J. Agric. Sci. Mansoura Univ., 31 (5): 2853 - 2861, 2006

INFLUENCE OF SOWING DATES ON YIELD AND YIELD COMPONENTS OF SOME FABA BEAN TYPES

Sawsan M. A-E. Abou Taleb
Agric. Botany Depart., Faculty of Agric.Univ. of Cairo, Giza 12613, Egypt

ABSTRACT

Two field experiments were conducted in the Experimental Research Station of the Faculty of Agriculture, Cairo University at Giza during 2000/2001 and 2001/2002 seasons to explore the effects of four sowing dates on yield and yield components of six faba bean cultivars. The four sowing dates were ranged from mid October to first December at 15 days interval. The cultivars belonged to various seed sizes and origins. These cultivars included 3 Egyptian improved cultivars and 3 exotic ones. The results showed that mid November seemed to be the appropriate sowing date for the Egyptian cultivars. The exotic cultivars varied in their responses to various sowing dates. The exotic cultivars Minica and Kristall are more adapted to delaying sowing to first December, whenever low temperature predominate. Mid November was the most proper for the exotic cultivar PBL 938. The early sowing dates, before mid November, had negative effects on the performance of all studied cultivars for most investigated traits.

INTRODUCTION

Faba bean (*Vicia faba* L. var. minuta) is an important annual legume crop. It is of great importance for human consumption and crop rotation in Egypt. The environmental factors are with no doubt of great importance for determining the rates of phenological development during all phases of faba bean growth (Abou-Taleb, 2002).

The effects of light and temperature on different physiological processes were reported by several investigators (Skjelvag ,1981 a & b in Skandinavia, Abd El-Halim *et al* ,1990 and Rady and Rizk ,1990 in Egypt). The former illustrated that raising temperatures up to 24 °C decreased both numbers of pods and seeds per plant as well as number of seeds per pod and 100-seed weight. Undesirable effects of high temperature on pod and seed set of faba bean plants were reported by Evans (1959), Said *et al* (1967) and Abdalla and Fischbeck (1978). The later suggested the early sowing to allow sufficient vegetative growth followed by flowering in mild temperature in winter which lead to good pod set and escaping high temperature that may prevail in spring.

Sowing date was reported to be an important and effective factor for determining the vegetative growth (Zeidan *et al.*, 1986, Pilbeam *et al.*, 1990 and Abou-Taleb, 2002) as well as reproductive growth (Ibrahim *et al.*, 1982, Zeidan *et al.*, 1986, Amer *et al.*, 1992, El-Murshedy 1996 and El-Kacham, 2003) of faba bean plants.

Date of sowing faba bean was investigated in newly reclaimed lands of Egypt. In Ismailia, planting during the first half of November was reported to be an appropriate date for faba bean sowing (Metwally *et al.*, 2000). In newly reclaimed land of Upper Egypt, Hussein *et al.* (2002) indicated that early sowing date in mid October resulted in producing higher values of seed yield, number of pods and seeds per plant compared to those of later one, first November.

The first part of the present study proved variable morphological characters and dry matter distributions of the investigated faba bean cultivars under studied sowing dates (Abou-Taleb, 2002). The present paper dealt with the effects of these four sowing dates that ranged from mid October to first December on yield and yield components of six variable faba bean cultivars.

MATERIALS AND METHODS

Two field experiments were carried out at the Experimental Research Station, Faculty of Agriculture, Cairo University, Giza, during 2000/2001 and 2001/2002 seasons. Each trial included the four sowing dates and six faba bean cultivars in a split-plot design with three replications. Six faba bean cultivars belonging to various seed types and origins were evaluated under field conditions using four sowing dates. The origin, sources and some features of these cultivars are presented in Table (1).

Table (1): Code, origin, sources and some features of the investigated faba bean cultivars.

Code	Origin	Source	Some features
Cairo 375	Egyptian local selection	Agron. Dept., Fac.Agric., Cairo Univ.	High yielder, medium seed size.
Giza 429	Improved cultivar	ARC, Ministry of Agric., Giza.	*Orobanche* resistant, medium seed size.
X-Line	Local selection	Agron. Dept., Fac. Agric., Cairo Univ.	High pod setting-medium seed size.
Minica	Netherlands	Institute of Agron.& Plant Breeding, Gottingen, Germany	Large seed size.
Kristall	Germany	Institute of Agron.& Plant Breeding, Gottingen, Germany	Small seed size.
BPL 938	Colombia	Institute of Agron.& Plant Breeding, Gottingen, Germany	Foliar disease resistant-medium seed size.

The four sowing dates were ranged from mid October to first December in 15 days intervals.

The sowing dates assigned as main plots and the cultivars were distributed randomly in the sub-plots. Each sub-plot consisted of 4 ridges and each ridge was 4 m long and 60 cm apart. Seeds were hand planted in one side of the ridge in doubled-seed hills distanced 20 cm. Recommended cultural practices were followed.

At harvest, the central ridges of each experimental plot were considered for sampling and traits determination. Ten guarded plants were taken for determining the yield and yield components of the individual plant as an average of this sample. The yield of the central two ridges was considered as yield per plot (4.8 m^2). The studied individual plant characters were numbers of pods and seeds/plant, plant dry weight and seed yield (g). A random sample of seeds were taken for recording the 100-seed weight as seed index. The percentages of seed yield per plant to plant dry weight was estimated as harvest index. The obtained data were statistically analyzed as split-plot design with sowing dates as the main plots and the cultivars as sub-plot. Least significant differences (LSD) at 5 % level of probability were used

for differentiating between means. The meteorological variables at Giza Agro.met. Station (No.14) during the course of trials are recorded in Fig. (1).

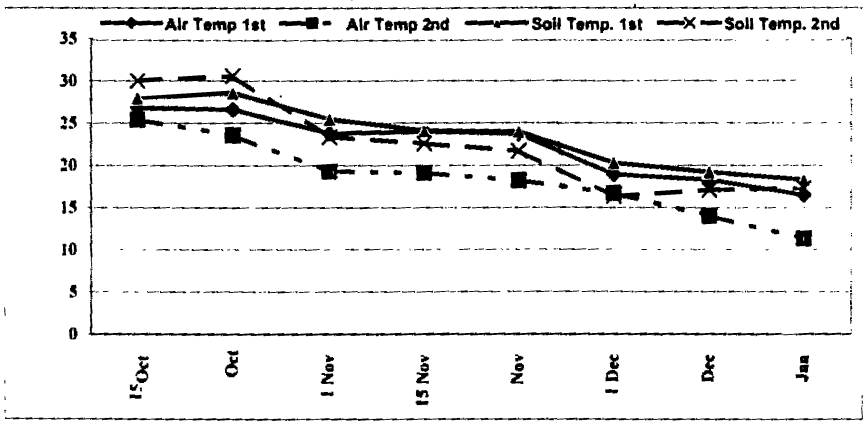

Fig. (1): Air and soil temperatures during four sowing dates in both seasons

RESULTS AND DISCUSSION

Effects of sowing dates:

Table (2) illustrated the effects of four sowing dates on various yield components of faba bean plant in both successive seasons (2000/2001 and 2001/2002). Faba bean plants behaved better as seeds. Were sown in mid November. Under the influence of this date most of yield characters were significantly performed better than under other earlier or later sowing dates during both seasons.

Table (2): Mean seed yield and its components as affected by four sowing dates during 2000/2001 and 2001/2002 growing seasons.

Trait	Season	Sowing date				
		Mid. Oct.	First Nov.	Mid. Nov.	First Dec.	$LSD_{0.05}$
No. Pods/plant	000/001	13.6 D	15.6 C	20.7 A	16.8 B	0.8
	001/002	14.1 C	15.2 BC	21.4 A	17.0 B	2.2
No. Seeds/plant	000/001	38.6 BC	38.8 B	46.3 A	35.6 C	3.0
	001/002	32.8 B	44.8 AB	52.6 A	45.5 A	14.3
Plant dry wt., g	000/001	107.0 A	91.3 B	86.7 B	88.3 B	9.5
	001/002	72.5 B	74.7 B	93.7 A	93.1 A	5.1
SY/plant, g	000/001	24.3 B	25.0 B	30.1 A	24.8 B	2.4
	001/002	21.8 D	24.9 C	35.0 A	29.9 B	1.0
Harvest index	000/001	22.7 C	28.2 B	34.9 A	28.1 B	2.3
	001/002	30.0 C	33.5 B	37.6 A	32.3 BC	2.3
100-seed weight, g	000/001	64.0 C	65.3 BC	65.8 B	69.0 A	1.6
	001/002	66.7 A	61.2 A	67.5 A	67.2 A	NS
SY/plot ($4.8m^2$), g	000/001	1027.1 C	1163.8 C	1875.4 A	1424.2 B	169.7
	001/002	1100.6 C	1220.9 B	1692.3 A	1670.3 A	102.1

Ns = insignificant differences.

Means of sowing dates followed by the same capital letter/s are not statistically different at 5%.

Hence, it seemed to be the appropriate date for sowing faba bean. The efficacy of sowing during the first half of November on faba bean yield was reported by many authors, Abd El-Rahman *et al* (1980), Ibrahim *et al.* (1982), Zeidan *et al.* (1986), Salih & Ageeb (1987), Amer *et al.* (1992), El-Murshedy (1996), Abuldahab *et al.* (2002) and El-Kasham (2003). Hussein *et al.* (1994), in Nubaria. They reported negative effects of sowing in 1st and mid November as a delayed sowing dates compared to mid-October date.

No significant difference was detected between mid November date and 1st December date in the 2nd season with respect to seed yield g per plot. This observation may be interpreted by enhancement in the seed yield per plot of the exotic cvs. Minica & Kristal due to delaying sowing date up to 1st December.

The earliest sowing date, i.e. mid October date, recorded the maximum plant dry weight in the first season. However, in the second season the higher values of plant dry weight was recorded by last two dates, i.e. mid November & 1st December. This variable response in dry matter accumulation may be attributed to prevalent air and soil temperatures during the two successive growing seasons Fig. (1). Worthy to notice that the 100-seed weight recorded the maximum value as affected by 4th sowing date in the first season, while no significant differences were detected between all dates in the second one. This may be referred to best accumulation of dry matter in the formed pods which may be attributed to warmer weather of the first growing season. Producing reduced numbers of pods and seeds per plant may enhance pod filling.

Faba bean plants in the latest sowing date produced the highest percentages of reproductive organs dry weight, Abou-Taleb (2002). This followed by possessing reduced numbers of pods & seeds per plant especially in the first season. This may be attributed to high levels of flowers & pods abscission and/or forming aborted seeds.

The earlier sowing dates negatively affected most of yield components and significantly differed with other dates . Worthily to notice that plants of the latest sowing date yielded better than those of the earliest one. The early sowing date, and according to various environmental factors was reported to be the appropriate for sowing faba bean (Sliman, 1993 in Saudi Arabia, Kumar and Singh 1993 in India, Bekheit *et al.* 2001 in Assuit and Hussein *et al.* 2002 in Newly reclaimed land in Upper Egypt).

The adverse effects of delayed sowing on faba bean yield were previously reported by El-Shaer *et al.* (1987), Labuda and Kossowski (1989) in Poland, Pilbeam *et al.* (1990) in UK, Bruns *et al.* (1991) in three locations in Germany, Austria and Denmark, Kumar and Singh (1993) in India and Hatam *et al.* (1999) in Pakistan.

Performance of faba bean cultivars:

Variations among the studied cultivars during both seasons are presented in Table (3). The Egyptian cvs. (C.375, G.429 and Line X) produced higher number of pods per plant than the exotic ones in the two seasons. Although, the relatively produced lower numbers of pods per plants by the exotic cvs. Minica and Kristall, they possessed the highest numbers of seeds per plant in the second season. This may be due to the higher number

of seeds per pod. No significant differences were detected between all cultivars under study with respect to the harvest index in the first season. The Egyptian cvs. recorded significant higher harvest index than the exotic ones in the second season.

Minica cv. produced the heaviest 100-seed weight, while Kristall possessed the lighter ones, due to larger and smaller seeds, respectively. A notable reduction (9.3 g) was recorded by Minica in second season comparing to the first one. However, line X recorded lighter 100-seed weight in the first season than the second one by about (5 g). The other cultivars possessed lighter differences between both seasons for seed index. In spite of, producing the lowest number of seeds per plant, PBL 938 cv. was one of the highest yielders per plot in the first season. Moreover, it surpassed all cultivars in the second one.

Table (3) Performance of faba bean cultivars for yield and its components over sowing dates during 2000/2001 and 2001/2002 growingseasons.

Trait	Season	Cultivar						
		C.375	G.429	Line X	Minica	Kristall	BPL 938	LSD 0.05
No. Pods/plant	000/001	18.9 a	18.0 ab	18.5 a	13.3 d	14.4 c	17.0 b	1.0
	001/002	18.6 a	18.6 a	18.1 a	12.9 c	16.0 b	17.4 a	1.2
No. Seeds/plant	000/001	44.5 a	41.0 b	42.2 ab	34.7 d	39.0 c	37.4 cd	3.0
	001/002	42.9 ab	43.4 ab	41.7 ab	45.4 ab	51.9 a	38.2 b	11.6
Plant dry wt., g	000/001	100.6 a	93.5 b	92.5 bc	103.3 a	82.5 d	87.4 cd	6.0
	001/002	79.5 b	83.0 ab	80.1 b	88.6 a	88.8 a	81.1 b	7.4
SY/plant, g	000/001	28.7 a	25.9 bc	26.2 bc	27.8 ab	22.2 d	25.5 c	1.9
	001/002	28.3 ab	28.3 ab	28.1 ab	28.0 ab	28.7 a	26.1 b	2.4
Harvest index	000/001	29.0 a	28.7 a	28.7 a	28.1 a	27.3 a	29.0 a	Ns
	001/002	35.5 a	34.2 a	35.1 a	31.4 b	31.9 b	32.0 b	1.5
100-seed weight, g	000/001	64.7 c	63.1 cd	62.4 d	80.3 a	57.2 e	68.3 b	1.6
	001/002	66.2 a	65.4 a	67.3 a	71.0 a	55.8 b	68.1 a	5.8
SY/plot (4.8m^2), g	000/001	1503.1 a	1437.6 b	1509.7 a	1235.6 c	1103.2 d	1446.6 ab	65.4
	001/002	1481.0 b	1377.5 c	1406.4 bc	1364.0 c	1334.2 c	1563.0 a	79.4

Ns = insignificant differences.
Means of cultivars followed by the same letter/s are not statistically different at 5%.

Fig. (2) represents the performance of yield characters of studied cultivars affected by various sowing dates. The third date, i.e. mid Nov. seemed to be the most effective for the Egyptian cvs. as most of yield characters performed better under this date. No great differences were detected between studied cultivars with respect to the seed index as affected by various sowing dates in both seasons. However, seed index of Minica cv. recorded notable decrease as affected by second sowing date, i.e. 1st November, in the second season. The fourth sowing date, as low temperatures predominate, seemed to be the desired for Minica cv.
It surpassed all studied cvs in both seasons with respect to seed yield per plant and per plot, while producing an intermediate values of seeds & pods per plant in the second season (2001/2002).

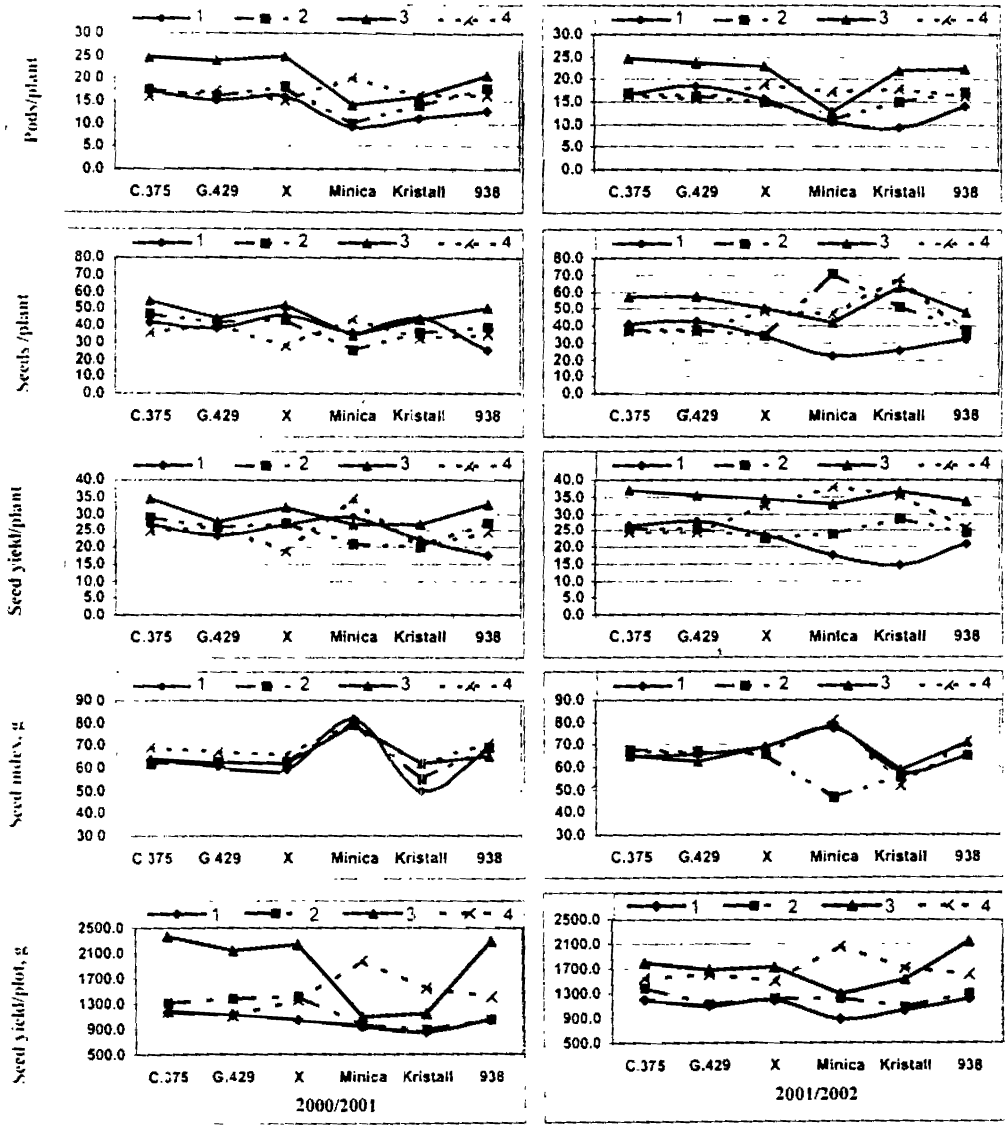

Fig. (2): Performance of studied cultivars as affected by four sowing dates for pods, seeds, seed yield/plant and 100-seed weight as well as seed yield/plot in both seasons.

The exotic cv. PBL 938 behaved better under the third sowing date comparing to both early and late dates as most of yield components performed better under this date in both seasons. This cultivar more or less, reaches the levels of plot yield productivity of the Egyptian cvs. that recorded under the third date in the first season and surpassed all cvs in the second one. Delaying sowing date to 1st December affected positively the seed index of PBL 938 cv. especially in the first season (raised by 5.2 g from mid-November date). The fourth sowing date seemed to be the most favorable for the exotic cultivar Kristall due to the best seed yield per plot in both seasons was obtained.

Fig. (2) exhibited that the earlier sowing dates (mid October & 1st November) were not desired for all studied cultivars under Giza conditions. These dates seemed to have negative effect for most of studied yield components.

Variations in response and productivity of cultivars subjected to the same sowing date(s) were reported by Labuda and Kossowski (1989) and Pilbeam *et al.* (1989). The later attributed variation between yield of two spring faba bean cvs. under three sowing dates in UK to the ability of transferring stored assimilates from the stem to the developing pod.

The effects of different environments as sowing dates in the performance of different cultivars may be due to the advantage of some dates for growth and dry matter accumulation as the absorption of photosynthetically active radiation and the ability to partitioning assimilates into seeds (Lopez-Bellido *et al.*, 2005). Some environmental factors are favourable for growth and balanced such growth with seed yield. These factors should be adopted for recommending different cultivars for variable locations.

REFERENCES

Abdalla, M.M.F. and G. Fischbeck (1978). Growth and fertility of five stocks of field beans grown under three temperature regimes and the effect of natural water stress on seed index of collection of *Vicia faba* L. Z. Acker und Pflanzenbau 147 (2): 81-91.

Abd El-Halim, A.H., A.H. El-Attar and F.M. Morsi (1990). Prediction equations for estimating yield of some field crops based on climatic factors, Proc. 4th Conf. Agron. Cairo, 11: 519-533.

Abd El-Rahman, K.A., M.A. El-Morshidy, M.A. Khalifa, E.A. Hassaballa and H.M. Abdel-Rahim (1980). Flowering, abscission, yield and quality of broad beans as affected by sowing date and irrigation frequency. Res. Bull. Fac., Agric. Ain Shams Univ. 1253, 12.

Abou Taleb, Sawsan M.A-E.(2002). Morphological variation and dry matter distribution in some faba bean cultivars under different sowing dates. Proc. Recent Technologies in Agriculture, Fac. Agric., Cairo Univ., Egypt.Vol.(IV): 864-875.

Abouldahab, A.A., W.A. El-Murshedy and G.O. Mahmoud (2002). Phonological response of faba bean to climatological effects under different sowing dates and plant distributions. J. Agric. Sci., Mansoura Univ., 27 (4): 1969-2003.

Amer, M.I.A., M.A. El-Borai and M.M. Radi (1992). Response of three faba bean (*Vicia faba* L.) cultivars to three sowing dates under different plant densities in North delta. J. Agric. Res. Tanta Univ., 18 (4): 591-599.

Bakheit, B.R., A.Y. Allam and A.H. Galal (2001). Response of some faba bean cultivars to planting dates and populations densities. Assuit J. Agric. Sci., 32 (2): 85-101.

Bruns, S., D. Stelling and G. Robblen (1991). Aspects of genetic variability and habitability of tolerance to late sowing in field beans (*Vicia faba* L.). Angewandte-Wissenschaft. Sonderheft, 293-301.

El-Kacham, A.M.(2003). Effect of planting date and plant density on growth and yield of some faba bean varieties. M.Sc. Thesis. Fac. Agric. Cairo Univ., Egypt.

El-Murshedy, W.A. (1996). Dry matter and crop yield as influenced by environmental conditions of some cropping patterns. Ph. D. Thesis, Fac. Agric. Cairo Univ., Egypt.

El-Shaer, M.H., E.M.S. Gheith, H.M. Soliman, A.A. Abd El-Hafeez and M.A. Rady (1987). Faba bean yield and its components as affected by some microclimatic factors. Ann. Agric. Sci., Moshtohor, 26 (2): 1-16

Evans, L.T. (1959). Environmental control of flowering in *Vicia faba* L. Annals of Botany, vol. 23: 521-546.

Hatam, M.; Khattak, K. M.;M. Amanullah (1999). Effect of sowing date and sowing geometry on growth and yield of faba bean (*Vicia faba* L.). FABIS Newsletter, 1999, Publ. 2000) No. 42: 26-28.

Hussein, A.H.A., M.A. El-Deeb and Kh. El-Yamani (2002). Response of new faba bean genotypes to different sowing dates and plant densities in the newly reclaimed lands in Upper Egypt. National Ann. Cord. Meet. ICARDA/EC. Cairo, 22-23 Sept. 70-74.

Hussein, A.H.A., R.F. Dossoky, M.A. El-Deeb and M.M. El-Morsy (1994). Effect of sowing dates and plant densities on yield and yield components of new faba bean cultivars (Giza blanca) in newly reclaimed land. J. Agric. Sci., Mansoura Univ., 19 (2): 447-451.

Ibrahim, A.A., A.M. Nassib and M.H. El-Sherbeeny (1982). Faba bean agronomy in Egypt. 109-116. In. G.H. Hawtin and C. Webb (eds.). Faba Bean Improvement., ICRADA, 139-150.

Kumar, R. and R.C. Singh (1993). Response of faba bean (*Vicia faba*) genotypes to sowing date and row spacing. India. J. Agron. 38 (1): 135-137.

Labuda, H. and M. Kossowski (1989). The effect of sowing date on the yield of milky-stage broad beans. Biuletyin-Warzywniczy, 33: 65-80.

Lopez-Bellido, F.J., L. Lopez-Bellido and R.J. Lopez-Bellido (2005). Competition, growth and yield of faba bean (*Vicia faba* L.). Europ. J. Agron. 23 (4): 359-378.

Metwally, A. A.; M. M.Shafik;M.A.Hassanin and D. S. Darwish (2000). Influence of sowing dates and population densities on performance of some faba bean varieties grown in newly reclaimed land. J. Agric. Sci. Mansoura Univ., 25 (9): 5587-5599

Pilbeam, C.J.; P.D. Hebblethwaite and H.E. Richetts (1989). The response of determinate and semi-determinate faba bean varieties to different sowing dates in the spring. Annals of Applied Biology. 114 (2): 377-390.

Pilbeam, C.J., P.D. Hebblethwaite, H.E. Richetts and O.A. Hassan (1990). Effect of autmn sowing dates on growth and yield of indeterminate and determinate field beans (*Vicia faba* L.). J. Agric. Sci., Mansoura Univ., 114 (3): 339-352.

Rady, M.A. and W.M.Rizk (1990). The influence of limited environment on some faba bean cultivars. II. Phenology, growth and yield. Egypt. J. Appl. Sci., 5 (6): 553-571.

Said, H., T. Hegazi and R.M. Imam (1967). The effect of night temperature on germination, carbohydrates and nitrogen metabolism of faba seedlings. Acta Biol. Hung., 18 (4): 421-436. (C.A. G.H. Hawtin and C. Webb (eds.). In faba Bean Improvement, ICARDA, 145-159.

Salih, F.A. and O.A.A. Ageeb (1987). The effect of plant population, sowing date and pigeon pea shelter (shading), on the incidence of the root rot/wilt disease complex and yield of faba bean. FABIS Newsletter, 18: 18-21.

Skjelvag, A.O. (1981a). Effect of climatic factors on the growth and development of the field bean (*Vicia faba* L.). I. Phenology, high growth and yield in a phytotrone experiments. Acta Agric. Scand, 31: 358-371.

Skjelvag, A.O. (1981b). Effect of climatic factors on the growth and development of the field bean (*Vicia faba* L.). II. Phenological development in outdoor experiments. Acta Agric. Scand, 31: 372-381.

Sliman, Z.T. (1993). Response of faba beans (*Vicia faba*) to seeding date in central region of Saudi Arabia. J. King Saud Univ., Agric. Sci., 5 (2): 219-226.

Zeidan, E.M., E.M. El-Naggar, M.E. Saleh and M.I. Amer (1986). Studies on some faba bean (*Vicia faba* L.) cultivars. 2. Effect of sowing date, irrigation, cultivars and plant density on productivity. Zagazig J. Agric. Res., 13 (2): 355-382.

تأثير مواعيد الزراعة على المحصول ومكوناته لبعض طرز الفول البلدى

سوسن محمود أبو العلا أبو طالب

قسم النبات الزراعى-كلية الزراعة-جامعة القاهرة-جيزة ١٢٦١٣-مصر

أجريت تجربتان حقليتان فى محطة التجارب والبحوث الزراعية لكلية الزراعة جامعة القاهرة بالجيزة لدراسة تأثير أربعة مواعيد للزراعة على أداء ستة أصناف محسنة من الفول البلدى.

كانت مواعيد الزراعة هى منتصف أكتوبر واول نوفمبر ومنتصف نوفمبر واول ديسمبر. أما الأصناف فكان ثلاثة منها مصرية وهى (قاهرة ٣٧٥ و جيزة ٤٢٩ وسلالة X) أما الثلاثة الأخرى فهى مستجلبة من الخارج وهى مينيكا (هولندى الأصل) وكريستال (المانى الأصل) والصنف الكولومبى الأصل ٩٣٨.

واظهرت النتائج المتحصل عليها ان الزراعة فى منتصف نوفمبر كانت الأفضل فى أداء الأصناف المصرية لغالبية الصفات التى درست.أما الصنفان المستوردان (مينيكا وكريستال) فكانا اكثر تأقلما للزراعة فى أوائل ديسمبر حيث درجات الحرارة المنخفضة. أما ميعاد الزراعة منتصف نوفمبر فكان الأنسب بالنسبة للصنف الكولومبى ٩٣٨.

ولقد كان لزراعة الفول البلدى قبل منتصف نوفمبر تأثيرات سلبية على أداء كل الأصناف تحت الدراسة. وعلى ما يبدو فان العوامل البيئية المختلفة أظهرت تأثيرات متباينة على نمو وإنتاجية الأصناف المختلفة مما يجب مراعاته عند التوصية بموعد زراعة صنف ما.