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EFFECT OF SOWING DATE AND PLANT DENSITY ON GROWTH AND PRODUCTIVITY OF TWO FABA BEAN (*Vicia faba*, L.) CULTIVARS

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ABSTRACT

Two field trials were conducted at the Agric. Exp. Sta., Fac. Agric., Cairo University, in 2003/2004 and 2004/2005 growing seasons. The objective was studying the response of two faba bean cultivars (Giza 843 and Cairo 375) to three plant densities (22, 33 and 44 plants/m^2) under three sowing dates (October 15th, November 5th and November, 25th) .The most important results could be summarized as follows:

Seed yield /faddan, seeds/plant, number of pods and harvest index of 5 November sowing were significantly higher than those of 15 October or 25 November sowing dates. However, branches/plant (no.), plant dry weight and biological yields of early sowing (15 October), were significantly the highest.

Yields of faba bean/fad and harvest index had significantly increased with increasing plant density to 44 plants /m^2, but the other individual plant characters tended to decrease with the increase of plant density.

Cairo 375 cultivar significantly surpassed Giza 843 in seed and biological yields /faddan, harvest index and number of pods and seeds/plant but the former had lighter seed index and plant dry weight than the later.

Significant varietals responses to sowing date and plant density had detected. The maximum seed yield (2 ton / fad.) could achieve by sowing Cairo 375 cultivar on 5 November with a plant density of 44 plants /m^2.

INTRODUCTION

In Egypt, faba bean (*Vicia faba* L.) is one of the most important pulse crops, it is the main staple food and perhaps the main source of protein for people. During the last two decades, the faba bean cultivated has been drashically decreased. Therefore, the total national production is far beyond the evergrowing consumption. Attempts should be devoted to maximise the productivity of faba bean per unit area.

Sowing date is one of the important factors which affects productivity through govering the timing and duration of the vegetative and reproductive stages, since, environmental factors such as temperature and light duration differ with varying sowing date. Individual elements such as light and temperature have direct effects on physiological processes such as photosynthesis and respiration. So, it is very important to determinate the ptimum date of sowing for faba bean that achieve the optimum limits for these factors in order to get the best yields. Amer *et al.*(1992) indicated that the highest seed yield per plant, 100-seed weight, number of branches, number of pods and number of seeds per plant were recorded in early sowing date (Nov.,1st),whereas, delaying sowing date beyond Nov., 30th significantly decreased those yield components. Abou Taleb (2002) indicated that plant dry weight and number of branches/plant significantly reduced as sowing date delayed. Abuldahab *et al.*(2002) reported that number of days to

emergence and to flowering increased as sowing date was delayed to 10 December. On the other hand, flowering and maturiety were earieler with delaying sowing to 10 December. The highest number of pods/m², seed index, seed yield/plant as well as biological and seed yield/ faddan resulted from 10 November sowing. Nassif (2002) concluded that environmental conditions (air, soil temperature and relative humidity) significantly affected flowering ,branching and seed index of faba bean stocks. The lower temperatures dominating during the second season led to longer periods to flowering. But, the yield and yield components were better under such conditions than those under the first season.

Inter-plant competition for environmental resources, degree of weed infestation and diseases infection are influenced by number of plants per unit area. EL-Metwally (1989) reported that with decreasing the distance either between or within rows resulted in a significant increase in seed yield per hectar. The highest seed yield/ha was obtained from planting 67 or 44 plants/m^2. Rady and Rizk (1990) indicated that number of days (ND) required by all phenological stages was increased significantly with decreasing number of plants /hill except, ND to 50 % flowering in second season. Zeidan *et al.*(١٩٩٠) reported that the highest plant density (44 plants/m²) gave significant increase in seed yield /faddan of faba bean as compared with 29 and 22 plants/m². Ghonema and Salama (1991) indicated that leaving one plant per hill spaced at 10 cm apart or two plants per hill spaced at 20cm apart on the two sides of ridge, yielded the highest seed yield through increasing 100-seed weight, number of branches and pods per plant. Shams EL-Din (1991) reported that yield components of faba bean were significantly decreased as plant density was increased from 33 to 133 plants/m². On the other hand seed, straw and biological yields per faddan were significantly increased by increasing plant population up to 133 plants/m². El-Douby *et al.* (١٩٩٦) reported that yield of faba bean was increased with increasing plant density from 27 to 44 plants/m. Ashmawy *et al.* (1998) indicated that increasing plant density up to 50 plants/m² decreased seed yield/plant, number of branches and pods/plant and 100-seed weight.

The possibility of increasing productivity of faba bean yield could be achieved by planting 33 or 50 plants/ m². Abdel -Aziz and Shalaby(1999) indicated that plant population of 33 plants/m² gave significant increase in seed yield and harvest index of faba bean as compared with the lower densities (22 and 27 plants/m²). Bakheit *et al.* (2001) reported that growing 33 plants/m² gave significant increase in seed yield as compared with 22 and 66 plants/m². El-Murshedy *et al.*(2002) indicated that increasing plant density of faba bean to 33 plants /m^2 increased seed yield/faddan. El-Metwally *et al.* (2003) indicated that seed yield per unit area significantly increased with increasing plant density up to 40 plants/m². The greatest biological yield was recorded for plant densities over 33 plants/m². The highest values of harvest index were obtained from planting 27 and 40 plants /m².

The Egyptian faba bean cultivars differ in growth and yield characters (Rady and Rizk,1990; EL-Batal and Abdel Gawad,1991; Ashmawy *et al.*,1998; Abdel Aziz and Shalaby,1999; Hussein *et* al ,1999; Abou-Taleb, 2002; Nassif,2002 and El-Metwally *et al.*,2003

MATERIALS AND METHODS

Three field trials (one for each date of sowing) were conducted at the Agric. Exp. station, fac. Agric., Cairo univ., Giza, during each of 2003/2004 and 2004/2005 seasons to study the response of two faba bean cultivars to three plant densities under three planting dates (15 October, 5 November and 25 November). The two studied faba bean cultivars were Giza 843 and Cairo 375 (Agron. Dep., Fac. Agric., Cairo Univ). Soil type was clay loam in texture. Super phosphate fertilizer was added after seedbed preparation at a rate of 15.5 kg $P_2 O_5$ per faddan (4200 m²). Ridging was done at a fixed spacing of 60cm apart. Irrigation was scheduled at 25 days interval up to ne month before harvest. Seeds were seeded in three plant densities on both sides of the ridge as follow:

1. Seeding one sound seed per hill spaced at 15 cm apart (22 plants/m²).
2. Seeding two sound seeds per hill spaced at 20 cm apart (33 plants/m²).
3. Seeding two sound seeds per hill spaced at 15 cm apart (44 plants/m²).

The used experimental design was split plots with four replications.The main plots were allocated to the two faba bean cultivars (Giza 843 and Cairo 375). The three plant densities were assigned to the sub plots. Each plot consists of 5 ridges with 4 meters long (12 m²)

Phenological stages event in terms of number of days to each stage takes were recourded as follows:

1. Days from sowing to 50% of seedlings emergence.
2. Days from emergence to flowering (first flower).
3. Days from flowering to maturity.
4. Days from sowing to maturity.

At harvest, ten plants were randomly taken from the central three ridges to determine number of branches, pods and seeds/plant, plant dry weight, seed yield/plant. Seed and biological yields as will as ١٠٠-Seed weight were determined from the central three ridges of each plot (7.2 m²) and then converted to ton/faddan (4200 m²). Harvest index (ratio of seed yield to biological yield at harvest without dropped leaves) was calculated. The obtained data of each sowing date and season were statistically analyzed according to Gomez and Gomez(1984). Bartlet test of variance homogeneity was carried out before the combined analysis. Means were compared using L.S.D. at 0.05 % level of probability.

RESULS AND DISCUSSION

1. Seasonal variation

All phenological stages were significantly different through the two growing seasons. Both of Giza 843 and Cairo 375 faba bean plants needed more days to reach all phenological stages in 2004/2005 than 2003/2004 season, except, the stage from emergence to first flower. The highest averages of yields and their attributes except, 100-seed weight were recorded in the second season (Table 1). The seasonal variation in phenological stages of faba bean was also reported by Rady and Rizk (1990) and Nassif (2002).

Table 1: Phenological stages, yields and their attributes of faba bean as affected by growing seasons (combined data over the studied factors.)

Studied traits	Seasons		Sign.
	2003/2004	2004/2005	
Days from sowing to emergence	10.0	10.9	*
Days from emergence to flowering	37.1	35.6	**
Days from flowering to maturity	103.7	110.0	**
Days from sowing to maturity	150.8	156.5	**
Branches /plant (no)	2.45	2.42	NS
Plant dry weight (gm)	23.94	24.49	NS
Pods /plant (no)	9.70	12.30	**
Seeds /plant (no)	26.20	35.80	**
100-seed weight (gm)	79.01	76.88	*
Seeds /plant (gm)	23.13	26.19	**
Seed yield/fad. (ton)	1.04	1.20	**
Biological yield/fad (ton)	4.77	4.95	*
Harvest index (%)	21.56	23.80	**

*, ** and ns: significant, highly significant and not significant, respectively

2. Effect of sowing date

As shown in Table 2 , each delay of sowing was followed by a significant increase in days from sowing to emergence and from emergence to flowering. On the other hand, days from sflowering to maturity and hence days from sowing to maturity were drastically decreased with delaying sowing to 25 November. Early sowing (15 October) recoded the highest number of branches /plant and the heaviest plant dry weight as well. However, the highest number of pods / plant and hence the highest number of seeds and weight of seeds / plant were recorded by the 5 November planting , irrespective of its lightest 100 – seed weight. Therefore, the highest biological yield and seed yield/ fad were recorded by this date of sowing where the highest harvest index was achieved. These results clearly indicate that though the early sown faba bean plant had the shortest period to reach flowering, they could maximize their branching and hence their dry weight. This improved growth was on the expense of fruit set as well as seed set where they had lower number of pods/plant with lower number of seeds/pod compared with the medium sowing date plants (Nov., 5th) which recoded the highest averages in these respects.

The results further indicate that the increase in number of seeds/ plant was on the expense of seed filing where the lightest seed index was recorded by this date of sowing. Furthermore, the highest seed yield/fad and per plant were recorded by the medium sowing date where the lowest ones were recorded by the latest date of sowing (25 November) due to a significant decrease in all seed yield atributes. The drastic decrease of harvest index which hardly reached 19% of the early) and late sown plants compared with that recorded (30.68%) by the medium sown ones, clearly indicate that these plants maintained a good balance between the source and the sink. The number of days from flowering to maturing was too long (126.2 days) by the

early sown plants and, on the other hand, was too short (86.6 days) by the late sown one compared with this number (107.7 days) in the medium sown one. Therefore, the date of sowing governed the phenological stages of faba bean plants and hence their yielding capacity which was of in favour of the medium date of sowing. Similar results were obtained by Rady and Rizk (1990), Bakheit *et al.*(2001) and Abuldahab *et al.*(2002).

Table 2: Phenological stages, yields and their attributes of faba bean as affected by sowing date (combined analysis for the two growing seasons.)

Studied traits	Sowing dates		
	15 October	5 November	25 November
Days from sowing to emergence	8.5 c	9.8 b	13.0 a
Days from emergence to flowering	31.4 c	37.2 b	40.5 a
Days from flowering to maturity	126.2 a	107.7 b	86.6 c
Days from sowing to maturity	166.1 a	154.8 b	140.1 c
Branches /plant (no)	3.05 a	2.64 b	1.62 c
Plant dry weight (gm)	41.40 a	20.16 b	11.09 c
Pods /plant (no)	11.5 b	15.5 a	6.0 c
Seeds /plant (no)	31.7 b	46.0 a	15.2 c
100-seed weight (gm)	83.57 a	70.56 c	79.71 b
Seeds /plant (gm)	26.30 b	33.17 a	13.90 c
Seed yield/fad. (ton)	1.16 b	1.55 a	0.66 c
Biological yield/fad (ton)	6.19 a	4.97 b	3.42 c
Harvest index (%)	18.66 b	30.68 a	18.83 b

Means designated with the same letter in the same row aren't significantly different at 0.05 level of probability.

3. Effect of plant density

Plant densities had significant effects on days to all phenological stages, except, days from sowing to emergence. Increasing plant population density to 44 plants/m² decreased days from emergence to flowering and days from flowering to maturity. Days from sowing to maturity significantly were increased with decreasing plant density to 22 plants/m². These results are in harmony with those obtained by Rady and Rizk (1990), El Batal and Abdel Gawad (1991) and Abuldahab *et al.* (2002) .

Plant density had significant effect on yield of faba bean and its attributes. At harvest, number of branches per plant, plant dry weight, number of pods and seeds per plant, 100-seed weight and seed yield/plant were markedly depressed with increasing plant density up to 44 plants/m². On the other hand, seed yield per faddan was significantly increased with increasing plant density to 44 plants /m² (1.37 ton) as compared with 33 and 22 plants/m² (1.20 and 0.79 ton, respectively). Also raising plant density to 44 plants/m² resulted in highly significant increase in biological yield/faddan as compared with 22 and 33 plants/m².The maximum harvest index could be achieved with planting 33 or 44 plants/m² (24.42% and 24.57 %, respectively). These results clearly indicate that the increase of planting

density could over compensate for the decrease of individual plant yield attributes.

The over all picture of this study indicates that maximum seed yield could be achieved by planting 44 plants/m² followed by 33 plants/m². These results are in the same line with those of EL-Metwally(1989), Abo- Shetaia (1990), Shams EL-Din (1991), Metwally (1997), Ashmawy *et al.* (1998), Abdel Aziz and Shalaby (1999), Bakheit *et al.* (2001) and El-Metwally *et al.*(2003).

Table 3. Phenological stages,yields and their attributes of faba bean as affected by plant density (combined analysis for the two growing seasons.)

Studied traits	Plant densities		
	22 plants/m²	33 plants/m²	44 plants/m²
Days from sowing to emergence	10.4 a	10.5 a	10.4 a
Days from emergence to flowering	37.6 a	36.3 b	35.5 c
Days from flowering to maturity	107.4 a	106.6 b	106.6 b
Days from sowing to maturity	155.4 a	153.2 b	152.5 c
Branches /plant (no)	2.91 a	2.34 b	2.06 c
Plant dry weight (gm)	28.40 a	24.01 b	20.24 c
Pods /plant (no)	13.1 a	10.8 b	9.2 c
Seeds /plant (no)	38.6 a	29.5 b	24.9 c
100-seed weight (gm)	80.83 a	77.89 b	75.12 c
Seeds /plant (gm)	30.37 a	23.98 b	19.62 c
Seed yield/fad. (ton)	0.79 c	1.20 b	1.37 a
Biological yield/fad (ton)	4.06 c	4.88 b	5.63 a
Harvest index (%)	19.18 b	24.42 a	24.57 a

Means designated with the same letter in the same row aren't significantly different at 0.05 level of probability.

4. Cultivar differences

There was no significant difference between Cairo 375 and Giza 843 cultivars in days from sowing to emergence. Cairo 375 flowered earlier than Giza 843 cultivar but took more days from flowering to maturity and hence from sowing to maturity. Darwish and Abdalla (1994) reported that Cairo 375 cultivar is characterized by profuse and extended flowering period.

Cairo 375 genotype significantly surpassed Giza 843 cultivar in number of pods and seeds/plant, seed and biological yield/faddan and harvest index. While, Giza 843 significantly surpassed Cairo 375 in plant dry weight and 100-seed weight. The differences between the two cultivars in number of branches/plant and seed yield/plant didn't reach the level of significance. Darwish and Abdalla (1994) reported that Cairo 375 cultivar is a highly yielding cultivar. El-Metwally *et al.*(2003) reported that although Cairo 375 surpassed Giza 2 in number of pods and seeds/plant, they statisticaly did not vary in seed indx or seed yield/faddan. Significance varietal differences were also reported by Bakheit *et al* .(2001), Abou Taleb (2002) and Nassif (2002).

Table 4: Phenological stages, yields and their attributes of the two faba bean cultivars (combined analysis for the two growing seasons.)

Studied traits	Cultivars		Sign.
	Giza 843	Cairo 375	
Days from sowing to emergence	10.4	10.4	NS
Days from emergence to flowering	36.6	35.9	*
Days from flowering to maturity	106.3	108.4	**
Days from sowing to maturity	153.3	154.7	**
Branches /plant (no)	2.43	2.44	NS
Plant dry weight (gm)	24.8	23.6	*
Pods /plant (no)	10.6	11.4	**
Seeds /plant (no)	29.9	32.1	**
100-seed weight (gm)	83.34	72.56	**
Seeds /plant (gm)	24.93	24.39	NS
Seed yield/fad. (ton)	1.08	1.16	**
Biological yield/fad (ton)	4.82	4.90	*
Harvest index (%)	22.9	23.35	**

*, ** and NS: significant, highly significant and non-significant, respectively.

5. Effect of interactions

5.1. Effect of sowing dates × plant densities interaction

As shown in table 5, plants sown with higher plant densities at all sowing dates reached flowering in fewer number of days. Early dense sown plants (15 Octber × 44 plants /m^2) were the earliest compared with light late sown ones (25 November × 22 plants/m^2).

Delaying sowing date to 25 November with all plant populations considerably hastened the maturity of faba bean plants. The longest period from sowing to maturity was recorded with sowing 22 plants/m^2 on 15October, but the shortest period was recorded with sowing 44 plants/m^2 on 25 November (Table,5).

The sowing dates × plant densities interaction significantly affected also yields and their attributes except 100-seed weight. The highest number of branches and plant dry weight were obtained from sowing 22 plants/m^2 on 15 October. The highest number of pods and seeds/plant and seed yield/plant were obtained from sowing 22 plants/m^2 on 5 November. However, the highest seed yield/faddan (1.93 ton) was obtained from sowing on 5 November with a plant density of 44 plants/m^2. However plants sown on 25 November with a plant density of 22 plants/m^2 gave the lowest seed yield/faddan. The highest biological yields/faddan (7.04 tons) was obtained from sowing 44 plants/m^2 on 15 October. However, the lowest biological yield was recorded from sowing 22 plants/m^2 on 25 November. The highest value of harvest index was obtained from sowing 44 or 33 plants/m^2 on 5 November. However the lowest harvest index was recorded with planting 22 plants/m^2 on 25 November (Table, 5). This interaction indicates that dense sown plants forced to commit early flowering particularly when they early sown on 15 October probably due to lese branching than light sown ones and late sown ones on 25 November. This reflected on almost the entire seed

yield attributes on individual plant basis. However, the increase of planting density could compensate for this low yield attributes where the highest seed yield/ fad and harvest index recorded by dense sowing and planting on 5 November.

Table 5: Yields and their attributes of faba bean as affected by sowing dates and plant densities interaction (combined analysis for the two growing seasons).

Sowing dates	Plants/ m^2 (no)	Branch./ plant (no.)	Plant dry (gm)	Pods/ plant (no.)	Seeds/ plant (no.)	Seeds/ plant (gm.)	Seed Yield/ fad. (ton)	Biolog. Yield/ fad. (ton)	Harvest index (%)
Oct. 15	22	3.67 a	48.3 a	13.8 c	39.4 c	33.2b	0.88 e	5.29 d	16.8 h
	33	2.98 c	41.1 b	11.0 e	30.1 e	25.0c	1.30 c	6.24 b	20.86 e
	44	2.51 d	34.8 c	09.7 f	25.6 f	20.8d	1.29 c	7.04 a	18.28 g
Nov. 5	22	3.24 b	23.7 d	18.2 a	57.1 a	41.6 a	1.09 d	4.17 f	26.05 c
	33	2.41 d	19.5 e	15.2 b	44.0 b	33.2b	1.62 b	5.00 e	32.31 b
	44	2.27 e	17.2 f	13.1 d	36.9 d	26.5c	1.93 a	5.74 c	33.68 a
Nov. 25	22	1.82 f	13.2 g	7.2 g	19.3 g	16.3e	0.40 g	2.72 h	14.66 l
	33	1.64 g	11.4 h	6.1 h	14.4 h	13.8 f	0.68 f	3.41 g	20.08 f
	44	1.39 h	8.7 l	4.7 l	12.1 l	11.6g	0.90 e	4.12 f	21.74 d

Means designated with the same letter in the same column aren't significantly different at 0.05 level of probability.

5.2. Effect of sowing dates × cultivars interaction

Plants of Cairo375 genotype sown on 15 October were the earliest in flowering, however, Giza 843 plants sown on 25 November were the latest in flowering. The period from sowing to maturity of Giza 843 and Cairo 375 were significantly at par. The shorter period to maturity was that of Giza 843 sown on 25 November (Table 6).

Sowing dates × cultivars interaction exerted a highly significant influence on plant dry weight, number of pods /plant, number of seeds /plant, 100-seed weight, seed yield/plant, seed yield/faddan and biological yield/faddan (Table 6).

Table 6: Yields and their attributes of faba bean as affected by sowing dates and cultivars interaction (combined analysis for the two growing seasons).

Sowing dates	Cultivars	Plant dry (gm.)	Pods/ plant (no.)	Seeds/ plant (no.)	100-Seed (gm.)	Seeds/ plant (gm.)	Seed yield (t/fad.)	Biologic. yield (t/fad.)
15 Oct.	Giza 843	43.73 a	11.9 c	32.3 c	88.4 a	29.4 c	1.15 c	6.25 a
	Cairo 375	39.06 b	11.5 d	30.2 d	78.7 b	23.2 d	1.17 c	6.12 b
5 Nov.	Giza 843	19.89 c	14.6 b	42.7 b	74.2 c	32.9 b	1.48 b	4.86 d
	Cairo 375	20.43 c	16.4 a	49.3 a	66.9 d	34.6 a	1.61 a	5.07 c
25 Nov.	Giza 843	10.75 e	5.5 f	13.6 f	87.4 a	12.5 f	0.62 e	3.33 f
	Cairo 375	11.44 d	6.6 e	16.9 e	72.0 c	15.3 f	0.70 d	3.51 e

Means designated with the same letter in the same column aren't significantly different at 0.05 level of probability.

The highest number of pods/plant, number of seeds/plant, seed yield/plant and seed yield/faddan were obtained from sowing Cairo 375 on 5 November.While the lowest values of these traits appeared with sowing on 25 November. The highest plant dry weight, 100-seed weight and biological yield/faddan were obtained from Giza 843 cultivar sown on 15 October. However, averages of these traits reduced with sowing Cairo 375 cultivar on 25 November (Table 6).

5.3. Effect of cultivars × plant densities interaction

Plant densities × cultivars interaction didn't significantly influence most phenological stages, except, days from sowing to maturity. The longest period from sowing to maturity was that of Cairo 375 cultivar followed by that of Giza 843 with 22 plants/m² (Table 7).

Most studied traits of yields and their attributes didn't show significance response to the interaction between cultivars and plant densities, except, seed yield/plant, seed yield/faddan and harvest index. The highest seed yield/faddan was obtained from Cairo 375 or Giza 843 cultivars when sown with 44 plants/m². The maximum seed yield/plant (31.73 gm) was obtained from Giza 843 when sown with 22 plants/m². However, the plants of Cairo 375 cultivar when sown with 44 plants/m² yielded the lowest yield/plant. The highest harvest index was recorded from sowing Cairo 375 with 33 plants/m² (Table 7).

The following response equation was calculated from the seed yield / fed of the two cultivars at the these planting densities

Ý Cairo 375 = 0.83 + 0.58 x - 0.15 x^2

Ý Giza 843 = 0.78 + 0.31

The response equations of seed yield/fed to the increase of planting density was liner in Giza 843 but quadratic in Cairo 375, indicating non-diminishing increases in the former, but diminishing increase in the latter. In other words, Giza 843 needed for denser planting than 44 plants / m^2 in order to maximize its seed yield/fad. However, this density was quite enough to maximize the seed yield of Cairo 375.

Table 7: Some studied traits as affected by the interaction between faba bean cultivars and plant densities (combined analysis for the two growing seasons.)

Cultivars	Plant density (pl/m²)	Studied traits			
		Days from sowing to maturity	Seeds/ plant (gm)	Seed yield/ fad (ton)	Harvest index (%)
Giza 843	22	154.8 b	31.7 a	0.75 e	18.42 e
	33	153.0 cd	23.6 c	1.14 c	23.44 c
	44	152.3 e	19.5 d	1.36 a	24.41 b
Cairo 375	22	156.0 a	29.0 b	0.83 d	19.94 d
	33	153.3 c	24.4 c	1.26 b	25.39 a
	44	152.7 de	19.8 d	1.39 a	24.72 b

Means designated with the same letter in the same column aren't significantly different at 0.05 level of probability.

5.4. Effect of planting dates × cultivars × plant densities interaction

All studied phenological stages were not significantly influenced by sowing dates, cultivars and plant densities interaction . However this interaction exerted a significant influence on plant dry weight, number of seeds per plant, seed yield/plant, seed yield/faddan, biological yield/faddan and harvest index. The highest biological yield/faddan was obtained from sowing Giza 843 cultivar on 15 October with 44 plants/m², however, the highest plant dry weight was recorded from this cultivar on 15 October but with 22 plants/m². The highest number of seeds/plant and seed yield/plant were obtained from sowing Giza 843 or Cairo 375 cultivar on 5 November with 22 plants /m². The highest seed yield/faddan and harvest index were recorded from sowing Cairo 375 cultivar on 5 November with 44 plants/m² (Table 8).

The over all picture of this study indicates that maximum seed yield/faddan could be achieved by sowing Cairo 375 genotype on 5 November with 44 plants /m² .

Table 8. Yields and their attributes of faba bean as affected by sowing dates, cultivars and plant densities interactions(combined analysis for the two growing seasons).

Sowing date	Cultivars	Plant density (pl/m²)	Plant dry weigh (gm.)	Seeds/ plant (no.)	Seeds/ plant (gm.)	Seed yield (t/fad.)	Biolog. yield (t/fad.)	Harvest index (%)
		22	49.59 a	41.4 d	38.8 b	0.86 j	5.27 g	16.5 kl
	Giza 843	33	44.27 c	31.2 h	26.4 e	1.24 f	6.36 c	19.4 l
15 Oct.		44	37.33 d	27.1 l	22.8 g	1.34 e	7.12 a	18.8 l
		22	47.01 b	37.4 f	27.5 e	0.91 ij	5.30 g	17.16 jk
	Cairo 375	33	37.97 d	29.0 l	23.5 fg	1.37 e	6.12 d	22.3 f
		44	32.20 e	24.1 j	18.7 h	1.23 f	6.95 b	17.7 j
		22	24.08 f	52.7 b	41.9 a	1.04 h	4.09 k	25.2 e
	Giza 843	33	18.64 h	40.3 de	31.3 d	1.53 d	4.84 l	31.7 c
5 Nov.		44	16.94 l	35.1 g	25.6 ef	1.87 b	5.66 f	33.0 b
		22	23.33 f	61.6 a	41.4 a	1.14 g	4.24 j	26.9 d
	Cairo 375	33	20.42 g	47.7 c	35.0 c	1.70 c	5.15 h	33.0 b
		44	17.53hi	38.8 ef	27.5 e	2.00 a	5.81 e	34.3 a
		22	13.28 j	17.6 l	14.5 l	0.36 n	2.62 o	13.5 m
	Giza 843	33	10.46 k	13.1 n	12.9 l	0.64 l	3.34 m	19.3 l
25Nov.		44	8.50 l	10.1 o	10.1 j	0.86 j	4.04 k	21.4 gh
		22	13.10 j	21.0 k	18.2 h	0.45 m	2.83 n	15.8 l
	Cairo 375	33	12.28 j	15.6lm	14.7 l	0.73 k	3.47 l	20.9 h
		44	8.94 l	14.1mn	13.1 l	0.93 l	4.21 j	22.1 fg

Means designated with the same letter in the same column aren't significantly different at 0.05 level of probability

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تأثير مواعيد الزراعة والكثافات النباتية على نمو وانتاجية صنفين من الفول البلدى

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أجريت تجربتان حقليتان في محطة التجارب الزراعية بكلية الزراعة - جامعة القاهرة - الجيزة- خلال موسمي ٢٠٠٣/٢٠٠٤ ، ٢٠٠٤/٢٠٠٥ . وذلك بهدف دراسة تأثير ميعاد الزراعة (١٥ أكتوبر، ٥ نوفمبر، ٢٥ نوفمبر) والكثافة النباتية (٢٢، ٤٤، ٣٣ نبات/ م^2) على نمو ومحصول صنفين من الفول البلدي(جيزة ٨٤٣ ، قاهرة ٣٧٥ ة). التصميم التجريبي المستخدم هو القطع المنشقة مرة واحدة في أربع مكررات كاملة العشوائية حيث مثلت الأصناف القطع الرئيسية والكثافات النباتية القطع الشقية وتم زراعة التجربة فى ثلاث مواعيد للزراعة.

وفيما يلى ملخص لأهم النتائج

أولا: تأثير موسم النمو

أظهر موسم النمو تاثيرات معنوية لكل المراحل الفينولوجية المدروسة ، بشكل عام أخذت النباتات للوصول لهذه المراحل عدد ايام اكثر في الموسم الثاني عنه في الموسم الأول، ماعدا المرحلة من الانبات حتى ظهور اول زهرة. اما باقي الصفات لم تختلف معنويا من موسم لأخر. تفوق عدد القرون والبذور/النبات، وزن١٠٠بذرة، وزن البذور/النبات، محصول البذور والمحصول البيولوجي/فدان ودليل الحصاد ماعدا وزن ١٠٠ بذرة فى الموسم الثاني على الموسم الأول.

ثانيا: تأثير موعد الزراعة

أدت الزراعة المبكرة (١٥أكتوبر) أو الزراعة المتأخرة (٢٥ نوفمبر)الى نقص معنوي فى عدد الأيام الازمة للوصول للمراحل الفينولوجية مقارنة بالزراعة فى ٥ نوفمبر. تفوقت الزراعة فى ١٥ أكتوبر على الموعدين ٥ نوفمبر، ٢٥ نوفمبر في صفات عدد الفروع على النبات، الوزن الجاف للنبات عند الحصاد، وزن ١٠٠بذرة، والمحصول البيولوجي (طن/فدان).

تفوق الموعد ٥ نوفمبر على الموعدين ١٥ أكتوبر، ٢٥ نوفمبر في صفات عدد القرون/النبات، عدد البذور/النبات، وزن البذور/ النبات، محصول الفدان من البذور (طن) ودليل الحصاد.

ثالثا: تأثير الكثافة النباتية

زيادة الكثافة النباتية إلى ٤٤ نبات /م^{2} أنقصت بشكل معنوي عدد الأيام اللازمة من الإنبات حتى ظهور أول زهرة ، عدد الأيام من ظهور أول زهرة حتى النضج وعدد الأيام من الزراعة للنضج.

أيضا أشارت النتائج إلى أن عدد الفروع / النبات، الوزن الجاف للنبات عند الحصاد، عدد القرون والبذور / النبات، وزن ١٠٠ بذرة ووزن البذور / النبات قد انخفض بشكل معنوي مع زيادة الكثافة النباتية إلى ٤٤ نبات/م^{2}.

بالنسبة لمحصول البذور والمحصول البيولوجي من الفدان، فقد ازدادت مع زيادة عدد النبات في وحدة المساحة إلى ٤٤ نبات/ م^{2} (١,٣٧ طن/فدان) مقارنة بالكثافتين ٣٣ ، ٢٢ نبات /م٢ (١,٢٠ ، ٠,٧٩ طن /فدان على التوالي). أعلى قيمة لدليل الحصاد كانت في الكثافتين ٣٣ و ٤٤ نبات/م^{2} (٢٤,٤٢% و٢٤,٥٧ %)، على التوالي. مقارنة بالكثافة ٢٢ نبات /م^{2} (١٩، ١٨ %).

يمكن ان نستخلص من هذه الدراسة أن أعلى محصول من البذور يمكن الحصول عليه بزراعة ٤٤ نبات /م^{2} يليها ٣٣ نبات/م^{2}.

رابعا: الأختلافات الصنفية

لم توجد فروق معنوية بين الصنفين في عدد الأيام من الزراعة للإنبات ، أما المرحلة من الإنبات إلى ظهور أول زهرة ، كان الصنف قاهرة ٣٧٥ مبكر نسبيا عن الصنف جيزة ٨٤٣ في الوصول لهذه المرحلة، إلا انه تأخر نسبيا عن الصنف جيزة ٨٤٣ في الوصول لمرحلتي من أول زهرة إلى النضج الفسيولوجي ومن الزراعة للنضج الفسيولوجي. أشارت النتائج أن الصنف قاهرة ٣٧٥ تفوق بشكل معنوي على الصنف جيزة ٨٤٣ في عدد القرون / النبات، عدد البذور/ النبات، محصول الفدان من البذور، المحصول البيولوجي طن / فدان ودليل الحصاد بينما تفوق الصنف جيزة ٨٤٣ في صفات الوزن الجاف للنبات ووزن ١٠٠بذرة.

الخلاصة : توصي هذه الدراسة بزراعة الصنف قاهرة ٣٧٥ في ٥ نوفمبر بكثافة نباتية ٤٤ نبات /م^{2}. تحت ظروف محطة التجارب الزراعية بكلية الزراعة والظروف المشابهة