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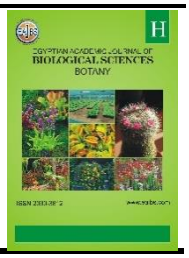

Productivity of Some Faba Bean (*Vica faba* L.) Cultivars Under Different Planting Times

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ABSTRACT

Faba bean (*Vicia faba* L.) is the most important food legume crop in the world as well as Egypt. Two field experiments were done in the Nubaria region (Latitude: 30° 39' 59.99" N; Longitude: 30° 03' 60.00" E), Alexandria, Egypt, during the winters seasons of 2021–2022, and 2022–2033, to examine how different faba bean varieties respond to three planting dates under drip irrigation.. A split plot design with three replications was used. Planting dates (1st October, 15th October, and 1st November) were allocated in main plots, whereas the three faba bean varieties (Nubaria 1, Giza 716 and Giza 843) were distributed at random within the subplots in both seasons. The results showed that faba bean cultivars responded to the different three dates (1st October, 15th October and 1st November) under study conditions. The results indicated that the studied cultivars significantly differed in most of the studied characteristics such as plant height (cm), number of branches/plant, number of pods/plant, number of seeds/pod, 100-seed weight (g), biological yield, seed yield (kg/fed), straw yield (kg/fed), harvest index (%), seed protein content (%), pod length, and pod setting %,, also they affected by the sowing dates and their interaction. Finally, the results could be concluded to increase the seed yield/fed and its component of faba bean when planting Nubaria 1 in the middle of October under Nubaria region, Alexandria, Egypt.

INTRODUCTION

Faba bean (*Vicia faba* L.) is the most important food legume crop in Egypt, as a source of plant protein, and plays a good role in farming, as a break crop in intensive cereal systems. In Egypt during the last five years, about 113.810 fed Faba beans with an average productivity of 9.2 ardabs/ feddan according to FAO (2020). There is a need to improve productivity and total production to meet the increasing demand for faba beans in Egypt. This could be achieved through enhancing crop breeding and agronomy research (FAO, 2020). Increasing the productivity of faba bean seed yield, in Egypt, is one of the main

Egyptian government objectives. Since the growing area in Egypt, is limited; so, the priority must be given by the government as well as the Egyptian Agricultural Institutes towards the improvement of faba bean productivity. The attainment of maximum yield of faba bean from the unit area of land is greatly affected by different cultural practices in addition to environmental conditions. The sowing date is one of the most important factors, which may affect the timing and duration of the vegetative and reproductive stages, which mainly contribute to seed yield. added a recent citation.

The performance of faba bean yield is often limited by the sensitivity of the crop to environmental conditions and the high susceptibility to diseases and pests (Torres and Ávila, 2011). Plants in desert environments are exposed to biotic stress (insect and pathological injuries) and abiotic stress (high temperature, soil salinity, soil salinity and drought) that negatively affect growth and yield. added a recent citation. In this regard, several researchers have reviewed recent advances on the beneficial roles of silicon on plant growth in adverse environmental conditions and increasing yield and its components for several crops (Van *et al*., 2017). However, Lizarazo *et al.* (2017) discovered that high solar radiation, moisture stress, photoperiod response, temperature, and PAR (photosynthetically active radiation) accelerated blooming.

Seed yield and yield components of faba bean reduced with sowing delay. The crop's environment (year × site) and management (sowing date) were found to explain 34.01% and 42.95% of the total seed yield variation, respectively. The data showed that the tested genotypes were positively influenced by the environment with sandy loam soil and early winter sowing date, resulting in a greater seed yield than in the other environment. In the two growing seasons, the three faba bean genotypes showed defense against conditions of winter frost. (Sellami *et al.,* 2021). On the other hand, Amer *et al.* (2008) and Badr *et al.* (2013) found that the sowing date in the middle of October produced the highest faba bean seed yield and its components.

Sowing date is an important factor that significantly affects the timing and duration of vegetative and reproductive stages consequently yielding its components and seed quality (Refay, 2001 and Turk and Tawaha, 2002). Since, environmental factors i.e., temperature and light differ due to sowing dates. There is a number of studies that indicated that sowing date had a significant yield-limiting factor on faba bean. Thus, El-Metwally *et al.* (2013) showed that sowing date faba bean on 25th October recorded the highest values of growth characters and pigment content (total chlorophyll). While the greatest values of yield and its components resulted from sowing on 25th November. The number of days to both flowering and maturity and the number of branches were significantly affected by the sowing date. The productivity traits were significantly affected by the sowing date, especially, seed yield/faddan. Results showed that the eight faba bean genotypes performed significantly differently with regard to both the number of days to blooming and maturity. Genotypes produced higher seed yield/plant at the 2nd sowing date (November 1st). Genotypes produced the heaviest 100- seeds on the 1st date, because plants stayed longer to reach maturity, relative to those planted on both November 1st and November 15th, since seeds were given much time to grow. Sakha-3 in both Mallawy and Sids, attained the highest seed yield. The second sowing date (November 1st) was most proper and any of Sakha-1 and Sakha-3 Sids-19 might be adopted to Middle Egypt (Tarek *et al.,* 2020).

Also, Shoman and Bughdady (2020) stated that the number of pods/plants, seed yield/plant, 100-seed weight, harvest index, shelling and seed yield were higher with planting on 15th October in both seasons. While, plant height, pod length, straw yield, WUE and seed carbohydrates content were higher with planting on 1st October in both seasons. All the examined metrics increased significantly when silicon foliar spray levels were increased to 300 ppm, with the exception of pod length. The interaction between sowing dates and silicon foliar application levels had significant effects on all studied characters except, pod

length. The highest values of yield and its components were performed when faba bean had sown on 15th October with spraying of 300 ppm silicon in the form of potassium silicate to obtain the highest possible productivity.

The objectives of this study were to identify the best combination of sowing dates and varieties for maximizing faba bean seed yield and its components when watered by drip irrigation on newly reclaimed fields in Nubaria Region, Alexandria Governorate, Egypt

MATERIALS AND METHODS

During the two winter seasons of 2021/2022 and 2022/2023, two field experiments were conducted at Nubaria Region, Alexandria Governorate, Egypt, to investigate the effect of planting dates on some faba bean varieties and their interaction on productivity under drip irrigation.

Representative soil samples from depth (0 – 60 cm) were taken from the experimental soil before starting the experimental work. Some soil properties were determined according to the method described by Page *et al.* (1982) and are presented in Table (1). In both seasons, the soil texture was sandy clay loam, low content of organic matter, very high calcium carbonate and non-saline. The available amounts of macro-elements were moderate for nitrogen and low for phosphorus and potassium. Regarding, available amounts of micro-nutrients, Fe, Cu and Mn were at medium levels in the soil, while Zn and B were at low amounts (Table 1).

Table 1. Some soil properties of the experimental sites at Nubaria in 2021/2022 and 2022/2023 seasons

Mechanical analysis					
Season	**Clay (%)**	**Silt (%)**	**Sand (%)**	**Organic matter (%)**	**Texture class**
2021/2022	23.35	21.17	52.20	0.43	Sandy clay loam
2022/2023	22.63	23.61	53.38	0.50	

Chemical analysis												
Season	**pH**	**EC (ds/m)**	**HCO_3^- (%)**	**Ca CO_3 (%)**	**Available element (mg/kg)**							
					N	**P**	**K**	**Fe**	**B**	**Zn**	**Cu**	**Mn**
2021/2022	8.05	1.96	12.21	24.88	23.2	21.39	123.1	3.7	1.0	0.35	0.90	3.5
2022/2023	8.15	1.88	11.65	24.45	24.7	20.45	122.9	4.2	0.8	0.36	0.95	4.6

EC: Soil Electrical Conductivity.

The design of the experiment was a split-plot design with three replications. Where, the main plots were occupied by planting dates (1st October 15th October, and 1st November), while the subplots were occupied by the three faba bean varieties (Nubaria 1, Giza 716 and Giza 843).

Each plot size of 10.5 m2 included 6 rows, each 3.00 m in length, and 60 cm in width; the distance between plants was 10 cm. The seeds were planted at a rate of 2 seeds per hill. Faba bean seeds were obtained from Nubaria Station, Agricultural Research Centre (ARC), Egypt.

The field experiment was ploughed once, then phosphorus fertilizer (15.5 P_2O_5) was applied at a rate of 480 kg/ha before planting, and potassium sulphate (48% K_2O) was added at a rate of 120 kg/ha before planting with soil preparation. A Rhizobium inoculation (R. leguminosum cv. Vicieae bacterium) solution containing 10 cells per gramme was applied to faba bean seed. Nitrogen fertilizer, on the other hand, was applied as urea fertilizer (46% N) at a rate of 120 kg N/ha in a single dosage with the first watering. Other agricultural

practices for cultivating faba bean plants were used as the recommendation of the Ministry of Agriculture and Land Reclamation.

At harvest time, 10 plants were taken randomly from the inner three ridges of each subplot in both seasons to determine plant height (cm), number of branches/plant, number of pods/plant, number of seeds/pod, 100- seed weight (g), biological yield, seed yield (kg/fed), straw yield (kg/fed), harvest index (%), seed protein content (%), pod length, and pod setting %, were measured

Data obtained was exposed to the proper method of statistical analysis of variance as described by Gomez and Gomez (1984). The treatment means were compared using the least significant differences test (LSD) at the 5% level of probability. All the statistical analysis using CoStat 6.311 (2005) computer software package.

RESULTS AND DISCUSSION

The results presented in Tables (2 and 3) showed the effect of planting dates on the three faba bean cultivars and their interaction on seed yield, straw yield, biological yield (kg/fed), harvest index (%), 100-weight seed (g), number of seeds/pod, number of pods/plant, pod length (cm), number of branches/plant, seed protein content (%), and pod setting (%) during 2021/2022 and 2022/2023 seasons.

Concerning the effect of planting date on yield and its components characters, the results in Tables (2 and 3) revealed that the second date 15 October recorded the highest values of all the studied characters followed by the third date 1st November in these characters i.e., seed yield/fed, straw yield/fed, biological yield/fed, harvest index (%), and number of pods/plant, which had no significant difference between the second and the third date, while the second date had no significant difference with the first date 1st October in these characters such as 100- weight seed (g), number of seeds/pod, pod length (cm), number of branches/plant, protein %, and pod setting %, during the two seasons. These results are in line with those reported by Wakweya *et al*. (2016); Mohamed and El-Sayed (2018); Manning *et al*. (2020); Shoman and Bughdady (2020); Yasmin *et al*. (2020); Sellami *et al*. (2021) who reported that sowing faba bean on the second week of November increased seed yield, its components, and its quality.

In terms of the response of faba bean to studied condition, the results in Tables (2 and 3) indicated that the three cultivars differed in all the studied characters, where in general Nubaria 1 cultivar recorded the highest mean values of all the studied characters such as seed yield/fed, biological yield/fed, harvest index (%), number of pods/plant, 100- weight seed (g), number of seeds/pod, pod length (cm), number of branches/plant, protein %, and pod setting %, followed by Giza 843 which also gave the highest values of straw yield/fed and comes in the next order after Nubaria 1 in the most of studied characters with no significant difference between Nubaria 1 in this study during the two seasons. These results are in harmony with those results reported by Badr *et al*. (2013); Abido and Seadh (2014); Mohamed and El-Sayed (2018); Manning et al. (2020); Tarek et al. (2020); Yasmin *et al*. (2020) who detected that faba bean cultivars differed in all the studied characters such as seed yield and yield components.

This belongs to the interaction effect between the two factors as shown in Tables 2 and 3. The results showed that there was a significant response of the three cultivars of faba bean when they planting on 15th October, where planting Nubaria 1 on 15th October recorded the highest values of seed yield/fed, biological yield/fed, harvest index (%), number of pods/plant, 100- weight seed (g), number of seeds/pod, pod length (cm), number of branches/plant, protein %, and pod setting %, while Giza 843 with 15th October gave the highest straw yield while Nubaria 1 with 1st October recorded the maximum values of

branches number per plant of faba bean, comparing with the other interactions in the first season and second season.

Table 2: Plant attributes of the three faba bean varieties as affected by planting dates and their interaction in both seasons.

A). Planting dates	Season 2021/2022							Season 2022/2023						
	B). Faba bean varieties			Average (A)	L.S.D. at 0.05			B). Faba bean varieties			Average (A)	L.S.D. at 0.05		
	Nubaria 1	Giza 716	Giza 843		A	B	AB	Nubaria 1	Giza 716	Giza 843		A	B	AB
	Seed yield (kg/fed)													
1st October	1297.32	1084.33	896.26	1092.64	93.63	70.01	121.27	1318.92	1061.55	911.88	1097.45	84.27	72.45	125.48
15th October	1428.81	1347.19	1037.22	1271.07				1437.55	1363.62	1056.55	1285.91			
1st November	1215.47	1200.00	949.34	1121.60				1231.12	1203.88	963.22	1132.74			
Average (B)	1313.87	1210.51	960.94					1329.20	1209.68	977.22				
	Straw yield (kg/fed)													
1st October	2867.79	3276.99	2966.67	3037.15	155.10	88.22	152.80	2806.72	3256.62	2926.15	2996.50	132.68	91.25	158.04
15th October	3057.77	3444.33	3303.19	3268.43				3038.38	3421.80	3284.17	3248.12			
1st November	2842.34	3260.47	3181.00	3094.60				2811.18	3240.92	3155.33	3069.14			
Average (B)	2922.63	3327.26	3150.29					2885.43	3306.45	3121.88				
	Biological yield (kg/fed)													
1st October	4574.31	4051.00	3764.05	4129.79	152.57	122.81	212.71	4575.54	3987.70	3718.60	4093.95	157.81	131.05	226.98
15th October	4873.14	4650.38	4094.99	4539.50				4859.35	4647.79	4094.93	4534.02			
1st November	4475.94	4381.00	3791.68	4216.21				4472.04	4359.21	3774.40	4201.88			
Average (B)	4641.13	4360.79	3883.57					4635.64	4331.57	3862.64				
	Harvest index (HI %)													
1st October	28.36	26.77	23.81	26.31	2.15	1.18	2.05	28.83	26.62	24.52	26.66	1.67	1.20	2.07
15th October	29.32	28.97	25.33	27.87				29.58	29.34	25.80	28.24			
1st November	27.16	27.39	25.04	26.53				27.53	27.62	25.52	26.89			
Average (B)	28.28	27.71	24.73					28.65	27.86	25.28				
	100-weight seed (g)													
1st October	86.33	74.33	91.00	83.89	3.96	4.39	7.61	82.33	75.33	92.67	83.44	3.40	4.14	7.17
15th October	91.33	78.67	87.50	85.83				89.60	78.53	88.00	85.38			
1st November	81.50	67.33	86.00	78.28				82.00	67.67	85.00	78.22			
Average (B)	86.39	73.44	88.17					84.64	73.84	88.56				
	Number of seeds/pod													
1st October	5.67	3.67	3.83	4.39	0.77	0.57	0.99	5.42	3.67	4.17	4.42	0.53	0.53	0.92
15th October	5.50	4.77	3.83	4.70				5.87	4.33	3.67	4.62			
1st November	4.90	3.67	3.33	3.97				4.82	3.67	3.33	3.94			
Average (B)	5.36	4.04	3.66					5.37	3.89	3.72				

Table 3: Plant attributes of the three faba bean varieties as affected by planting dates and their interaction in both seasons.

A). Planting dates	Season 2021/2022							Season 2022/2023						
	B). Faba bean varieties			Average (A)	L.S.D. at 0.05			B). Faba bean varieties			Average (A)	L.S.D. at 0.05		
	Nubaria 1	Giza 716	Giza 843		A	B	AB		Giza 716	Giza 843		A	B	AB
	Number of pods/plants													
1st October	20.33	23.00	15.67	19.67	3.54	3.53	2.90	21.00	21.33	15.00	19.11	2.68	1.61	2.79
15th October	25.67	24.67	19.87	23.40				25.50	23.67	19.00	22.72			
1st November	24.27	19.43	18.33	20.68				21.93	19.33	19.33	20.20			
Average (B)	23.42	22.37	17.96					22.81	21.44	17.78				
	Pod length (cm)													
1st October	10.00	7.80	7.00	8.27	0.55	0.46	0.80	9.2	7.17	6.53	7.63	0.68	0.48	0.83
15th October	10.70	9.67	9.27	9.88				10.5	9.5	9.43	9.81			
1st November	9.43	7.67	7.33	8.14				8.37	7.53	6.83	7.58			
Average (B)	10.04	8.38	7.87					9.36	8.07	7.60				
	Number of branches/plants													
1st October	6.72	5.00	4.00	5.24	0.91	0.42	0.73	6.61	5.33	4.00	5.31	0.83	0.60	1.03
15th October	5.67	6.67	4.89	5.74				5.67	6.39	5.17	5.74			
1st November	4.89	4.56	4.56	4.67				4.78	4.56	4.83	4.72			
Average (B)	5.76	5.41	4.48					5.69	5.43	4.67				
	Seed protein content (%)													
1st October	24.88	21.33	20.67	22.29	1.14	1.51	2.61	24.17	22.33	21.17	22.56	1.25	1.89	2.17
15th October	25.79	22.63	22.71	23.71				25.33	21.65	21.67	22.88			
1st November	22.13	21.66	19.96	21.25				22.00	20.17	19.50	20.56			
Average (B)	24.27	21.87	21.11					23.83	21.38	20.78				
	Pod setting %													
1st October	43.68	45.43	29.88	39.66	9.06	5.26	9.11	48.55	39.83	35.16	41.18	5.41	2.38	4.11
15th October	70.15	49.32	45.17	54.88				63.22	52.6	44.22	53.35			
1st November	44.15	36.01	31.96	37.37				50.24	41.7	37.45	43.13			
Average (B)	52.66	43.59	35.67					54.00	44.71	38.94				

CONCLUSION:

The current study highlighted the significance of seeding at the right time to maximize the potential yield of faba bean varieties. According to the findings of these two growing season field studies, the yield, and components of the faba bean crop increased with the planting of Nubaria 1 on October 15th, which also recorded the highest yield and components when compared to the other cultivars (Giza 843 and Giza 716) under study conditions at Nubaria Region, Alexandria Governorate, Egypt.

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