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Response of Faba Beans (*Vicia faba* L.) to Seeding Date in Central Region of Saudi Arabia

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Abstract. Two faba bean cultivars, viz., Giza 3 and X77TA66, were seeded at four planting dates (15 Oct., 30 Oct., 15 Nov., and 1 December) at Deirab Agricultural Experimental Station, King Saud University, in the winter seasons of 1988/89 and 1989/90. Analysis of variance for seed yield indicated that the effect of seeding date was highly significant (P=0.01). The early seeding resulted in significantly higher seed yield and total dry matter. However, late seeding resulted in a 62% and 46% decrease in yield for the early versus late seeding comparison of Giza 3 and X-77TA66, cultivars, respectively. Also, the harvest index values significantly declined with delayed seeding. Therefore, the decrease in seed yield with a delay in planting was due to a significant decline in total dry matter production and to the inefficient translocation of the photosynthates to the seeds.

Introduction

Faba bean is grown over a wide range of latitudes (15-60 N) and the suitable temperature requirement for growth ranges between 10–30°C. The crop grows where altitude and latitude combinations permit these temperatures [1, pp. 155-156]. However, little is known about the major environmental factors which regulate the phenological development of the crop [2, pp. 189-208]. They suggested a quantitative long-day photoperiod; i.e., the crop is responsive for long day and vernalization. However, constant temperature above 23°C can inhibit flowering [3]. Wide diurnal fluctuations may also inhibit flowering [4].

The agroclimatic conditions of Saudi Arabia are mostly arid and semi-arid. Consequently, successful agriculture production is practiced under irrigtion in several regions. The climatic conditions allow a number of crops to be grown in winter and/or summer seasons, with the possibility of establishing double or triple cropping. The present pattern of land use is characterized by the predominance of wheat and barley, but an almost complete absence of seed legumes. Therefore, the inclusion of these legumes such as faba bean, in a crop rotation would improve the cropping system and provide more crude protein for human and animal feeding.

The importance of seeding date may be considered simply in terms of the time available for biomass production and hence, the production of seed yield. It was found that the longer the growing season, the higher the crop yield [5,6]. In Egypt, Salem [7] pointed out that late sowing delayed flowering and reduced the number of flowers, pods, seed yield and 100-seed weight. He concluded that seed and straw yields progressively decreased with delaying sowing date from the last week of October until the third week of December at Sharkia Province in lower Egypt.

Abu-salih *et al.* [8] showed that delaying the sowing of faba beans after October greatly lowered the yield of seeds as a result of increased infestation by aphids and the incidence of Sudanese broad bean mosaic virus.

There is little information on the effect of seeding date on growth and yield of faba bean in the Central Region of Saudi Arabia. The present study was performed to test the effect of seeding date on the yield and yield components of two faba bean cultivars grown under Riyadh conditions.

Materials and Methods

The experiment was conducted for two consecutive winter seasons (1988/89 – 1989/90) at the Experimental Fields of the College of Agriculture, KSU, Riyadh, Deirab (24 42 N, 44 46 E, 600 m Alt.). The soil of the experimental site is highly calcareous, sandy loam in texture with a pH of 7.6, low in available nitrogen (90 Kg/ha) and phosphorus (10 Kg/ha) and medium in available potassium (130 Kg/ha). The climate is tropical to sub-tropical with hot summer and cool winter. The split-plot design with four replications was used in both seasons. The main plots were assigned to two cultivars (Giza 3 and X77TA66, introduced from ICARDA) and the sub-plots to four planting dates (15 October, 30 October, 15 November, and 1 December). Sub-plots were 5 m long, four rows wide, spaced a 50-cm. Seeds were sown in hills, 20 cm apart.

Prior to planting, seeds were treated with the recommended insecticides and fungicides. Fertilizers were applied at the rate of 50, 50 and 15 kg/ha of N, P and K, respectively, two weeks after planting. Since the soil was virgin and inoculants were absent, another dose of N, 120 kg/ha, was applied one month later. Weeding and harvest were both done by hand. Flood irrigation was applied.

For each sub-plot, days to flowering (DF) was calculated as the number of days from seeding until when 50% of the plants flowered, days to maturity (DM) was calculated as the number of days from seeding until when 90% of the plants reached

maturity, plant height (PH) was measured in cm as the average height of plants at the maximum growth, and seed yield (SY) and weight of 100 seeds (SW) were recorded from the two 3-m long central rows of each sub-plot. Data obtained were statistically analyzed according to Little and Hills [9, p. 350].

Results and Discussion

Seed yield was significantly affected by seeding date and cultivars in both seasons. Interaction of dates X cultivars was significant at P=0.05. When the data were combined over seasons, season and date, but not cultivar were all significant (Table 1).

Yield declined significantly with delay in seeding date in both years (Table 2). Late seeding resulted in a 62% and 46% decrease in yield for the early versus late sowing comparison for Giza 3 and X-77 cultivars, respectively. From Table 3, it is clear that seeding date was highly and negatively corrected with seed yield (r=–0.804). These findings are similar to those of Kondra [10] who found yield reductions of nearly 60% with a 4-wk delay in seeding.

Total dry matter production (TDM) paralleled yield and declined significantly with delay in seeding date in both years (r=–0.529). The decline in TDM from early to late seeding was about 33%. This decline in dry matter production was due mainly to the reduction in plant height as a result of seeding too late. From Table 3, it is clear that PH negatively and highly significant affected by seeding date (r=–0.865). The decrease in seed yield with delay in planting was therefore due, in large part, to the decline in TDM, but was also due to a significant decline in harvest index (HI) with delay seeding date for both years. HI declined by 31% for the early versus late seeding date (Table 1). Thus, later planted faba bean was less efficient at converting dry matter into seed yield. Furthermore, 100-seed weight declined significantly with delay in seeding date. The mean reduction was about 11% of the early versus the late planting. These results are in agreement with those of Rowland [11] who found that a 3-wk delay in seeding did not affect 1000-seed weight in 2 out of 3 yr, but did result in a significant decrease in 1000-seed weight in the third year of the experiment.

Delays in seeding date significantly increased days to 50% flowering (DF) but reduced the number of days to maturity (DM) for each successive planting date in both seasons (Table 1) with r=0.619 and –0.929 for DF and DM, respectively. For late versus early planting date comparisons, DF increased about 6 days. On the other hand, DM declined by 24 days for the late versus early seeding date comparisons. These significant reduction in number of days to maturity (DM) parallel significant

Table 1. Effect of seeding date, cultivars, and growing season on some agronomic characteristics.

Source	DF	DM	FP	PH	TDM	SY	100SW	HI
	days	days	days	cm	t/ha	t/ha	gm	
Seeding Date								
15 Oct.	54.19	170.69	116.50	86.31	13.73	3.85	82.01	0.29
30 Oct.	55.50	165.81	110.31	75.88	12.55	3.36	82.49	0.27
15 Nov.	57.00	156.25	99.25	55.25	10.48	2.13	79.51	0.21
1 Dec.	60.69	146.69	86.00	48.63	9.16	1.74	73.39	0.20
LSD .05	1.17	1.50	1.70	4.35	1.74	0.39	5.11	0.03
Cultivars								
Giza 3	55.03	158.66	103.63	67.91	11.22	2.47	79.22	0.24
X77TA66	58.66	161.06	102.40	65.12	11.74	2.80	79.48	0.24
LSD .05	0.83	1.06	1.20	NS	NS	NS	NS	NS
Season								
1988-89	57.19	158.66	101.47	62.69	13.03	3.05	77.55	0.24
1989-90	56.50	161.06	104.56	70.34	9.92	2.92	81.14	0.24
LSD .05	NS	1.06	1.2	3.08	1.23	0.28	3.62	NS

DF : Days to flowering
DM: Days to maturity
FP : Filling period
PH : Plant height
SY : Seed yield
SW : Weight of 100 seeds
TDM : Total dry matter
HI : Harvest index

Table 2. Effect of seeding date on seed yield (t/ha) of two faba bean cultivars

Seeding	Giza 3			X77TA66		
date	1988-89	1989-90	Mean	1988-89	1989-90	Mean
15 Oct.	4.00	4.17	4.09	3.81	3.42	3.61
30 Oct.	3.71	3.02	3.36	3.41	3.29	3.35
15 Nov.	2.49	1.49	1.99	2.71	1.84	2.27
1 Dec.	2.03	1.04	1.54	2.25	1.64	1.94
Mean	3.06	2.43	2.75	3.05	2.55	2.79

LSD 0.05: for seeding date = 0.39
for cultivars = NS

reduction in biological yield and seed yield in both years (r=0.436 and 0.733, respectively). These results are almost in agreement with those reported by Rowland [11] and McVetty *et al.* [12].

Moreover, there were significant differences between the two growing seasons and between the two cultivars, almost for all traits. These differences were expected as a result of the direct effect of the environmental conditions on plant response.

In conclusion, delays in seeding date reduced yields of faba beans significantly via significant reductions in both total dry matter production and harvest index. The reduction in HI indicated that later planted faba bean was less significant at converting dry matter into seed yield. Seeding date is thus an importlant factor to consider in maximizing faba bean yields in Centarl Region of Saudi Arabia.

Table 3. Correlation matrix for all the studied parameters.

Trials	D	DF	DM	FP	PH	TDM	SY	SW	HI
Cultivar (CV)	0.000	0.479**	0.123	–0.050	–0.080	0.078	0.026	0.016	–0.019
Seeding Date (D)		0.619**	–0.929**	–0.943**	–0.865**	–0.529**	–0.804**	–0.399**	–0.614**
Days to flowering (DF)			–0.500**	–0.715**	–0.572**	–0.265**	–0.491**	–0.292**	–0.431**
Days to maturity (DM)				0.963**	0.393**	0.436**	0.733**	0.408**	0.619**
Filling period (FP)					0.828**	0.435**	0.745**	0.420**	0.634**
Plant height (PH)						0.393**	0.668**	0.442**	0.549**
Total dry matter (TDM)							0.743**	0.294**	0.087**
Seed yield (SY)								0.357**	0.714**
100 Seed weight (SW)									0.204

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استجابة الفول لموعد الزراعة تحت ظروف المنطقة الوسطى للمملكة العربية السعودية

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ملخص البحث. أجريت تجربتان في محطة الأبحاث والتجارب الزراعية بديراب في موسمي ١٩٨٨/١٩٨٩، ١٩٨٩/١٩٩٠م لدراسة تأثير موعد الزراعة (١٥ أكتوبر، ٣٠ أكتوبر، ١٥ نوفمبر، ١ ديسمبر) على النمو ومحصول صنفين من الفول (جيزة ٣، X77TA66). وقد أوضحت النتائج المتحصل عليها أن تأخير موعد الزراعة أدى إلى انخفاض إنتاجية المادة الجافة والمحصول، بالإضافة إلى انخفاض قيمة دليل الحصاد. ويُعزى انخفاض المحصول أساسًا إلى انخفاض الإنتاجية من المادة الجافة وإلى انخفاض كفاءة النباتات في نقل وتوزيع نواتج البناء الضوئي إلى البذور.