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PERFORMANCE OF TWO FABA BEAN VARIETIES UNDER DIFFERENT ENVIRONMENTS

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ABSTRACT

Two field experiments were carried out at the Agricultural Experimental and Research Station of the Faculty of Agriculture, Cairo University, Giza governorate, Egypt, during the two winter seasons of 2005/06 and 2006/07 to study the Performance of two faba bean varieties under different planting dates, plant densities and their interactions.

The results obtained could be summarized as follows: the best performance of the two varieties was obtained from planting date on 15 November which recorded the highest seed yield and harvest index. While, seed yield was significantly increased with increasing plant density from 22 to 44 plant/m^2. Generally, Giza-843 surpassed Giza-40 in seed yield/faddan. The interaction between planting date and varieties had a significant effect on seed yield/faddan in the second seasons only. The highest seed yield was obtained from second planting date on 15 November combined with Giza-843. The highest seed yield was recorded from the interaction of 15 November × Giza-843 × 44 plant / m2.

Key words: ***Faba bean, Vicia faba, Planting date, Population Density, Variety.***

INTRODUCTION

Faba bean (*Vicia faba* L.) is the most important annual pulse crops grown in Egypt. The adoption of improved cultivars performed better under different planting dates, and plant densities play an important role for increasing seed production.

It has been clearly established that time of planting, is a major factor affecting faba bean yield and its components (Confalone *et al* 2010). Planting faba bean genotypes earlier on October gave higher number of pods/plant (Hatam *et al* 1999), seed yield than November (Bakheit *et al 2001*, Hatam *et al* 1999 and Hussein *et al* 2002) and biological yield (Hatam *et al* 1999). In contrast, Abuldahab *et al* (2002) found that the best yield components *i.e.*, number of pods, seed index, seed number/plant and seed yields and straw yields/fed resulted from sowing in November.

Faba bean variable plant densities can affect differentally the growth, yield and components of various cultivars (Abd Alla and Omran 2002 and Abdel Latif 2008), (Abdel-Aziz and Shalaby 1999, Hatam *et al* 1999 and Mokhtar 2001), Abdel-Aziz 1999, Abdel Latif 2008, Abd Alla and Omran 2002, Mokhtar 2001), (Abdel-Aziz and Shalaby 1999, Hatam *et al* 1999 and Hussein *et al* 2002), (Abdel-Aziz, 1999).

Besides, there is a tendency to start with higher planting seed density to avoid lost plants which may be a considerable than required for insuring reliable yield production. On the other hand, number of pods and seeds per plant decreased with increasing densities (Hussein *et al* 1999 and Ibrahem 2000), seed yield per faddan increased with increasing plant density (Hussein *et al* 1999, Ibrahem 2000, Mohamed, 2000 and Abd Alla 2002), biological yield per faddan (Hussein *et al* 1999, Ibrahem 2000 and Mohamed 2000) and harvest index (Mohamed 2000). In contrast, plant density had insignificant effect on 100-seed weight (Abdel-Aziz 1999, Ibrahem, 2000 and Abd Alla 2002).

However, the optimum number of plants at harvest for each variety is not well known. Also, the time required from planting to harvesting under different plant population densities and different varieties are needed to be accurately established. Generally, Karadavut *et al* (2010) showed that significant differences between varieties in faba bean characters. Also, marked variations among cultivars were noticed in number of branches per plant (Abou-Taleb 2002), number of pods /plant (Mohamed 2000, Hussein *et al* 2002 and Nassif, 2002), number of seeds/plant (Mohamed 2000 and Hussein *et al* 2002), seed index (Bakheit *et al* 2001 and Nassif, 2002) seed yield/faddan (Bakheit *et al* 2001). Moreover, cultivars had no effect on number of pods and seeds/plant (Bakheit *et al* 2001 and Abd Alla *et al* 2002), branches/plant (Nassif 2002), harvest index (Nassif 2002), seed yield (Nassif 2002).

Changes in plant density significantly affected performance of faba bean varieties (Matthews *et al* 2008). While, Matthews *et al* (2008) recorded significant effect on seed yield/fed due to the interaction between faba bean varieties × plant densities. Meanwhile, Abuldahab *et al* (2002) reported that the interactions between sowing dates and distribution patterns had a significant effect on seed yield per faddan. On the contrary, Hussein *et al* (2002) found that the interaction between sowing dates × genotypes × plant densities didn't significantly affect faba bean yield and its components.

Thus, the main objectives of this research were to find out the best planting date and to determine the optimum plant density for two newly released varieties of faba bean.

MATERIALS AND METHODS

Two field experiments were carried out at the Agricultural Experiment and Research Station of the Faculty of Agriculture, Cairo University, Giza, Egypt, during 2005/06 and 2006/07 seasons. The soil texture of the experimental area was clay loam with pH 7.4.

The preceding crop was maize in both seasons of the study.
Each experiment included 18 treatments, which were the combinations of:

1. Three planting dates, *viz.*, 1, 15 and 30 November (at 2 week intervals).
2. Three plant density, *i.e.*, 22, 33 and 44 plant/m^2.
3. Two varieties, *i.e.*, Giza 843 and Giza 40.

A randomized complete block design with spilt-split plot with four replications was used. The main plot was devoted to the planting dates. Sub-plots were allocated to the varieties, while, sub-sub plots to the plant densities. Each experimental plot consisted of five ridges each was 60 cm apart and 3 meter long. The sub-sub plot area was 9 m^2 (3.0 × 3.0 m).

All cultural practices were conducted according to the recommendations of ARC, Ministry of Agriculture concerning Faba bean production.

Studied characters

Ten plants were randomly taken from each sub-sub plots at harvest to calculate the following characters:

The number of branches per plant, Number of pods per plant, Number of seeds per plant, Seed index (weight of 100 seed, in grams).

Seed yield per faddan (ardab): was determined from the two middle ridges of each sub-sub plot and converted to seed yield, in ardab (ardab = 155 Kg) per faddan.

Harvest index (HI): expressed as following formula:

HI% = (seed yield / biological yield) x100

Data obtained from each season were statistically analyzed according to procedures outlined by Steel *et al* (1997) using MSTAT-C Computer packages (Freed *et al* 1989). The differences between treatment means were compared by Least Significant Differences test (L.S.D) at 0.05 level of probability.

RESULTS AND DISCUSSION

Effect of planting dates

Results in Table (1) indicated that sowing dates had insignificant effect on number of branches per plant in both seasons. Meanwhile, number of pods and seeds/plant, seed yield/fad and harvest index was significantly affected by planting date in both seasons but seed index was insignificant in second season.

The highest number of pods/plant was recorded by planting on 15 November in both seasons (Table 1). Such increase may be due to more favorable conditions specially temperature at that time. These findings are in harmony with those obtained by Bakheit *et al* (2001) and Hussein *et al* (2002).

Also, data showed that the highest number of seeds/plant was obtained from planting on 15 November. Such increase may be due to

increase in number of pods/plant. Similar findings were obtained by Amer *et al* (1992) and Hussein *et al* (2002).

Seed index in Table 1 was significantly affected by planting date in early planting (1st November). This agreed Amer *et al* (1992but disagreed with Bakheit *et al* (2001).

Data in Table (1) indicated that the highest seed yield was recorded from planting on 15 November in both seasons. Such increase may be due to more favorable conditions specially temperature at that time; meanwhile, the lowest seed yield (7.95 and 8.55 ardab) was recorded at the last sowing date (30 November) in both seasons. These results are in general agreement with those obtained by Hussein *et al* (2002) and Abuldahab *et al* (2002). But do not agree with those obtained by Bakheit *et al* (2001).

Data in Table (1) indicated that the planting date (15 November) recorded the highest harvest index in both seasons.

Effect of plant densities

Data in Table (2) indicated significant effects of plant density on number of branches, pods and seeds/plant, as well as, seed index, seed yield/fad and harvest index of faba bean during 2005/06 and 2006/07 seasons.

Data indicated that the lowest plant density (22 plant/m^2) gave the highest number of branches/plant in both seasons. This result may be due to the better chance for each plant to get nutrients, sunshine and light due to less plant competition wiehin hills. Generally, these results are on line with those of Ibrahem (2000), Mohamed (2000), Bakheit *et al* (2001), Mokhtar (2001) and Abd Alla (2002).

Results in Table (2) showed that number of pods/plant was significantly increased with decreased plant density from 44 to 22 plant/m^2 in both seasons. The greatest number of pods/plant was recorded from plant density 22 plant/ m^2 in both seasons. The reduction in number of pods/plant with increasing plant density may be due to plant competition in hills. These results go in line with those of Mohamed (2000), Bakheit *et al* (2001), Mokhtar (2001), Abd Alla (2002) and Abdel Latif (2008).

Data in Table (2) cleared that the plant density 22 plant/m^2 recorded the highest number of seeds/plant in both seasons. The increase in number of seeds/plant may be due to increasing number of branches/plant and number of pods/plant. The current view agreed with that reported by Mokhtar (2001), Abd Alla (2002) and Abdel Latif (2008). Seed index was significantly increased by decreasing plant density from 44 to 22 plant/m^2 in both seasons. The better seed index was obtained from plant density 22 plant/m^2 in both seasons.

Table 1. Yield and yield components of tow faba bean varieties as affected by planting dates during 2005/2006 and 2006/2007 seasons

Sowing date	No. of branches/ plant		No. of pods/plant		No. of seeds/plant		Seed index (g)		Seed yield (ardab/fed.)		Harvest index %	
	2005/06	2006/07	2005/06	2006/07	2005/06	2006/07	2005/06	2006/07	2005/06	2006/07	2005/06	2006/07
1st November	2.83	2.99	8.57b	10.13b	23.27b	22.86b	71.85a	68.84	8.56b	9.11b	28.79b	33.59b
15th November	2.81	2.95	9.69a	11.75a	27.07a	26.50a	69.49b	70.20	10.22a	10.61a	41.73a	44.46a
30th November	2.90	2.95	8.30b	10.38b	26.58a	26.23a	69.76b	70.39	7.953b	8.55b	29.13b	31.41b
LS.D at 0.05	ns	ns	0.54	0.29	0.79	2.11	1.62	ns	0.89	1.04	4.72	6.29

Table 2. Yield and yield components of two faba bean varieties as affected by plant density during 2005/2006 and 2006/2007 seasons

Plant density	No. of branches/ plant		No. of pods/plant		No. of seeds/plant		Seed index (g)		Seed yield (ardab/fed.)		Harvest index %	
	2005/06	2006/07	2005/06	2006/07	2005/06	2006/07	2005/06	2006/07	2005/06	2006/07	2005/06	2006/07
22plants/m^2	3.24a	3.17a	10.41a	12.04a	29.16a	28.27a	73.09a	72.71a	7.43c	7.98c	30.78b	34.59b
33plants/m^2	2.76b	3.01b	8.71b	10.73b	25.78b	26.34a	69.82b	69.06b	9.14b	9.63b	33.31ab	36.46ab
44plants/m^2	2.54c	2.71c	7.44c	9.48c	21.98c	20.98b	68.20c	67.66b	10.17a	10.66a	35.56a	38.40a
LS.D at 0.05	0.12	.015	0.50	0.55	1.12	1.95	1.44	1.77	0.53	0.61	3.54	2.36

These results agreed with those obtained by Bakheit *et al* (2001) and Mokhtar (2001) but are contrary to Abdel-Aziz and Shalaby (1999) and Amer *et al* (1992).

Also, results showed that seed yield per faddan was significantly increased with increasing plant density from 22 to 44 plant/m^2 in both seasons. This increase in seed yield under higher density may be due to the increase in plant population. These results are in consistence with those reported by Quagliotti *et al* (1994), El-Douby *et al* (1996), Loss *et al* (1998), Mohamed (2000) and Hussein *et al* (2002) who found that the seed yield increased by increasing plant density.

Harvest index was significantly increased with increased plant density from 22 to 44 plant/m^2 in both seasons (Table 2). The better harvest index was obtained from plant density 44 plant/m^2 in both seasons. These results agreed with those obtained by Abdel-Aziz and Shalaby (1999) and Mohamed (2000).

Effect of cultivars

Data in Table (3) showed the effects of cultivars on number of branches, pods and seeds/plant, as well as, seed index, seed yield/fad and harvest index of faba bean in 2005/06 and 2006/07 seasons. Results showed that cultivars had insignificant effect on number of pods and seeds/plant, as well as, harvest index in 2005/06 and 2006/07 seasons. Meanwhile, cultivars had a significant effect on number of branches per plant, seed index and seed yield/fad in both seasons.

It is clear from the results in Table (3) that Giza-843 surpassed Giza-40 in number of branches/plant, seed index and seed yield/faddan in both seasons.

Effect of the interactions

The interaction between planting date and varieties (Table 4) had a significant effect on number of branches per plant in 2006/2007 season only, number of pods and seeds per plant, seed index in both seasons, seed yield/faddan in the second seasons only. Meanwhile, harvest index was not affected by the interaction of planting dates and varieties in both seasons.

The highest number of branches/plant was obtained from second planting date on 15 November combined with Giza-40. Meanwhile, the highest number of pods/plant, seed index and seed yield/faddan were obtained from second planting date on 15 November combined with Giza-843.

The interaction between planting dates and plant densities (Table 5) had a significant effect on number of branches and seeds per plant in season 2005/2006 only. The remaining traits were not affected by the interaction between planting date and plant density.

The interaction between cultivars and plant densities (Table 6) had insignificant effect on all studied traits. Also, the effect of planting dates ×

Table 3. Yield and yield components of two faba bean varieties during 2005/2006 and 2006/2007 seasons

Varieties	No. of branches/ plant		No. of pods/plant		No. of seeds/plant		Seed index (g)		Seed yield (ardab/fed.)		Harvest index %	
	2005/06	2006/07	2005/06	2006/07	2005/06	2006/07	2005/06	2006/07	2005/06	2006/07	2005/06	2006/07
Giza 843	2.92	2.87	8.66	10.48	25.93	25.26	74.91	74.23	9.58	10.03	34.58	39.04
Giza 40	2.77	3.06	9.05	11.03	25.38	25.13	65.83	65.39	8.24	8.81	31.84	33.92
LS.D at 0.05	*	*	ns	ns	ns	ns	**	**	*	*	ns	ns

Table 4. Yield and yield components of faba bean as affected by the interaction between planting dates (P) and varieties (V) during 2005/2006 and 2006/2007 seasons

Interactions	No. of branches/ plant		No. of pods/plant		No. of seeds/plant		Seed index (g)		Seed yield (ardab/fed.)		Harvest index %	
	2005/06	2006/07	2005/06	2006/07	2005/06	2006/07	2005/06	2006/07	2005/06	2006/07	2005/06	2006/07
P_1-V_1	2.90	2.72c	8.60b	9.90c	24.00cd	22.20c	73.78	71.48b	9.11	8.96bc	31.00	33.72
P_1-V_2	2.77	3.27a	8.53b	10.35bc	22.55d	23.52bc	69.92	66.21c	8.01	9.26bc	26.58	33.45
P_2-V_1	2.85	2.97b	7.47c	9.45c	25.55bc	25.43ab	75.57	75.62a	11.06	11.88a	43.22	50.26
P_2-V_2	2.77	2.93b	9.13ab	11.32ab	27.62a	27.57a	63.42	64.79c	9.38	9.33b	40.24	38.65
P_3-V_1	3.02	2.93b	9.90a	12.08a	28.23a	28.13a	75.38	75.59	8.57	9.26bc	29.55	33.15
P_3-V_2	2.78	2.97b	9.48a	11.42ab	25.90b	24.32bc	64.15	65.18	7.34	7.85c	28.71	29.66
LS.D at 0.05	ns	0.20	0.87	1.24	1.60	3.03	2.35	1.80	ns	1.42	ns	ns

P_1= 1st November P_2= 15th November P_3= 30th November

V_1= Giza 843 V_2= Giza 40

Table 5. Yield and yield components of two faba bean varieties as affected by the interaction between planting dates (P) and plant densities (D) during 2005/2006 and 2006/2007 seasons

Interactions	No. of branches/ plant		No. of pods/plant		No. of seeds/plant		Seed index (g)		Seed yield (ardab/fed.)		Harvest index %	
	2005/06	2006/07	2005/06	2006/07	2005/06	2006/07	2005/06	2006/07	2005/06	2006/07	2005/06	2006/07
P_1-D_1	3.28	3.17	10.00	11.05	28.10	25.77	74.04	72.46	7.06	7.76	25.94	32.17
P_1-D_2	2.63	3.03	8.52	10.40	23.80	24.65	71.53	67.33	9.00	9.08	30.30	32.15
P_1-D_3	2.60	2.78	7.18	8.93	17.92	18.15	69.98	66.75	9.62	10.49	30.13	36.44
P_2-D_1	3.28	3.10	9.55	11.57	29.00	28.85	73.36	72.96	8.80	8.77	41.82	42.66
P_2-D_2	2.78	3.05	8.35	10.30	26.65	27.35	68.58	70.02	10.19	11.27	39.20	46.16
P_2-D_3	2.38	2.70	7.00	9.27	24.10	23.30	66.55	67.63	11.67	11.78	44.17	44.55
P_3-D_1	3.17	3.25	11.68	13.50	30.38	30.17	71.86	72.72	6.43	7.41	24.60	28.93
P_3-D_2	2.88	2.95	9.25	11.50	26.90	27.02	69.36	69.83	8.22	8.55	30.44	31.07
P_3-D_3	2.65	2.65	8.15	10.25	23.92	21.48	68.07	68.61	9.21	9.70	32.36	34.22
LS.D at 0.05	0.21	ns	ns	ns	1.94	ns	ns	ns	ns	ns	ns	ns

P_1= 1st November P_2= 15th November P_3= 30th November
D_1= 22 plants/m^2 D_2= 33 plants/m^2 D_3= 44 plants/m^2

Table 6. Yield and yield components of two faba bean varieties as affected by the interaction between varieties (V) and plant densities (D) during 2005/2006 and 2006/2007 seasons

Interactions	No. of branches/ plant		No. of pods/plant		No. of seeds/plant		Seed index (g)		Seed yield (ardab/fed.)		Harvest index %	
	2005/06	2006/07	2005/06	2006/07	2005/06	2006/07	2005/06	2006/07	2005/06	2006/07	2005/06	2006/07
V_1-D_1	3.40	3.13	9.98	11.60	29.67	28.23	77.20	77.40	8.03	8.34	32.66	37.72
V_1-D_2	2.77	2.97	8.60	10.48	26.15	26.35	74.88	73.31	9.68	10.40	34.32	38.38
V_1-D_3	2.60	2.52	7.38	9.35	21.97	21.18	72.65	71.98	11.04	11.36	36.78	41.03
V_2-D_1	3.08	3.22	10.83	12.48	28.65	28.30	68.97	68.03	6.84	7.62	28.91	31.46
V_2-D_2	2.75	3.05	8.82	10.98	25.42	26.33	64.77	64.81	8.60	8.87	32.30	34.54
V_2-D_3	2.48	2.90	7.50	9.62	22.00	20.77	63.76	63.34	9.30	9.95	34.33	35.77
L.S.D at 0.05	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns

D_1= 22 plants/m^2 D_2= 33 plants/m^2 D_3= 44 plants/m^2
V_1= Giza 843 V_2= Giza 40

plant densities × cultivars interaction had insignificant effect on all studied traits except number of seeds/plant only in the first season which was highly significant. While, planting G 843 variety in November 15th with 44 plant / m^2 gave the highest seed yield / faddan (12.83 ardab / faddan).

Giza 843 cultivar recorded the highest seed yield under the plant density 44 plants /m^2 when sowing date was 15th November.

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١ - قسم المحاصيل - كلية الزراعة - جامعة القاهرة - الجيزة- مصر
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نفذت تجربتان حقليتان منفصلتان بمحطة التجارب والبحوث الزراعية لكلية الزراعة جامعة القاهرة، محافظة الجيزة، مصر خلال الموسمين الشتويين ٢٠٠٥/٢٠٠٦، ٢٠٠٦/٢٠٠٧ لدراسة أداء صنفين من الفول البلدي (جيزة ٨٤٣ وجيزة ٤٠) تحت مواعيد زراعة (١ و١٥ و٣٠ نوفمبر) وكثافات نباتية مختلفة (٢٢ و٣٣ و٤٤ نبات / م^2) وكذلك تأثير التفاعل بينهم. كان الهدف من هذه الدراسة البحث عن إيجاد أفضل ميعاد للزراعة وتحديد الكثافة النباتية المثلي لصنفي من الفول البلدي الحديثة الاستنباط. استخدم تصميم القطع المنشقة مرتين موزعة في قطاعات كاملة العشوائية.

ويمكن تلخيص أهم النتائج فيما يلي: كان أفضل اداء لكلا الصنفين من الزراعة في منتصف نوفمبر والتي حققت أعلي محصول للبذرة ودليل الحصاد. وأظهرت النتائج أيضاً زيادة معنوية لمحصول البذور بزيادة الكثافة النباتية من ٢٢إلى ٤٤نبات/م^2. وبصفة عامة تفوق الصنف جيزة-٨٤٣ علي جيزة- ٤٠ بالنسبة لمحصول البذور للفدان. وبما يتعلق بالتفاعل بين مواعيد الزراعة والاصناف أظهرت النتائج وجود تأثير معنوي لهذا التفاعل علي محصول البذرة للفدان وذلك في الموسم الثاني فقط. وتحقق أعلي محصول للبذرة عند الزراعة في منتصف نوفمبر للصنف جيزة-٨٤٣. بمعدل كثافة نباتية ٤٤ نبات /م^2

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