PERFORMANCE OF SOME FABA BEAN GENOTYPES UNDER DIFFERENT DISTRIBUTION OF PLANTS

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ABSTRACT

Two field experiments were carried out in the Research and Experimental Center of Faculty of Agriculture at Moshtohor, Benha University, Egypt, during 2008/09 and 2009/10 winter seasons to study the performance of 5 faba bean genotypes (Sakha 1, Moshtohor 151, Sakha 3, Giza 3 improved and Giza 843) under 4 plant distributions:- 1. Planting one side of ridge, 60 cm apart, two plants hill^{-1}, 10 cm-apart, 2. Planting two sides of ridge, at 60 cm apart, with one plant hill^{-1}, of 10 cm-apart, 3- Planting two sides of ridge, 60 cm apart, two plants hill^{-1}, 20 cm-apart, 4- Planting three sides on ridge, 60 cm apart, one plant hill^{-1}, 15 cm-apart. The plant population amounted to140,000 plants fed^{-1}.

Studied traits were No. of days to flouring, plant height (cm), number of branches and pods plant^{-1}, number of seeds pod^{-1}, weight of pods and seeds plant^{-1}(g), weight of 100-seed (g), seed and biological yields fed^{-1}(kg). A split plot design with three replications was used with faba bean genotypes as main plots and plant distributions treatments as subplots.

The results could be summarized from the combined analyses of the two seasons as follows:

Sakha 3 genotype was of the highest values of number of branches plant^{-1}, number of pods plant^{-1}, number of seeds pod^{-1}, weight of pods plant^{-1}, weight of seeds plant^{-1}, seed yield fed^{-1} and biological yield fed^{-1} while, Moshtohor 151 genotype gave the highest value of 100-seed weight. Moreover, Sakha 1 and Giza 843 genotypes were flowered of earlier compared to the other genotypes. Planting in two sides of ridge, 60 cm apart, one plant hill^{-1}, 10 cm-apart (two sides) showed the highest values of number of branches plant^{-1}, number of pods plant^{-1}, number of seeds pod^{-1}, weight of pods plant^{-1}, weight of seeds plant^{-1}, 100-seed weight, seed yield fed^{-1} and biological yield fed^{-1}.

Significant interaction effect was noticed between the grown faba bean genotypes and their plant distributions for all the studied characters except biological yield fed^{-1}. The highest number of branches plant^{-1}, number of pods plant^{-1}, number of seeds pod^{-1}, weight of pods plant^{-1}, weight of seeds plant^{-1} and seed yield fed^{-1} were recorded for Sakha 3 genotype when planting two sides on ridge, 60 cm apart, one plant hill^{-1}, 10 cm-apart. Whereas, the heaviest weight of 100-seed was recorded for Moshtohor 151 genotype at the same treatment of plant distributions.

Simple correlation study indicated positive and high significant correlation coefficients between seed yield fed^{-1} and each of other studied traits except for plant height in the combined analysis.

Generally, it can be concluded that planting Sakha 3 faba bean or moshtohor 151 genotype planted in the two sides of the ridge, at 60 cm apart, one plant hill^{-1}, of 10 cm-apart may be the recommended treatment to improve the productivity of faba bean crop under the conditions of the present study.

Key Words: *Faba bean, Genotypes, plant distributions, Yield and yield components.*

INTRODUCTION

Faba bean *(Vicia faba L.)* is an important winter season in Egypt. It's seed not only provide a cheep source of protein but also a food of high calorific and nutritive value especially in the diet. Moreover, production of faba bean in Egypt is still limited in spite of its increase in local consumption. This is due to its limited cultivated area in Egypt, and `due to the strong competition between faba bean and other strategic winter season crops as wheat and clover on the limited arable land of Nile valley and Delta. Faba bean production is affected by different factors such soil fertility, varieties or genotypes and plant distributions. That is why this investigation aimed to study the performance of some of the available local faba bean genotypes under field distributions of plants. Many investigators have reported high variability among faba bean genotypes and varieties for growth characters, yield and yield components **(El-Hosary and Sedhom, 1990, Gomaa, 1996, El-Hosary and Mehasen, 1998, Mehasen, 1998, Said, 1998, Tageldin and Mehasen, 2004, Al-Fageh and Mehasen, 2006, Ahmed and El-Abagy, 2007, Al Ghamdi, 2007, Osman *et al,* 2010 and Bakry *et al,* 2011).**

Plant distribution of field bean is an important factor in the old or new lands which depends on stand establishment. However, plant competition for environmental resources is affected by the spatial arrangement of those plants, this may be affected by the plant density (number of plants per unit area) and distance between rows. The effect of row spacing or plant population densities indicated increasing seed yield as row spacing decreased. On the other hand, previous studies of **Caballero (1987), Mc Ewen *et al,* (1988) and Thalji (2006)** pointed that seed and pods yields plant^{-1} were increased by increasing row spacing. Others studies of, **Stutzel and Aufhammer (1991), Pilbeam *et al,* (1991), Silim and Saxana (1992), Stutzel *et al,* (1994), El-Moursy (1998) and Bakry *et al,* (2011)** referred to the response of faba bean varieties or genotypes to plant density or row spacing.

Therefore, the present study aimed to evaluate yield and yield components of five faba bean genotypes under four plant distributions. Experiments were conducted in the Research and Experimental Center of Faculty of Agriculture at Moshtohor, Kalubia Governorate, S. Delta.

MATERIALS AND METHODS

Five genotypes of faba bean (Sakha 1, Moshtohor 151, Sakha 3, Giza 3 improve and Giza 843) were provided from Field Crop Research Institute, ARC, and which developed in faba bean breeding program at Moshtohor. Each of these genotypes were planted under 4 plant distributions**:- 1.** Planting one side of the ridge, of 60 cm apart, with two plants hill^{-1}, at10 cm-apart, **2.** Planting two sides of ridge, at 60 cm apart, with one plant hill^{-1}, of 10 cm-apart, **3-** Planting two sides of the ridge, at 60 cm apart, with two plants hill^{-1}, of 20 cm-apart, **4-** Planting three sides of the ridge, of 60 cm apart, with one plant hill^{-1}, at 15 cm-apart, using standard plant population density of 140,000 plants fed^{-1}. The experiments were conducted at the Research and Experimental Center of the Faculty of Agriculture at Moshtohor, during the two successive seasons of 2008/09 and 2009/10. Soil analysis indicated clay texture with pH values of 7.95 and 7.85, organic matter content 1.72 and 1.85%, total N 0.17 and 0.19%, and total P 0.55 and 0.60% in the first and second seasons, respectively. The preceding crop was corn in both seasons.

Split plot design with three replicates was usid, in which faba bean genotypes were randomly allocated in the main plots while the sub plots were devoted for plant distribution treatments. Each sub plot was 5 ridges of 3.5 m long and 60 cm wide,

with 10.5 m^2 area was (1/400 fed). Planting dates were 15th and 9th Nov. in 2008 and 2009 seasons, respectively. Soil preparation was done by applying phosphorus fertilizer level (150 kg fed^{-1}) in the form of calcium super phosphate (15.5% P_2O_5), and nitrogen fertilizer level (30 kg N fed^{-1}) was added before the first irrigation in the form of ammonium nitrate (33.5% N). Other cultural practices for growing faba bean were applied properly.

Number of days to flowering was determined. Then at harvest, ten guarded faba bean plants were taken at random from the central ridge of each experimental plot to estimate the following studied traits**:** plant height (cm), number of branches $plant^{-1}$, number of pods $plant^{-1}$, number of seeds pod^{-1}, weight of pods $plant^{-1}$ (g), weight of seeds $plant^{-1}$ (g) and weight of 100-seed (g). Moreover, the whole plot was harvested to determine biological and seed yield (kg fed^{-1}) was determined from the three central ridges of each experimental plot.

Data were statistically analyzed for each of the two growing seasons. Combined analysis was conducted for the data of the two seasons after conducting the homogeneity test of both seasons according to **Snedecor and Cochran (1990)**. Simple correlation was carried out according to procedures outlined by **Gomez and Gomez (1983).** Least significant difference (LSD) was used to compare between means.

RESULTS AND DISCUSSION

Mean square values of faba bean yield and its related characters in 2008/09 and 2009/10 seasons as well as combined analysis are presented in **Table (1)**. Test of homogeneity revealed that the variance error for the two seasons were homogenous, therefore combined analysis was valid. Year's mean squares were highly significant for all of the studied traits. It is evident that faba bean genotypes significantly varied for the No. of days to flowering, plant height, number of branches $plant^{-1}$, number of pods $plant^{-1}$, number of seeds pod^{-1}, weight of pods $plant^{-1}$, weight of seeds $plant^{-1}$, weight of 100-seed, seed and biological yields fed^{-1} for each of the studied season and their combined analysis. Results also indicated that plant distributions significantly affected all the studied characters of each genotypes of faba bean under study in both seasons as well as their combined data. Moreover, the interaction effect between faba bean genotypes and plant distributions mean squares was significant for all of the studied characters except No. of days to flowering, number of pods $plant^{-1}$ and

biological yield fed^{-1} in the first season; No. of days to flowering and plant height in the second season and biological yield fed^{-1} in their combined analysis. Also, the interactions between years and faba bean genotypes was significant for all of the studied characters except for No. of days to flowering, plant height, number of pods plant^{-1}, seed yield fed^{-1} and biological yield fed^{-1}. Meanwhile, the interaction between years and plant distributions was not significant for all of the studied characters except number of pods plant^{-1}, weight of pods plant^{-1}, weight of 100-seed and seed yield fed^{-1}. Whereas, the interaction between years, faba bean genotypes and plant distributions was not significant for all of the studied characters except for No. of days to flowering, weight of pods plant^{-1}, weight of seeds plant^{-1}, weight of 100-seed and seed yield fed^{-1}.

- Effect of growing season:

Data in **Table (2)** showed significant seasonal effects for all of the studied characters. High values for all characters were detected in the second season compared with the first season except number of days to flowering and plant height. It could be concluded that the increase in seed yield fed^{-1} in the second season may be due to earlier planting date, accompanied with low percentage for choclate spot, rust disease and the significant increase in the number of pods plant^{-1}, weight of pods plant^{-1} and weight of 100-seed.

- Genotypes differences:

Results reported in **Table (3)** clearly indicated that, there were significant differences between the different faba bean genotypes in all of the studied traits. Sakha 3 gave the highest values of number of branches plant^{-1}, number of pods plant^{-1}, number of seeds pod^{-1}, weight of pods plant^{-1}, weight of seeds plant^{-1}, seed and biological yields fed^{-1}. Whereas, Sakha 1 gave the highest value of plant height, while, Moshtohor 151 gave the highest value of 100-seed weight, while, Sakha 1 and Giza 843 genotypes were of earliest heading compared with other genotypes. Data also cleared that the highest seed and biological yields fed^{-1} of 1553 and 3289 kg fed^{-1}, respectively, were obtained for Sakha 3 genotype flowed by Moshtohor 151 genotype which produced 1457 and 3205 kg fed^{-1} for seed and biological yields fed^{-1}, respectively.

The highest number of branches and seed yield plant^{-1} may be due to the different genetical make up which affect the growth behaviour. Highest mean value

for seed yield fed^{-1} was recorded for Sakha 3 followed by Moshtohor 151 genotype. The high seed yield fed^{-1} of various genotypes could be attributed to the high weight of pods and seeds plant^{-1}, number of seeds pod^{-1} and weight of 100-seed. The present results are in harmony with those of **El-Hosary and Sedhom (1990), Gomaa (1996), El-Hosary and Mehasen (1998), Mehasen (1998), Said (1998), Tageldin and Mehasen (2004), Al-Fageh and Mehasen (2006), Ahmed and El-Abagy (2007), Al Ghamdi (2007), Osman *et al,* (2010) and Bakry *et al,* (2011).**

Table 1. Mean squares values and significance for yield and its attributes of faba bean genotypes in 2008/09, 2009/10 seasons and their combined analysis

S.O.V	d.f	No. of days to Flour-ing	Plant hei-ght (cm)	No. of bran-ches plant^{-1}	No. of pods plant^{-1}	No. of seeds pod^{-1}	Pods weight plant^{-1} (g)	Seed weight plant^{-1} (g)	100-seed weight (g)	Seed yield fed^{-1} (kg)	Biological yield fed^{-1} (kg)
2010 season											
Rep.	**2**	0.067	0.417	0.004	0.006	0.000	2.646	0.408*	0.054	11.267	1152.02
G.	**4**	17.6**	70.2**	0.39**	0.21**	0.21**	41.7**	12.9**	108.3**	57176**	94663**
Er(a)	**8**	0.608	2.292	0.002	0.018	0.003	1.823	0.083	0.026	57.475	1979.5
D.	**3**	2.33**	43.5**	0.55**	1.13**	0.16**	28.1**	22.5**	4.134**	5150**	24003**
G.xD.	**12**	0.286	7.51**	0.010*	0.017*	0.010*	1.717	0.22**	0.12**	97.77**	1561.6
Er(b)	**30**	0.344	2.228	0.004	0.007	0.004	1.852	0.048	0.027	18.367	1522.47
CV%		1.18	1.59	1.91	0.88	1.72	3.47	0.69	0.19	0.30	1.24
2011 season											
Rep.	**2**	0.517	0.867	0.018	0.005	0.004	0.07	0.612*	0.113	0.717	54.317
G.	**4**	18.6**	64.9**	0.26**	0.18**	0.17**	53.5**	14.8**	101.4**	58317**	63034**
Er(a)	**8**	0.725	0.512	0.006	0.003	0.005	0.148	0.085	0.064	92.8	151.775
D.	**3**	1.75**	21.2**	0.53**	0.9**	0.17**	11.6**	23.5**	3.8**	4616**	17574**
G.xD.	**12**	0.569	1.189	0.01**	0.014*	0.01*	13.6**	0.61**	0.12**	37.3*	71.03**
Er(b)	**30**	0.372	0.694	0.003	0.006	0.003	0.168	0.048	0.018	16.383	22.95
CV%		1.21	0.90	1.54	0.80	1.48	1.00	0.66	0.15	0.28	0.15
Combined analysis											
Years	**1**	22.5**	18.4**	0.62**	0.20**	0.49**	105**	39.8**	18.6**	6409**	35639**
RxY	**4**	0.292	0.642	0.011	0.006	0.002	1.358	0.51**	0.084	5.992	603.167
G.	**4**	36.2**	133**	0.64**	0.38**	0.35**	85.3**	27.4**	209.5**	115468**	155147**
YxG.	**4**	0.013	2.013	0.017*	0.010	0.03**	9.89**	0.29**	0.17*	24.367	2549.47
Er(a)	**16**	0.667	1.402	0.004	0.010	0.004	0.986	0.084	0.045	75.137	1065.635
D.	**3**	4.06**	61.5**	1.07**	2.03**	0.33**	32.2**	45.9**	7.78**	9694**	39763**
YxD.	**3**	0.022	3.275	0.004	0.024*	0.001	7.58**	0.12	0.098**	72.16**	1813.267
G.xD.	**12**	0.77*	4.15**	0.02**	0.02**	0.01**	7.85**	0.72**	0.152**	96.3**	852.24
YxGxD	**12**	0.085	4.55**	0.001	0.008	0.006	7.45**	0.11*	0.071**	38.817*	780.426
Er(b)	**60**	0.358	1.461	0.004	0.006	0.003	1.01	0.048	0.023	17.375	772.708
CV%		1.19	1.30	1.73	0.84	1.60	2.50	0.67	0.17	0.29	0.88

*** and ** indicates significant at *P*<0.05 and 0.01, respectively G= genotypes D= distribution of plants**

Table 2. Effect of planting season on yield and yield components of faba bean

Traits / Season	No. of days to Flou-ring	Plant height (cm)	No. of bran-ches plant^{-1}	No. of pods plant^{-1}	No. of seeds pod^{-1}	Pods weight plant^{-1} (g)	Seed weig plant^{-1} (g)	100-seed weight (g)	Seed yield fed^{-1} (kg)	Biolog-ical yield fed^{-1}
2008/09	**49.7**	**93.7**	**3.48**	**9.495**	**3.548**	**39.22**	**31.87**	**88.20**	**1434.9**	**3153**
2009/10	**50.6**	**92.9**	**3.62**	**9.577**	**3.677**	**41.09**	**33.02**	**88.99**	**1449.5**	3188
F-test	**	**	**	**	**	**	**	**	**	**

*** and ** indicates significant at *P*<0.05 and 0.01, respectively**

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Table 3. Yield and its components of faba bean as affected by genotypes and distribution of plants combined over the two seasons

Traits	No. of days to Flowr-ing	Plant hei-ght (cm)	No. of bran-ches plant^{-1}	No. of pods plant^{-1}	No. of seeds pod^{-1}	Pods weight plant^{-1} (g)	Seed weight plant^{-1} (g)	100-seed weight (g)	Seed yield fed^{-1} (kg)	Biologic-al yield fed^{-1} (kg)
Genotypes										
Sakha 1	49.0	96.7	3.36	9.36	3.63	37.2	31.2	84.1	1375	3079
Mosht 151	52.1	92.7	3.61	9.51	3.68	41.2	32.5	91.3	1457	3205
Sakha 3	50.2	90.7	3.79	9.70	3.77	42.1	34.2	90.6	1553	3289
Giza 3	50.2	91.9	3.55	9.58	3.53	40.6	32.2	89.9	1428	3154
Giza 843	49.3	94.4	3.46	9.53	3.46	39.6	32.1	87.1	1397	3126
LSD at 5%	**0.50**	**0.73**	**0.04**	**0.06**	**0.044**	**0.61**	**0.18**	**0.13**	**5.31**	**20**
YxG	**N.S**	**N.S**	*	**N.S**	**	**	**	*	**N.S**	**N.S**
Distribution of plants										
D1	50.7	94.7	3.35	9.26	3.50	39.5	31.2	88.1	1421	3129
D2	50.0	92.4	3.78	9.84	3.74	41.7	34.0	89.3	1463	3212
D3	50.1	94.2	3.63	9.65	3.64	40.0	32.8	88.7	1448	3187
D4	49.8	91.8	3.46	9.40	3.56	39.5	31.7	88.3	1437	3154
LSD at 5%	**0.31**	**0.62**	**0.03**	**0.04**	**0.029**	**0.51**	**0.11**	**0.08**	**2.13**	**14**
YxP	**N.S**	**N.S**	**N.S**	*	**N.S**	**	**N.S**	**	**	**N.S**

*** and ** indicates significant at *P*<0.05 and 0.01, respectively,**
N.S = non significant
D1=planting one side of the ridge, two plants hill^{-1}, 10 cm-apart
D2= planting two sides of ridge, one plant hill^{-1}, of 10 cm-apart
D3=planting two sides of the ridge, two plants hill^{-1}, 20 cm-apart
D4= Planting three sides on ridge, one plant hill^{-1}, 15 cm-apart

-Effect of plant distribution:

Results in **Table (3)** indicated that, yield and its attributes of faba bean genotypes as No. of days to flowering, plant height, number of branches plant^{-1}, number of pods plant^{-1}, number of seeds pod^{-1}, weight of pods plant^{-1}, weight of seeds plant^{-1}, weight of 100-seed, seed and biological yields fed^{-1} were significantly affected by the different plant distributions. It is clear that the significant highest values of number of branches plant^{-1} (3.78 branch), number of pods plant^{-1} (9.84 pods), number of seeds pod^{-1}(3.74 seeds), weight of pods plant^{-1} (41.7 g), weight of seeds plant^{-1} (34.0 g), weight of 100-seed (89.3 g), seed yield (1463 kg) and biological yield fed^{-1} (3212 kg) were produced by planting in the two sides of ridge, 60 cm apart, using one plant hill^{-1}, 10 cm-apart. While, planting one side of the ridge, of 60 cm apart, in two plants hill^{-1}, at 10 cm-apart gave the lowest values in all of the studied characters except plant height which gave the highest value (94.7 cm). The negative effect of highest plants (2 plants) in hill on some yield parametars could be contrebuted to the increase in population density area^{-1} of land which caused low penetration of light within faba bean plants. It could be concluded that high competition between plants for water, minerals and other essential environmental factors were the mean response

for plants competition. The increase in these studied traits may be attributed to the decrease number of plants in hill which in turn increase the synthezed metabolites due to less competition of plants in the same unit area of land. Along the same line**, Caballero (1987), Mc Ewen *et al,* (1988) and Thalji (2006)** pointed that seed and pods yields plant^{-1} were increased by increasing row spacing. Previous studies, **Stutzel and Aufhammer (1991), Pilbeam *et al,* (1992), Silim and Saxana (1992), Stutzel *et al,* (1994), El-Moursy (1998) and Bakry *et al,* (2011)** reported similar results regarding the response of faba bean varieties or genotypes to plant density or row spacing.

- Interaction effect:

Data of the combined analysis revealed that the interaction between faba bean genotypes and plant distributions was significant for all of the studied characters except biological yield fed^{-1} **(Table 4)**. Results showed that number of branches plant^{-1}, number of pods plant^{-1}, number of seeds pod^{-1}, weight of pods plant^{-1}, weight of seeds plant^{-1}, weight of 100-seed and seed yield fed^{-1} were reduced by increasing number of plants per hill (2 plants) for all of the tested genotypes. The highest number of branches plant^{-1}(4.10 branch), number of pods plant^{-1} (10.03 pods), number of seeds pod^{-1}(3.83 seeds), weight of pods plant^{-1} (44.17 g), weight of seeds plant^{-1} (36.45 g) and seed yield fed^{-1}(1576 kg) were recorded for Sakha 3 genotype by planting the two sides of the ridge, of 60 cm apart, with one plant hill^{-1},at 10 cm-apart. Meanwhile, the heaviest weight of 100-seed was recorded for Moshtohor 151 genotype at the same plant distributions treatment. On the other hand, the lowest values for these traits were recorded by Sakha 1 genotype at planting in one sides of the ridge, of 60 cm apart, with two plants hill^{-1}, of 10 cm-apart. The increase in seed yield fed^{-1} mainly attributed to the increase in yield components under the same condition. These results are in accordance with what was obtained by **Stutzel and Aufhammer (1991), Silim and Saxana (1992), Stutzel *et al,* (1994) and Bakry *et al,* (2011)**.

Table 4. Effect of the interaction between faba bean genotypes and plant distribution on seed yield and of significant attributes (Combined over the two seasons)

Genotype	Distribution of plants	No. of days to Flowr-ing	Plant hei-ght (cm)	No. of bran-ches plant^{-1}	No. of pods plant^{-1}	No. of seeds pod^{-1}	Pods weight plant^{-1} (g)	Seed weight plant^{-1} (g)	100-seed weight (g)	Seed yield fed^{-1} (kg)
Sakha 1	D1	49.33	97.7	3.15	9.067	3.500	35.67	30.08	83.47	1355
	D2	48.66	95.5	3.62	9.733	3.783	39.03	32.50	84.85	1394
	D3	49.16	97.5	3.43	9.500	3.650	37.50	31.67	84.45	1382
	D4	48.83	96.2	3.23	9.133	3.600	36.67	30.67	83.72	1371
Mosht 15	D1	52.33	94.3	3.43	9.233	3.600	39.90	31.53	90.83	1430
	D2	52.00	92.8	3.82	9.867	3.800	42.75	33.95	91.85	1482
	D3	51.83	94.2	3.65	9.617	3.700	41.65	32.78	91.33	1467
	D4	52.33	89.5	3.53	9.317	3.600	40.67	31.65	91.00	1451
Sakha	D1	51.00	91.5	3.63	9.383	3.733	41.23	32.25	90.32	1536
	D2	49.83	89.8	4.10	10.033	3.833	44.17	36.45	91.42	1576
	D3	50.00	91.5	3.78	9.800	3.767	41.25	34.62	90.47	1557
	D4	49.83	89.8	3.65	9.600	3.733	41.92	33.32	90.27	1544
Giza	D1	51.16	93.3	3.30	9.350	3.350	42.75	31.12	89.35	1403
	D2	50.16	90.8	3.72	9.817	3.683	40.92	33.58	90.37	1449
	D3	50.16	92.5	3.68	9.717	3.600	39.83	32.50	90.05	1437
	D4	49.33	90.8	3.48	9.450	3.483	38.77	31.72	89.70	1423
Giza 84	D1	49.50	96.8	3.23	9.250	3.333	37.83	31.15	86.62	1380
	D2	49.50	92.8	3.65	9.750	3.617	41.42	33.57	87.78	1415
	D3	49.33	95.5	3.58	9.617	3.500	40.00	32.50	87.40	1399
	D4	48.66	92.5	3.38	9.483	3.383	39.25	31.28	86.75	1395
LSD at 5%		**0.68**	**1.38**	**0.07**	**0.092**	**0.066**	**1.15**	**0.25**	**0.17**	**5**

D1=planting one side of ridge, two plants hill^{-1}, 10 cm-apart
D2= planting two sides of ridge, one plant hill^{-1}, of 10 cm-apart
D3=planting two sides of ridge, two plants hill^{-1}, 20 cm-apart
D4= Planting three sides on ridge, one plant hill^{-1}, 15 cm-apart

- Simple correlation study:

Simple correlation coefficients between each two traits of yield and its components were calculated using the combined correlation values between seed yield fed^{-1} and each of other traits are presented in **Table (6)**. There were positive and high significant correlation coefficients between seed yield fed^{-1} and each of number of branches plant^{-1}, number of pods plant^{-1}, number of seeds pod^{-1}, weight of pods plant^{-1}, weight of seeds plant^{-1}, weight of 100-seed and biological yield fed^{-1} except for plant height which of was negatively significant correlation coefficients. Therefore, these traits may be more attributed for higher yielding of faba bean. Also, significant positive phenotypic correlations were observed between the weight of seeds plant^{-1} and each number of branches plant^{-1}, number of pods plant^{-1}, number of seeds pod^{-1}, weight of pods plant^{-1}, weight of 100-seed and biological yield fed^{-1}.

These results might indicate that selection for high values of the characters is more effective for increasing seed yield fed^{-1}. These results were supported by those of **Al-Fageh and Mehasen (2006). Sedghi and Amanpour-Balaneji (2010)** where they found that correlation coefficient analysis of grain yield had significant positive and negative association with No. of pods plant^{-1} and plant height, respectively.

Generally, it can be concluded that planting Sakha 3 or moshtohor 151 faba bean genotypes under planting on the two sides of the ridge, of 60 cm apart, with one plant hill^{-1}, at 10 cm-apart could be recommended to improve the productivity of faba bean crop under the prevailing environmental conditions of the present study in South Delta, Egypt.

Table 5. Correlation coefficient between yield and yield components of faba bean (combined over the two seasons)

Components	1	2	3	4	5	6	7	8	9
1- No. of days to Flowring	1.000								
2-Plant height (cm)	-0.292**	1.000							
3-No. of branches plant^{-1}	0.273**	-0.562**	1.000						
4-No. of pods plant^{-1}	0.039	-0.429**	0.839**	1.000					
5- No. of seeds pod^{-1}	0.250*	-0.299**	0.722**	0.544**	1.000				
6- Wt. of pods plant^{-1}	0.450**	-0.569**	0.663**	0.554**	0.437**	1.000			
7-Wt.of seeds plant^{-1}	0.191	-0.515**	0.926**	0.842**	0.695**	0.684**	1.000		
8-wt. of 100-seed	0.675**	-0.706**	0.654**	0.469**	0.361**	0.683**	0.585**	1.000	
9-Biological yield fed^{-1}	0.396**	-0.630**	0.807**	0.657**	0.613**	0.565**	0.807**	0.767**	1.000
Seed yield fed^{-1}	0.108	-0.679**	0.761**	0.556**	0.612**	0.624**	0.759**	0.752**	0.917**

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سلوك بعض التراكيب الوراثية من الفول البلدى تحت نظم مختلفة لتوزيع النباتات

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أقيمت تجربتان حقليتان خلال فصل الشتاء لموسمي ٢٠٠٨/٢٠٠٩ و ٢٠٠٩/٢٠١٠م بمركز البحوث والتجارب بكلية الزراعة بمشتهر – جامعة بنها ، جنوب الدلتا- مصر بهدف تقييم خمس تراكيب وراثية من الفول البلدي (سخا ١ – مشتهر ١٥١ – سخا ٣ – جيزة ٣ محسن وجيزة ٨٤٣) تحت اربع نظم مختلفة لتوزيع النباتات بكثافة واحدة هي ١٤٠٠٠٠ نبات/فدان (الزراعة علي ريشة واحدة بمسافة ١٠ سم بين الجور مع ترك نباتين بالجورة وبمسافة ٦٠ سم بين الخط والاخر – الزراعة علي الريشتين بمسافة ١٠ سم بين الجور مع ترك نبات واحد بالجورة وبمسافة ٦٠ سم بين الخط والاخر - الزراعة علي الريشتين بمسافة ٢٠ سم بين الجور مع ترك نباتين بالجورة وبمسافة ٦٠ سم بين الخط والاخر - الزراعة علي الريشتين وبينهما علي ظهر الخط بمسافة ١٥ سم بين الجور مع ترك نبات واحد بالجورة وبمسافة ٦٠ سم بين الخط والاخر) والصفات المدروسة هى: عدد الايام من الزراعة حتي بداية التزهير- طول النبات (سم) – عدد فروع وقرون النبات– عدد بذور القرن – وزن قرون وبذورالنبات (جم) – وزن الـ ١٠٠ بذرة (جم) – محصول البذور والمحصول البيولوجي (كجم/فدان). وكان التصميم المستخدم هو قطع منشقة حيث وزعت التراكيب الوراثية عشوائيا في القطع الرئيسية ووضعت نظم توزيع النباتات عشوائيا في القطع الشقية وكانت مساحة القطعة الشقية(٣ م X ٣.٥ م).

ويمكن تلخيص أهم النتائج المتحصل عليها من التحليل التجميعي لموسمى الزراعة ما يلي:

- أظهرالتركيب الوراثي سخا ٣ أعلي قيم لكل من عدد فروع النبات ، عدد قرون النبات ،عدد بذور القرن ،وزن قرون وبذور النبات ، محصول البذور للفدان و المحصول البيولوجي للفدان بفروق معنوية عن التراكيب الوراثية الاخري. بينما اعطي التركيب الوراثي مشتهر ١٥١ أعلي وزن ل١٠٠ بذرة بفرق معنوي عن التراكيب الوراثية الاخري. وأظهري كل من التركيبين الوراثيين سخا ١ وجيزة ٨٤٣ صفة التبكير في التزهير بفرق معنوي عن التراكيب الوراثية الاخري.
- أنتج نظام الزراعة علي الريشتين بمسافة ١٠ سم بين الجورة والاخري مع وجود نبات واحد في الجورة وبمسافة ٦٠ سم بين الخط والاخر اعلي القيم وبفروق معنوية عن المعاملات الاخري لنظم توزيع النباتات لكل من عدد فروع النبات ، عدد قرون النبات ،عدد بذور القرن ،وزن قرون وبذور النبات ، وزن ال١٠٠ بذرة ، محصول البذور للفدان والمحصول البيولوجي للفدان.
- أثبتت النتائج وجود تأثير معنوي للتفاعل بين التراكيب الوراثية للفول البلدي ونظام توزيع النباتات علي كل الصفات المدروسة ما عدا صفة المحصول البيولوجي للفدان. وتم الحصول علي اعلي القيم لكل من عدد فروع النبات ، عدد قرون النبات ،عدد بذور القرن ،وزن قرون وبذور النبات و محصول البذور للفدان عند زراعة التركيب الوراثي سخا ٣ و نظام الزراعة علي الريشتين بمسافة ١٠ سم بين الجورة والاخري مع وجود نبات واحد في الجورة وبمسافة ٦٠ سم بين الخط والاخر بينما تم الحصول علي أثقل وزن ل١٠٠ بذرة عند زراعة التركيب الوراثي مشتهر ١٥١ مع نفس معاملة نظام توزيع النباتات السابقة.
- أظهرت النتائج وجود ارتباط موجب وعالى المعنوية بين كل من محصول البذور للفدان وكل الصفات تحت الدراسة ما عدا طول النبات فى التحليل التجميعي لموسمي الزراعة.
- بصفة عامة يمكن التوصية بزراعة التركيب الوراثي سخا ٣ أو مشتهر ١٥١ و نظام الزراعة علي الريشتين بمسافة ١٠ سم بين الجورة والاخري مع وجود نبات واحد في الجورة وبمسافة ٦٠ سم بين الخط والاخر لتحسين إنتاجية الفول البلدى تحت ظروف هذه التجربة.