 1993 and El-Douby *et. al.*,1996). On the other hand, increasing P-fertilizer reduced the fresh and dry weights of total weeds (Gomaa and El-Naggar, 1995).

Weed control is very important practice to increase the vertical yield of faba bean. Bebb *et. al.* (1982) reported that the effect of the Fusilade herbicide on faba bean plant growth was generally small. The highest values of straw yield and seed yield and its components of faba bean were recorded with hand hoeing followed by herbicidal treatments (Shams El-Din and Salwau, 1994; Haikel *et al.* 1996; and Radwan 1997).0n the contrary, the highest values of seed yield and its components of faba bean were reported by herbicides followed by hand hoeing twice(Radwan ,1992; Selim *et. al.*, 1994 and Gomaa and El-Naggar 1995). Salwau (1994) found that Fusilade gave a satisfactory weed control and reduced fresh and dry weights of grassy weeds followed by hand hoeing. To detect characters that having the greatest influence on yield and their relative contribution in yield variation, several statistical procedures could be used in this matter, such as correlation matrix (Kim and Gary,1985 and Steel and Torrie, 1987), path coefficient analysis (Dewey and Lu 1959), multiple linear regression and stepwise analysis (Draper and Smith 1966), and principle components analysis (Berenson *et al.* 1983).

The aim of this study is to determine the effect of tillage system, phosphorus fertilizer levels and weed control on yield and its components of faba bean with evaluating some statistical procedures is detect characters which had greatest influences in faba bean yield.

MATERIALS AND METHODS

Two field experiments were carried out in Zarzoora Experimental Station at El-Beheira Governorate during 1998/1999 and 1999/2000 seasons to investigate the effect of tillage and zero tillage systems, P-fertilizer levels and weed control treatments on weeds and faba bean yield and its components under some statistical procedures.

Each experiment included 40 treatments which were the combination of two tillage systems (the conventional method of plowing and zero tillage systems), four phosphorus fertilizer levels (zero, 15, 30 and 45 P_2O_5 kg/fed) and five weed control treatments as follows:

1. Unweeded check.
2. Fusilade super 12.5% EC (Fluazifop-Butyl).2-[4-(5-triflurom-ethyl -2- Pyridylox) phe-

noxyl] propionate) at 2 liters/ fed applied post emergence at 3-4 leaves stage (after30 days from sowing).

3. Hand hoeing once (after 30 days from sowing).
4. Fusilade super 12.5% EC at 2.0 liters/ fed + hand hoeing once (after 60 days from sowing)
5. Hand hoeing twice (after 30 and 60 days from sowing).

The treatments were assigned in a split- split plot design with three replications. Tillage systems were arranged at random in the main plots, phosphorus fertilizer levels were arranged in the sub plots and weed control treatments were allocated in sub- sub plots. Each sub- sub plot consisted of 5 ridges. Each ridge was 3.5 m in length and 60 cm apart from each other. The sub- sub plot area was 10.5 m^2 .

Soil texture was clay with pH 7.8 and 2.3 % organic matter. Faba bean variety Giza 716 was planted on the 18^{th} and 15^{th} of November in the first and second seasons, respectively. The preceding crop was maize in both seasons. At 90 days after sowing, fresh and dry weight of grassy and total weeds g/ m^2 were recorded from each sub-sub plot in both seasons. At harvest, ten plants were randomly sampled from each sub- sub plot to determine plant height (cm), number of branches/plant, numbers of pods and seeds/plant, weights of pods and seeds/plant(g) and 100 seeds weight (g). Seedandbiologicalyields/fed(kg)wereestimated from three middle ridges of each sub-sub plot.

The collected data were statistically analyzed according to Snedecor and Cochran (1982) and treatments means were compared using leastsignificantdifferent (L.S.D.)at5%1evelof probability with evaluating some statistical procedures such as:

1. Analysis of variance: Basic statistical: arithmetic means, standard deviation, standard error and simple correlation coefficients were computed between plant yield and its components according to the method described by (Sendecor and Cochran, 1982). Correlation coefficient were calculated to determine how strong is the relation between faba bean and its attributes.

2. Stepwise multiple linear regression: It aims to determine the variables accounting for the majority of the total yield variation. This procedure computes a se-

quence of multiple regression equations in a stepwise manner. At each step, one variable is added to regression equation. It is the one that reduces error sum of squares. Equivalently, it isthevariable having the highest partial correlation with the dependent variable and if added had the highest value in regression analysis of variance. Stepwise regression was conducted according to Draper and Smith (1966)

3. Path coefficient analysis: As applied by Dewey and Lu (1959) and Duarte and Adams (1972) was used. A path coefficient is simply a standardized partial regression coefficient as it measures the direct influence of one variable upon another and permits the separation of the correlation coefficient into components of direct and indirect effects.

4. Principal component analysis: It was computed according to Peorson (1901), Hotelling (1933) and Berenson *et al.* (1983). It was supposedthatwehave (n)subjectsresponsestoa questionnaire containing (p) items. A basic purpose of principal component is to account for the total variation of these (n) subjects in (p) dimensional space by forming a new set of orthogonal and uncorrelated composite variables. Thus, each member of the new set of variables is a linear combination of the original set of measurements. The linearcombination will be generated in such a manner that each successive composite variant will account for a smaller portion of total variation. Hence, the first component (i.e., principal component) will have the largest variance, the second will have a variance smaller than the first but larger than the third, and so on. In general, the number of new composite variables that will be needed to account adequately for the total variation is less than (p).

RESULTS AND DISCUSSION

1. Effect of tillage system on:

(a): Weeds:

The dominant weed species confronted in the experimental plots include the following: Bermuda grass (Cynodon dactylon L.R.Rich), bur clover weed (Medicago hispida L. Gaertn), wild beet (Beta vulgaris L.) and bishops weed (Ammi majus L.). Whereas wild mustar (brassica nigra (L.)Koch), pimpernel (Anegallis arvensis L.) and sheep sorrel (Rumex dentatus L.) were few in the field of the experiments.

Table (1) showed that fresh weight of grassy weeds and dry weight of total weeds were significantly reduced by tillage compared with zero tillage in both seasons. Whereas, fresh weight of total weeds and dry weight of grassy weeds were significantly reduced by tillage in the second season . It is clear from Table(1) that tillaga was more effective than zero tillage in reducing fresh and dry weight of grassy and total weeds this reduction may be due to the role of plowing in controlling perennial weeds such as bermuda grass . These results coincided with those obtained by Selim *et. al.* (1994), Gomaa and El-Naggar (1995).

Table 1. Effect of tillage on fresh and dry weight of grassy and total weeds in 1998/ 1999 and 1999/2000 seasons.

Characters	Fresh weight of grassy weeds (g)/ m	Dry weight of grassy weeds (g)m^2	Fresh weight of total weeds (g)/m^2	Dry weight of total weeds (g)/m^2		Fresh weight of Grassy weeds (g)/m^2	Dry weight of grassy weeds (g) m^2	Fresh weight of total weeds (g)/m^2	Dry weight of grassy weeds (g) m^2
Treatments	1998/1999 season.					1999/2000 season.			
Tillage systems:									
Tillage	102.4	21.09	933.7	189.4		97.38	23.12	1294	270.2
Zero tillage	113.9	23.45	1203	230		106.2	24.39	1334	285.3
L.S.D. at 5% level	7.76	2.25	26.84	15.97		6.85	N. S.	N. S.	11.26

(b): Faba bean yield and its components:

Table(2) revealed that plant height, number of branches, and pods/ plant and 100 seeds weight were significantly increased by application of tillage in one season out oftwo. Also, tillage increased number of seeds/ plant and weight of pods and seeds / plantwith no significant effect compared with zero tillage in both seasons. The increases in growth and yield components of faba bean in the tillaged soil may be due to the highest efficiency of tillage in improving the physical properties of soil, in addition to weed control effect which depressed the serious competition between faba bean plants and weeds as previously mentioned in Table (1). Similar results were obtained by Selim *et. al.* (1994), Gomna and El-Naggar (1995). Seed and biological yields/fed were significantly increased by tillage system compared with zero tillage in both seasons as

shown in Table(2). These increases in seed and biological yields may be due to the increasing in growth and yield components characters of faba bean and their reflection on faba bean yields. These results are in accordance with those obtained by Gomaa and ElNaggar (1995), Whereas Rizk *et. al.* (1987) found that faba bean yield and its components were increased by zero tillage.

Table 2. Effect of tillage system on some growth, yield and yield component characters of faba bean in 1998/1999 and 1999/2000 seasons.

Characters / Treatments	Plant height cm	No. of branches /plant	No. of pods/ plant	No. of seeds/ plant	Wt. of pods/ plant (g)	Wt .of seeds/ plant (g)	Wt. of 100 seeds (g)	Seed yield / fed (kg)	Biological yield/ fed (kg)
Tillage systems:	1998/1999								
Tillage	148.53	2.04	11.17	28.48	27.65	16.63	52.76	1125	1799
Zero- tillage	146.66	1.98	10.98	27.5	26.9	16.13	52.28	1071	1722
L.S.D. at 5% level	1.86	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	37.07	56.23
1999/2000 season.									
Tillage	142.46	2.02	11.61	32.75	31.37	18.81	54.34	1348	2245
Zero tillage	139.53	1.87	11.14	31.9	30.69	18.3	52.88	1286	2116
L.S.D. at 5% level	N.S.	0.03	21	N.S.	N.S.	N.S.	0.12	38.37	83.37

2- Effect of P- fertilizer levels on:

a- Weeds:

The results presented in Table(3)revealed thatthe effect of P- fertilizeron fresh and dry weight of grassy and total weeds after 90 days from sowing date significantly reduced by increasing P- fertilizer up to 45 kg P_2O_5/fed. in both seasons. These results may be due to the high competition between faba bean plants and weeds for P-fertilizer which was in favor of faba bean plants. Similar results were obtained by Gomaa and El-Naggar (1995)

b- Faba bean yield and its attributes:

The data in Table(4) indicated that faba bean plant height significantly increased by adding P- fertilizer in both seasons. A trend towards increasing plant height was significantly detected in both seasons with the increase of phosphorus fertilizer level. The trend was also in favor of increasing the rate of phosphate fertilizer up to 45 kg P_2O_5/

fed. Itseemedthat increasing phosphorus application enhanced the merstematic activities, which in turn resulted in increasing growth and plant height. This result is in agreement with those obtained by Abo-Shetaia (1990) and El- Douby *et. al.* (1996).

Table 3. Effect phosphorus fertilizer levels on fresh and dry weight of grassy and total weeds in 1998/1999 and 1999/2000 seasons.

Characters / Treatments	Fresh weight of grassy weeds (g)/ m	Dry weight of grassy weeds (g)m^2	Fresh weight of total weeds (g)/m^2	Dry Weight of total weeds (g)/m^2	Fresh Weight of grassy weeds (g)/m^2	Dry weight of grassy weeds (g) m^2	Fresh weight of total weeds (g)/m^2	Dry weight of total weeds (g) m^2
	1998/1999 season.				1999/2000 season.			
P- fertilizer levels:								
Zero P_2O_5 kg/ fed	118.1	24.76	1169	221.7	137.5	31.12	1366	286.4
15 P_2O_5 kg/ fed	113.2	22.62	1119	211.9	94.33	21.81	1338	284.5
30 P_2O_5 kg/ fed	104	20.88	1007	211.2	89.06	21.61	1315	278.1
45 P_2O_5 kg/ fed	97.4	20.81	978.2	194	86.7	20.49	1277	262.1
L. S. D. at 5% level	15.93	3.08	66.08	N. S.	17.26	5.66	44.89	8.38

Table 4. Effect of phosphorus fertilizer levels on some growth, yield and yield components of faba bean in 1998/1999 and 1999/2000 seasons.

Characters / Treatments	Plant height (cm)	No. of branch/ plant	No. of pods/ plant	No. of seeds/ plant	Wt. of pods/ plant (g)	Wt. of seeds/ plant (g)	Wt. of 100- seeds (g)	seed yield/ fed (kg)	Biological yield fed (kg)
P-fertilizer levels:	1998/1999 season.								
Zero kg P_2O_5/ fed	144.2	1.95	9.53	24.9	24.73	14.66	52.63	966.3	1560
15 kg P_2O_5/ fed	146.8	1.99	10.74	27.96	26.83	16.16	52.3	1091	1746
30 kg P_2O_5/ fed	149.4	2.14	11.79	29.33	28.43	17.16	53	1164	1862
45 kg P_2O_5/ fed	149.8	2.17	12.24	29.76	29.1	17.53	53.16	1172	1875
L.S.D. at 5% level	0.55	N.S.	0.27	0.74	0.88	0.49	N.S.	9.09	15.83
1999/2000 season									
Zero kg P_2O_5/ fed	134.8	1.9	10.88	31.85	29.45	17.81	53.58	1118	1870
15 kg P_2O_5/ fed	142.1	1.93	10.93	32.12	30.33	17.63	53.84	1290	2132
30 kg P_2O_5/ fed	143.5	2	12.02	32.16	31.23	18.75	54.64	1423	2352
45 kg P_2O_5/ fed	143.5	1.96	12.1	33.16	33.23	19.95	54.37	1437	2370
L.S.D. at 5% level	1.65	N.S.	0.26	N.S	1.05	0.65	N.S.	14.89	64.81

Yield components characters of faba bean i.e. number of pods/ plant and weight of pods and seeds/ plant in both seasons. and number of seeds/ plant in the second season significantly increased by increasing P- fertilizer level up to 45 kg P_2O_5/fed, whereas number of branches/ plant and weight of 100 seeds showed no significant effect in both seasons as shown in Table(4). The level of 45 kg P_2O_5/fed recorded the highest values for the previous traits as compared with other levels. This may be due to that P- fertilizer increased the vegetative growth of faba bean, in addition to the role of P- fertilizer in enhancing photosynthesis process. These results coincided with those obtained by El- Habbak and El- Naggar (1991) and ElGazzar (1993).

The data presented in Table(4) clearly showed thatthe seed and biological yields/fed significantly increased by increasing P- fertilizer level in both seasons. However, there was no significant effect between adding 30 and 45 kg P_2O_5/fed in both seasons. The increase in seed yield were 12.00, 20.50 or 21.31% in the first season and 15.41, 27.35 or 28.60% in the second season compared with zero kg P_2O_5/fed in the first and second seasons, respectively, and were 11.92, 19.39 or 20.18% and 14.04,25.73 or 26.72% for biological yield. These results of seed and biological yields/ fed may be due to effect of P- fertilizer on increasing the percentage of flowering and setting which increased the number of pods and seeds/ plant. These results are in accordance with those obtained byAbo-Shetaia (1990), EL- Gazzarand El-Douby, *et. al.* (1996).

3. Effect of weed control on:

a- Weeds:

Data presented in Table (5) indicated that all weed control treatments significantly decreased fresh and dry weights of grassy and total weeds compared with unweeded treatment in both seasons. Fusilade + hand hoeing once recorded the lowest values forfresh and dry weights of grassy weeds followed by Fusilade followed by hand hoeing twice and hand hoeing once and the highest value was obtained with the unweeded treatment in both seasons. Whereas, hand hoeing twice was superior in decreasing biomass of fresh and dryweight of total weeds followed by Fuilade + hand hoeing once followed by hand hoeing once and Fusilade in both seasons. It is evident that the best activity of Fusilade herbicide in controlling weeds appeared with grassy weeds

as a specific herbicide. These results are in accordance with those obtained by Bebb *et. al.* (1982) and Salwau (1994), they found that Fusilade herbicide gave a satisfactory weed control and reduced fresh and dry weights of grassy weeds followed by hand hoeing.

Table 5. Effect of weed control treatments on fresh and dry weight of grassy and total weeds in 1998/1999 and 1999/2000 seasons.

Characters / Treatments	Fresh weight of grassy weeds (g)/ m^2	Dry weight of Grassy weeds (g) m^2	Fresh weight of Total weeds (g)/m^2	Dry weight of total weeds (g)/m^2	Fresh Weight of Grassy Weeds (g)/m^2	Dry weight of grassy weeds (g) m^2	Fresh weight of total weeds (g)/m^2	Dry weight of total weeds (g) m^2
	1998/1999 season.				1999/2000 season.			
Weed control treatments:								
Unweeded (control)	348.3	72	1990	398.1	310	71.95	2508	525.1
Fusilade	13.37	2.7	1657	323.1	6.68	1.46	2201	465.9
Hand hoeing once	143	29.32	755.2	142.7	145	34.6	779.8	168.2
Hand hoeing once + Fusilade	4.91	0.98	617.13	120.6	3.85	0.83	644	141.2
Hand hoeing twice	31.37	6.34	23.1	63	43.45	9.84	438.9	88.37
L.S.D. at 5% level	78.71	41.99	15.68	3.12	6.15	9.4	14.99	4.25

b- Faba bean yield and its components

From data summarized in Table(6), it could be seen that all studied characters of faba bean were significantly affected by weed control treatments compared with check treatment in both seasons. Plant height was tallestwiththe bestweed control treatments i.e. hand hoeing twice and hand hoeing once + Fusilade followed by hand hoeing once followed by Fusilade compared with unweeded treatment. This result could be due to the little biomass of growing weeds, which had no great ability to compete faba bean plants strongly. Similar resultswere obtained by Shams El-Din and Salwau (1994), Whereas Haikel *et al.* (1996) found that the tallest of plant height was recorded with unweeded treatment compared with other weed control treatments.

All weed control treatments under study gave a satisfactory yield component characters of faba bean yield as compared with the unweeded treatment in both seasons as shown in Table(6). Hand hoeing twice as well as hand hoeing once + Fusilande were the best in increasing yield components followed by hand hoeing once followed by Fusilade herbicide. The superiority of weed control in yield components of faba bean may be due to the high efficiency of such treatments in depressing weed biomass and reducing the competition between weeds and faba bean plants for nutrients, water, light and reflecting that on faba bean plants characters. Similar results were confirmed by Haikal *et. al* (1996) and Radwan (1997).

Concerning faba bean seed and biological yields/fed, the data revealed that all weed control treatments significantly increased seed and biological yields as compared to the unweeded treatment in both seasons as shown in Table(6).The excess in yield of faba bean at hand hoeing twice, hand hoeing once + Fusilade, hand hoeing once and Fusilade were estimated to 71.39, 69.37,30.68 and 22.9%, respectively over the unweeded treatment in the first season and were 56.35, 52.41, 33.81 and 27.04%, respectively in the second season. The excess in biological yield were estimated to 68.75, 67.75, 28.90 and 21.09% in the first season, and were 53.01,48.79,29.51 and 24.09% in the second season. The increases in seed yield and biological yield due to the good role of hand hoeing eithertwice or once beside fuislade in improving yield attributes of faba bean. Similar results coincided with those obtained by Shams El-Din and Salwau (1994), Haikal *et al.* (1996) and Radwan (1997), whereas Radwan (1992) and Gomaa and El-Naggar (1995), found that the highest values of seed yield and its components of faba bean were reported by herbicides followed by hand hoeing twice.

3. Interaction effects:

(a): Weeds:

Data in Table (7) indicated that all weed characterswere significantly affected bythe interaction among P-fertilizer levels with weed control treatments. The lowest values of fresh and dry weights of grassy weeds were obtained by hand hoeing once + Fusilade with 30 kg P_2O_5/ fed in the first season, and hand hoeing once + Fusilade with 45 kg P_2O_5 / fed in the second season. The best combination which recorded the lowest values forfresh and dry weights of total weeds was hand hoeing twice with 45 kg

P_2P_5 / fed in the second season.

Table 6. Effect of weed control treatments on some growth, yield and yield components of faba bean in 1998/1999 and 1999/2000 seasons.

Characters / Treatments	Plant height (cm)	No . of branches /plant	No . of pods/ plant	No . of seeds plant	Wt. of Pods/ plant (g)	Wt. of seeds/ plant (g)	Wt. of 100 seeds (g)	Seed yield/ fed (kg)	Biologic yield/ Fed (kg)
Weed control:	1 998/1999 season								
1	136.7	1.74	8.55	20.5	20.29	11.95	50.08	791	1280
2	146.4	2.01	11.27	27.87	26.83	16 37	52.58	972	1550
3	146.4	2.02	11.2	28.29	27.79	16.58	52.29	1033	1650
4	152.9	2.11	12.18	31.41	30.45	18.41	53.79	1339	2140
5	155.3	2.16	12.17	31.87	31	18.57	53.87	1355	2160
L.S.D.at5% level	1.07	0.04	0.39	0.68	0.75	0.42	0.27	27.04	49.36
	1999/2000 season								
1	126.6	1.21	8.71	25.31	24.5	14.4	52.17	983	1660
2	138.2	1.92	10.86	30.77	29.43	17.69	53.75	1249	2060
3	143.3	2.1	11.69	33.2	31.72	19.06	54.18	1316	2150
4	146.8	2.21	12.57	35.77	34.34	20.56	54.93	1499	2470
5	149.8	2.29	13.05	36.57	35.15	21.06	55.5	1538	2540
L.S.D.at5% level	1.33	0.04	0.14	0.75	0.85	0.3	0.12	13.46	68.16

1. Unweeded 2. Fusilade 3. Hand hoeing once 4. Hand hoeing once + Fusilade 5. Hand hoeing twice

Table 7. Significance, highest and lowest values and combination of the interaction on some weed characters in 1998/1999 and 1999/2000 seasons.

Characters / Treatments	Treatment value	Highest value	Treatment	Lowest
Weeds characters:	1998/1999			
Fresh wt. of grassy weeds (g)	P 1 X W 1	390.8	P 3 X W 4	2.333
Dry wt. of grassy weeds (g)	P 1 X W 1	81.967	P 3 X W4	0.483
	1999/2000			
Fresh weight of grassy weeds (g)	P 1 x W 1	488.6	P 4 X W4	3.667
Fresh weight of total weeds (g)	P 1 X W 1	2660	P 4 X W 5	409.1
Dry weight of grassy weeds (g)	P 1 X W 1	110.2	P 4 X W 4	0.833
Dry weight of total weeds (g)	P 1 X W 1	557.5	P 4 X W 5	80.5

T : Tillage systems
T1: Tillage
T2: Zero tillage

P: Phosphorus fertilizer levels
P1: zero P2O5/fed (kg)
P2: 15 p2 o5 kg / fed
P3: 30 P2 05 Kg/ fed
P4: 45 p2 05 KG/ fed

W: Weed control methods
W1: Unweeded (control)
W2: Fusilade
W3: Hand hoeing once
W4: Hand hoeing once + Fusilade
W5: Hand hoeing twice

(b): Faba bean:

The interaction effects among P- fertilizer levels and weed control treatments recorded on some faba bean characters in the second season as shown in Table (8) . The combination between P- fertilizer level 45 kg P_2O_5 / fed with hand hoeing twice recorded the highest values for number of pods/ plant and weight of seeds/ plant. The best combination which recorded the highest values for number of branches/ plant, weight of 100 seeds and seed and biological yields/fed was P - fertilizer level 30 kg P_2O_5 / fed with hand hoeing twice.

Table 8. Significance, highest and lowest values and combination of the interaction on some faba bean characters in 1998/1999 and 1999/2000 seasons.

Treatments / Characters	Treatment	Highest value	Treatment	Lowest value
Faba bean characters:		1999/2000		
Number of branches/ plant	P3 X W5	2.317	P1 X W1	1.133
Number of pods/ plant	P4 X W5	13.75	P2 X W1	8.283
Weight of seeds/ plant (g)	P4 X W5	22.3	P2 X W1	13.48
Weight of 100 seeds (g)	P3 X W5	56.16	P1 X W1	52.18
Seed yield/ fed (kg)	P3 X W5	1635	P1 X W1	900
Biological yield/ fed (kg)	P3 X W5	2709	P1 X W1	1623

Seed yield and yield component characters of faba bean were not significantly affected by the other combinations of the experimental factors in both seasons.

It could be concluded that hand hoeing twice or hand hoeing once + Fusilade and 30 kg P_2O_5/ fed under tillage system were more effective in faba bean productivity.

Simple correlation analysis:

Simple correlation coefficient, mean values, standerd deviation and standard error for studied variables are presented in Table (9). The results showed that, the relationship between seed yield/ plant and the six components were highly positively significant. The highest value of correlation coefficient was between seed yield/ plant and numberof seeds/ plant (0.992) followed by weight pods/ plant (0.991) followed by weight of 100-seeds (0.951) followed by number of pods/ plant (0.918) followed by

number of branches/ plant (0.763)followed by plant height (0.645) in the over seasons. These results are in accordance with Kambal (1969) and Mahmoud *et. al.* (1978)

Table 9. Simple correlation coefficients, means, standard deviation and standard error for faba bean seed yield and its components over both 1998/1999 and 1999/2000 seasons.

Components	r value	mean	standard deviation	standard error
Plant height	0.645**	144.3	8.81	0.007
Number of branches/plant	0.763**	1.982	0.33	0.207
Number of pods/plant	0.918**	11.229	1.7	0.058
Number of seeds/plant	0.992**	30.16	4.98	0.041
Weight of pods/plant (g)	0.991**	29.154	4.64	0.034
Weight of 100-seed (g)	0.951**	53.32	1.62	0.069
seed yield/ plant	-	17.471	2.86	0.249

** Significant at 0.01 levels of significance.

Multiple linear regression analysis:

Data in Table (10) showed the relative contribution (R^2%) of yield component was 99.30% of the total variation in seed yield/ plant could be linearly related to variation in all variables, and 0.07% could be due to residual. On the other hand, some variables may contributed a little to the accuracy of the prediction equation. The addition of a new variable will always increase R^2 but it will not necessary increase the precision of the estimate of the response. At this point, the stepwise multiple linear regression analysis was carried out to determine the best variables accounted for most of variance in yield .the prediction equation for seed yield/ plant is formulated as follows:

$$Y = 1.4263 + 0.0088\ x_1^{*} - 0.1301\ x_2^{**} + 0.1388\ x_3 + 0.3098\ x_4 + 0.2562\ x_5 - 0.0627\ x_6^{**}$$

Stepwise multiple linear regression analysis:

Either variables acceptance or removal, and relative contributions of variables (R^2%) in predicting seed yield per plant are tabulated in Table(11). According to these results, 99.27% of the total variation in seed yield/ plant could be attributed to three accepted variables, namely number of seed/ plant, weight of pods/ plant and number

of pods/ plant while the remainder variables, namely plant height, number of branches/ plant and weight of 100 seeds were removed from the analysis due to their low relative contributionsThese resultswere agreement with those obtained by Samia(1998). The prediction equation was formulated as follow:

$$Y = - 0.4718 + 0.5706 \text{ n/seed } ** + 0.2946 \text{ w/p/plant } ** + 0.1744 \text{ n/pods}**$$

Table 10. The relative contributions of six components in seed yield variation over both of 1998/99 and 1999/200O, using multiple linear regression analysis seasons, using multiple linear regression analysis.

Components	Regression Coefficient	Standard error	Relative contribution (Partial r^2 %)
Plant height (cm) (x_1)	0.0088	0.0066	2.4
number of branches/ plant (x_2)	-0.1301	0.2073	0.54
Number of pods/ plant (X_3)	0.1388**	0.0578	7.33
Number of seeds/ plant (X_4)	0.3098**	0.0413	43.5
Weight of pods/ plant (g) (x_5)	0.2562**	0.0345	43.09
Weight of 100-seed (g) (x_6)	-0.627	0.0689	1.12

Y- intercept = 1.4263 R squared = 0.9930

Standard error of est. = 0.2499 Multiple R =0.9965

Adjusted R squarad = 0.9924

Table 11. Accepted and removed variables according to stepwise analysis and their relative contributions (r^2%)in seed yield per plant variation over both of 1998/ 99 and 1999/2000 seasons.

Components	Regression coefficient	Standard error	Relative contribution (Partial r^2 %)
Accepted variables:			
number of seed/plant	0.5706	0.0084	51.19**
Weight of pods/plant (g)	0.2946	0.0372	43.23**
Number of pods/plant	0.1744	0.0383	21.45**
Removed variables:			
Plant height (cm)			0.0188
Number of branches/ plant			0.0006
Weight of 100-seed (g)			0.0083

Y = intercept = -0.4718 Standard error of estimation = 0.2490

Adjusted R squared = 0.9925 Standard error of estimation = 0.2490

R squared = 0.9927 Multiple R = 0.9964

Path coefficient analysis:

Path coefficient analysis was doneto estimatethe directand indirect contribution of seed yield/ plant attributes. It was interesting to find that the highest total contribution in faba bean seed yield/ plant were number of seed/ plant and weight of pods/ plant (0.9246), whereas the rest of yield attributes had low contribution of 0.0173 (Table 12). Furthermore, both number of seed/ pla nt and weight of pods/ plant have the prominent direct effect of 0.1829 and 0.2629, respectively and indirect effect of 0.2371 and 0.2416, respectively . The residual effect (0.0173) was due to either the studied yield components with negligible effects and/or slight contribution to the seed yield/ plant, in addition to unstudied yield components. The result was in agreement with (Mahmoud *et. al.*, 1978).

Table 12. Direct and indirect effects due to yield components of faba bean over both of 1998/99 and 1999/2000 seasons.

Characters	Direct	Inderect	Total contribution
Plant height (cm)	0.0004	0.0114	0.0118
Number of branches/ plant	0.0001	0.0087	0.0089
Number of pods/ plant	0.0008	0.0246	0.0254
Number of seed/ plant	0.1829**	0.2371	0.42014**
Weight of pods/ plant (g)	0.2629**	0.2416	0.5045**
Weight of 100- seed (g)	0.0002	0.0118	0.012
Total	0.4474	0.5353	0.9827
Residual	0.5526	0.4647	0.0173

Principal component analysis:

Principal component analysis results over of 1998/99 and 1999/2000 seasons are given in Table (13). The results showed that two independent component were considered over the two seasons. The first component accounted for 82.090% of the total variation. This component included seed yield/ plant in addition to number of pods/ plant. number of seeds/ plant, weight of pods/ plant and weight of 100 seed. The second component accounted for 10.709 of total variation This component was represented by plant height and number of branches/ plant Gad El-karim *et al.* (1990) applied factor analysis forfaba bean yield and its components and they found that 100

seed weight was exist in the first season.

It could be concluded that number of seeds/ plant and weight of pods/ plant were the common factors in all the previous statistical procedures in this study.

Table 13. Results of principal component analysis over both 1998/1999 and 1999/ 2000 seasons.

Characters	Components	
	1	2
Plant height (cm)	0.319	0.678
Number of branches/ plant	0.357	0.461
Number of pods/ plant	0.394	0.122
Number of seeds/ plant	0.400	-0.256
Weight of pods/ plant (g)	0.397	-0.260
Seed yield/ plant (g)	0.403	-0.231
Weight of 100- seed (g)	0.367	0.355
Percentage variance	82.090	10.709
Cumulative variance%	82.090	92.798

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تأثير الخدمة المزرعية والتسميد الفوسفاتي ومكافحة الحشائش على الفول البلدى وتقدير مساهمة مكونات المحصول أحصائياً

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أجريت تجربتان حقليتان في محطة بحوث زرزورة بمحافظة البحيرة خلال موسمي الزراعة ١٩٩٨/١٩٩٩، ١٩٩٩/٢٠٠٠ لدراسة تأثير الخدمة المزرعية (خدمة مزرعية وبدون خدمة مزرعية) أربعة مستويات للتسميد الفوسفاتي (صفر، ١٥، ٣٠، ٤٥ كجم فو٢ ٥١ /فدان) وخمسة معاملات لمكافحة الحشائش فيوليد إلى جانب معاملة المقارنة) على محصول الفول البلدى ومكوناته والحشائش المصاحبة. واستخدام تصميم القطع المنشقة مرتين فى ثلاث مكررات. كما استخدمت بعض الطرق الاحصائية (تحليل التباين، الارتباط البسيط، الانحدار المتعدد المرحلي، وتحليل المسار، وتحليل المكون) على محصول الفول البلدى ومكوناته، وكانت الصفات المدروسة هى : طول النبات، عدد أفرع النبات، عدد القرون بالنبات، عدد البذور للنبات، وزن القرون بالنبات، وزن ١٠٠ بذرة، ومحصول النبات.

وكانت أهم النتائج المتحصل عليها كالآتي:

١- نقص الوزن الغض للحشائش الضيقة وكذا الوزن الجاف للحشائش الكلية معنوياً بنظام الخدمة فى كلا الموسمين، بينما أدت الخدمة إلى نقص الوزن الغض للحشائش الكلية وكذا الوزن الجاف للحشائش الضيقة فى الموسم الثاني وذلك مقارنة بنظام عدم الخدمة إلى زيادة معنوية فى طول النبات وعدد أفرع النبات وعدد قرون النبات، وزن ١٠٠ بذرة فى موسم واحد، بينما زاد محصول البذور للفدان وكذا المحصول البيولوجي معنويا نتيجة نظام الخدمة فى كلا الموسمين.

٢- أدى زيادة معدل التسميد الفوسفاتى إلى نقص معنوي للوزن الغض والجاف للحشائش الضيقة والكلية فى كلا الموسمين. وبالنسبة للفول البلدى زادت صفات النمو والمحصول ومكوناته زيادة معنوية بزيادة مستوى التسميد الفوسفاتي فى كلا الموسمين بينما لم تتأثر صفتى عدد أفرع النبات، وزن ١٠٠ بذرة معنوياً فى كلا الموسمين.

٣- أدت عمليات مكافحة الحشائش إلى نقص معنوى للحشائش فى كلا الموسمين مقارنة بمعاملة المقارنة. كما أدت مكافحة الحشائش إلى زيادة واضحة لكل صفات محصول الفول البلدى تحت الدراسة فى كلا الموسمين. وقد سجلت معاملتي العزيق مرتين والعزيق مرة واحدة + مبيد الفيوزيليد – أعلى القيم لكل من محصول البذور والمحصول البيولوجي/الفدان.

٤- أظهرت نتائج تحليل الإرتباط البسيط على أن عدد البذور بالنبات ووزن القرون بالنبات هما المكونات تؤثر فى محصول البذور.

٥- أظهرت نتائج تحليل المكون أن الصفات المدروسة تقع فى مكونين يضم المكون الأول عدد القرون بالنبات وعدد البذور بالنبات ووزن القرون بالنبات ووزن ١٠٠ بذرة ومحصول البذور بالنبات بينما يحتوي المكون الثانى على صفات طول النبات وعدد أفرع النبات مما يفسر إرتباط الزيادة فى محصول البذور بعدد البذور وعدد القرون بالنبات اساسا مما يساعد المشتغلين في تحسين محصول الفول البلدي في تحديد الصفات المطلوب زيادة انتاجيتها.

٦- تشير نتائج تحليل المكون إلى أن الصفات المدروسة كانت كافية حيث أنها تفسر ٩٢,٨٪ من التباين الكلي. من ذلك يمكن التوصية باستخدام حزمة توصيات لزيادة إنتاجية الفول البلدى بالزراعة بخدمة الأرض وإضافة ٤٥ كجم فو ٢ ا٥ ومكافحة الحشائش بالعزيق مرتين أو استخدام الفيوزيليد سوبر متبوعاً بعزقة.