

PLANT DENSITIES AND ITS EFFECT ON YIELD AND ITS COMPONENTS OF SOME FABA BEAN VARIETIES

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ABSTRACT

Two field experiments were conducted at Shandawill Research Station, Sohag governorate during 1999/2000 and 2000/2001 seasons. The aim of this investigation was to study the effect of three plant population density i.e 16.7, 33.3 and 50 plants/m² on the performance of two faba bean cultivars i.e. (Giza 3 and Giza 674) on seed productivity as well as yield components. A split plot design with four replications was used. The main findings could be summarized as follow:

The results indicated that plant population density of 16.7 plants/m² gave the highest values of number of branches/plant, number of pods/plant, 100-seed weight and seed yield/plant, while plant population density of 33.3 plants/m² gave significant increase in plant height, first earing pods height and seed yield/fed, however, the plant population density of 50 plants/m² gave highly significant increase in plant height, first earing pods height and seed yield/fed. Increasing plant population density from 16.7 plants/m² to 50 plants/m² caused decreases with the two varieties used in number of branches/plant, number of pods/plant, 100-seed weight and seed yield/plant.

Sown Giza 3 cultivar gave heaviest of 100-seed weight with all plants populations used, while Giza 674 gave highest number of branches and pods per plant, seed yield/plant and seed yield/fed.

The interaction between plant population density and cultivars significantly affected plant height, number of branches per plant and seed yield per plant. The results indicated that tallest plants produced from sown Giza 674 cultivar at higher plant population density of 50 plants/m². Highest number of branches/plant and seed yield per plant are obtained from sown Giza 674 cultivar at lower plant density of 16.7 plants/m².

It could be recommended that for maximizing faba bean seed yield might attributed with sown Giza 674 cultivar at higher plant population density of 50 plants/m².

INTRODUCTION

In Egypt, faba bean (*Vicia faba* L.) is the most important pulse crop grown due to a major protein source for human consumption. The productivity of this crop affected by many factors such as plant density and cultivars. Ali (1983) showed that higher plant density (140,000 plants/fed) caused increases in seed yield/fed amount to 61.4 % and 25.4 % over plants density 70000 and 46667 plants/fed, respectively in the first season, and amount to 2.50% and 15.86%, respectively in the second season. On the other hand, yield components i.e. weight of pods/plant, weight of 100 seeds and seed yield/plant were decreased by increasing plant densities. Heaviest 100-seed was produced from sown at lower density of 46667 plants/fed as compared to the other plant densities. Dawelbeir (1988) showed that there were no significant differences between two rows/ridge and three rows/ridge on yield and yield components of faba bean. Abo-Shetaia (1990) found that planting

faba bean at 70000 plants/fed gave significantly higher number of branches, pods and seeds/plant, number of seeds/pod, weight of pods and seeds/pod and seed index than at 105000 plants/fed while the reverse was true of seed and straw yield/fed. El-Habbak and El-Naggar (1991) found that planting faba bean in two rows/ridge 60 cm apart (120000 plants/fed) gave the highest averages of number of branches/plant, number of pods/plant, weight of pods/plant, seed yield/plant and 100- seed weight, while the planting in three rows/ridge (180000 plant/fed) recorded the maximum averages of straw and seed yield/fed. Abdrabou (1992) stated that there was no significant effect of between plant density of 70000 and 140000 plants/fed on plant height, number of pods/plant, number of seeds/pod and seed yield/fed in the two growing seasons. Abdel-Aziz and Shalaby (1999) found that highest number of pod and seeds/plant, and seed yield/plant produced from sown Giza 2 cultivar followed by Giza 674 compared with other studied cultivars. Increasing density plant population from 22 to 27 plant/ m² produced highest number of branches, pods, seeds per plant and seed yield/plant. Metwally *et al* (2000) found that the number of pod and seeds/plant and seed yield/plant exhibited significantly lower values under the highest sowing density of 33 plants/ m² than under lower ones of 17 or 22 plants/m². Highest density of 33 plants/m² recorded significantly higher seed yield/fed than the lowest plant density of 17 plants/ m². Using about half of plant density as investigated by sowing one side resulted in reducing the productivity by about 30 %. Number of seeds per plant and seed yield/plant for Giza 2, Giza 429 and Giza 674 cultivars significantly increased with increasing plant population from 22 to 27 plants/ m². Mohamed (2000) found that maximum seed yield/fed could be achieved by raising the density up to 40 plants/ m² followed by 33.3 plants/ m², but the 40 plants/ m² stand reached actually 33 plants at harvest.

The objectives of this investigation is aimed to study the effect of plant population density on yield and yield components of two faba bean varieties.

MATERIALS AND METHODS

Two field experiments were carried out at Shandawill Agriculture Research Station, during two successive seasons 1999/2000 and 2000/2001 using two faba bean cultivars (Giza 3 and Giza 674). Soil texture of the experimental site is clay loam with a pH 7.8 and low organic matter 1.5%. The total nitrogen was 0.42 and available of Zn, Mg and Fe were 1.8, 12.1 and 13.5 ppm, respectively. A split plot design with four replications was used. The main plots were devoted to the faba bean varieties and sub plots to plant population density treatments. The three plant densities were:

- 1) D₁: 16.7 plants/ m² was obtained from planting on one ridge side and two plants per hill and 20 cm apart.
- 2) D₂: 33.3 plants/ m² was obtained from planting two ridge side and two plants per hill and 20 cm apart.
- 3) D₃: 50 plants/ m² was obtained from planting three ridge side and two plants per hill and 20 cm apart.

Plot area was 17.5 m² consisted of six ridges width 0.60 m and length 5 m. Seeds were sowing on October 18th and 23rd in the first and second seasons, respectively with double-seed/hills in 20 cm distances between hills. Calcium superphosphate (15.5 % P₂O₅) at rate of 200 kg/fed was applied during land preparation. Nitrogen fertilizer was applied at a rate of 15 kg N/fed as urea (46 % N) at 45 days after planting. Whereas, potassium sulphate (48 % K) at rate of 100 kg/fed was applied after 75 days from planting.

Faba bean plants were harvested after 5.5 months from planting. A samples of ten guarded plants were taken random to determine the following data; plant height (cm), first earing pods height, number of branches/plant, number of pods/plant, weight of 100 seeds (gm), seed yield/plant (gm). Seed yield/fed (ardab) was calculated from the data obtained from the total ridges of each sub plot.

All data were statistically analyzed according to the procedures outlined by Snedecor and Cochran (1981). LSD_(0.05) test was used to determine the significance of differences between treatment means.

RESULTS AND DISCUSSION

I- Cultivars performance:

Results in Table 1 indicate that all studied traits were significantly affected by varieties except number of branches and pods/plant in the two seasons. Giza 674 recorded the highest values of plant height, first earing pods height, number of branches and pods/plant, seed yield/plant and seed yield/fed in the two seasons. Giza 3 gave heaviest 100-seed weight was produced from sown Giza 3 cultivar compared with Giza 674. However, Giza 674 variety carried out significantly the highest number of branches and pods per plant which were reflected in significantly highest seed yield either per plant or per feddan in the both seasons. These results are in agreement with those reported by Abdel-Aziz and Shalaby (1999), Metwally *et al* (2000) and Mohamed *et al* (2000).

II- Plant population density effect:

The results in Table 2 show the plant population density had a significant effect on all studied characters in the both seasons. Plant population density of 16.7 plants/ m² gave highest values of number of branches and pods/plant, seed yield/plant and 100-seed weight, while plant height, first earing pods height and seed yield/fed were lower than the other density (D₁ or D₂). Meantime, increasing plant population density of 33.3 plants/ m² to 50 plants/ m² caused a significant increase in plant height, first earing pods/plant and seed yield/fed, while yield components, i.e number of branches and pods per plant, seed yield per plant and 100-seed weight were decreased. The maximum seed yield/fed was obtained by increasing plant population density to 50 plants/m² which amounted to 71 % and 10 % in the first season and 65 % and 8 % in second season over those obtained by density of 16.7 and 33.3 plants/m² respectively. However, seed yield/plant

was lower than those obtained with 16.7 and 33.3 plants/m² by 72 % and 20 % in the first season as well as 29 % and 15% in second season, respectively. Higher plant density of 50 plants/m² produced the lower values in yield components and tallest plants, this could be due to the competition occurring among plants in dense population for light and the other resources. These results are in agreement with those reported by Ali (1983), Dawelber (1988), Abo-Shetaia (1990), Abdrabou (1991), Metwally *et al* (2000) and Mohamed (2000). They reported that seed yield/fed was increased by increased of plant density, while yield components were decreased. Heaviest 100-seed weight was obtained when using lower density.

III- Interaction effect between plant population density and cultivars:

The effect of the interaction between plant population density and cultivars significantly affected plant height, number of branches per plant and seed yield/plant are presented in Table 3. Plant height significantly increased at higher plant population of 50 plants/m² with sown Giza 674 cultivars compared with other treatments in both seasons. Number of branches/plant and seed yield/plant were decreased as plant population density increased sown both cultivars. Sown Giza 674 cultivars at 16.7 plants/m² produced the highest number of branches/plant and seed yield/plant followed by Giza 674 when sown at 33.3 plants/m². The lowest values were resulted with Giza 3 cultivar at plant density of 50 plants/m². Meantime, seed yield/plant decreased with increasing plant populations. Decreasing percentage for seed yield/plant of Giza 674 was high with increasing plant populations from 16.7 plants/m² to 50 plants/m² compared with other treatments. These results are in agreement with those reported by Ali (1983), Abdel-Aziz and Shalaby (1999), Metwally *et al* (2000) and Mohamed (2000).

Table 1: Means of yield, yield components as affected by faba bean cultivars during 1999/2000 and 2000/2001 seasons.

Varieties	Plant height (cm)	First earing pods height (cm)	100-seed weight (g)	Number of branches/plant	Number of pods/plant	Seed yield per	
						Plant (g)	Feddan (Ardab)
First season 1999/2000							
Giza 674	155.9	57.7	58.6	4.3	19.8	20.9	8.7
Giza 3	137.7	50.8	61.0	3.3	17.8	17.7	8.0
F test	**	*	*	NS	NS	**	NS
Second season 2000/2001							
Giza 674	160.3	58.9	59.6	4.4	21.7	22.6	8.9
Giza 3	140.6	52.4	61.9	3.5	18.2	19.3	8.3
F test	**	**	*	NS	NS	**	NS

Table 2: Means of yield, yield components as affected by plant population density during 1999/2000 and 2000/2001 seasons.

Plant density/fed.	Plant height (cm)	First earing pods height (cm)	100-seed weight (g)	Number of branches/plant	Number of pods/plant	Seed yield per Plant (g)	Feddan (Ardeb)
First season 1999/2000							
16.7 plants/m ²	146.8	49.5	61.4	4.3	21.2	22.8	6.0
33.3 plants/m ²	145.3	53.9	60.9	3.8	19.5	19.6	9.4
50 plants/m ²	148.4	59.4	57.2	3.3	15.7	15.7	10.3
LSD 0.05	1.4	1.6	0.9	0.1	0.9	0.8	0.1
Second season 2000/2001							
16.7 plants/m ²	151.4	50.8	62.4	4.4	22.7	24.4	6.4
33.3 plants/m ²	148.4	55.2	61.8	4.0	20.8	20.3	9.7
50 plants/m ²	151.7	60.9	58.1	3.4	16.3	17.4	10.5
LSD 0.05	1.4	1.7	0.5	0.2	1.3	0.5	0.1

Table 3: Effect of interaction between plant densities and cultivars on plant height, number of branches/plant and seed yield/plant during 1999/2000 and 2000/2001 seasons.

varieties	Plant densities	Plant height (cm)	Number of branches/plant	Seed yield per Plant (g)
First season 1999/2000				
Giza 674	16.7 plants/m ²	155.7	4.9	25.2
	33.3 plants/m ²	153.4	4.3	21.3
	50 plants/m ²	158.3	3.6	16.2
Giza 3	16.7 plants/m ²	137.8	3.8	20.3
	33.3 plants/m ²	136.8	3.3	17.6
	50 plants/m ²	138.5	3.0	15.2
LSD 0.05		NS	0.2	1.1
Second season 2000/2001				
Giza 674	16.7 plants/m ²	161.3	4.9	26.6
	33.3 plants/m ²	157.9	4.4	22.8
	50 plants/m ²	162.0	3.7	18.4
Giza 3	16.7 plants/m ²	141.6	3.8	22.3
	33.3 plants/m ²	139.0	3.6	19.0
	50 plants/m ²	141.3	3.1	16.5
LSD 0.05		2.0	NS	0.7

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تأثير الكثافة النباتية على المحصول ومكوناته لبعض أصناف من الفول البلدى

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قسم بحوث التكايف المحصولى-معهد بحوث المحاصيل الحقلية-مركز البحوث الزراعية

أقيمت تجربتان حقليتان بمحطة البحوث الزراعية-شندويل محافظة سوهاج خلال موسمى ٢٠٠٠/١٩٩٩ ، ٢٠٠١/٢٠٠٠ حيث يهدف البحث إلى دراسة تأثير ثلاثة معدلات من الكثافة النباتية (١٦,٧ ، ٣٣,٣ ، ٥٠ نبات/م^٢) على المحصول ومكوناته لصنفين من الفول البلدى (جيزة ٣، جيزة ٦٧٤) وتم تنفيذ التجارب فى تصميم القطع المنشقة مرة واحدة، وفيما يلى ملخص لأهم النتائج المتحصل عليها:

١- أوضحت النتائج أن الصنف جيزة ٣ أعطى قيم أعلى فى وزن المائة بذرة بينما سجل الصنف جيزة ٦٧٤ أعلى معدل فى صفات عدد الفروع والقرون بالنبات ومحصول البذور للنبات والقدان.

٢- أشارت النتائج إلى أن الكثافة النباتية ١٦,٧ نبات/م^٢ أعطت أعلى قيم فى صفات عدد الفروع والقرون بالنبات، وزن المائة بذرة ومحصول النبات. بينما أعطت الكثافة ٣٣,٣ نبات/م^٢ أعلى زيادة فى ارتفاع أول قرن ثمرى ولكن الكثافة ٥٠ نبات/م^٢ سجلت أعلى زيادة معنوية فى محصول البذور للقدان. لقد أدت زيادة معدل الكثافة النباتية من ١٦,٧ نبات/م^٢ إلى ٥٠ نبات/م^٢ إلى نقص فى صفات عدد الفروع والقرون بالنبات-وزن ١٠٠ بذرة - ومحصول البذور للنبات.

٣- لقد سجل التفاعل بين الأصناف والكثافة النباتية تأثيرا معنويا على صفات طول النبات ، عدد الفروع بالنبات ومحصول البذور بالنبات.

يمكن التوصية بزراعة الصنف جيزة ٦٧٤ بالكثافة النباتية ٥٠ نبات/م^٢ وذلك للحصول على أعلى إنتاجية لمحصول البذور فى الفول البلدى وذلك تحت ظروف الزراعة فى محافظة سوهاج.