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INFLUENCE OF SOWING DATE AND PLANT SPACING ON GROWTH AND DRY SEED YIELD OF THREE BEAN *"PHASEOLUS VULGARIS L"* CULTIVARS IN ATUMUN SEASON UNDER ASSIUT CONDITIONS.

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Abstract: The present study was conducted at the Experimental Farm, Faculty of Agriculture, Assuit University, Assiut, during autumn of 2004 and 2005 seasons to study the effect of sowing date and plant spacing on dry seed yield (pulse) in three common bean cultivars (*Phaseolus vulgaris* L.) (Giza 6, Swiss Blanc and Nebraska). Plant spacings tested were 10, 20 and 30cm. Significant differences among cultivars were found in most studied traits. Nebraska cultivar was the earliest to produce mature dry seeds, gave the greatest records for pods/plant, dry seed yield/plant and the highest calculated seed yield/fed. Plants sown on Sept., 15, Sept., 18 gave the best potential for number of pods/plant, percentage of final plant stand, percentage of seed germination and seed yield /plant. Plants sown at 10 cm gave the highest values for dry seed yield (kg/fed.). Plants sown at 30 cm gave the highest values for percentage of final plant stand, pods/plant, and seed yield/plant.

Key words: *Phaseolus vulgaris* L., seed yield, sowing date, spacing.

Introduction

Common bean (*Phaseolus vulgaris* L.) is one of the popular leguminous crops, and considered as one of the most important vegetable crops in Egypt for both local marketing (pulse & green pods) and exportation (green pods). The acreage of dry bean (pulse) in Egypt during 2004 was about 41100 Feddan, which produce about 50355 tons of dry seed beans, with an average of 1.23 ton /feddan.

Dry beans (pulse) are important for the human nutrition in Egypt, where middle and low income families are often unable to have a sufficient animal protein for their feeds. Common bean is a warm-season crop. However, it is very sensitive to cold weather and high temperature. The best range of temperature for its growth is from 15°to 25°C (Inoue and Suzuki 1959 and Konsens et. l. 1991).

Environmental conditions in Assiut are less favourable to the growth and development of bean plants. Temperature is high all over the day and low all over the night. The differences between day

and night temperature are wide (Table 1). Gross and Kigel (1994) reported that high temperature (32/27°c day/ night) resulted in both lower pollen viability and impaired female performance in most flowers. Konsens *et. al.* (1991) reported that under 32/27°c day/night temperature abscission of flowers and young-pods (<3cm) happened. Mohamed (1997) and Faure *et.al.* (1988) reported significant differences among the cultivars they tested regarding days to flower and seed yield. Miranda and pettenazzi (1996) and Siviero *et.al.* (1985) found differences among cultivars regarding seed yield. Therefore, testing the proper sowing date as well as the suitable plant spacing for better growth of bean plant and dry seed yield were the objective of this work. Three cultivars of bean were used in this study.The objective of the present work is to study the optimum planting date to produce dry bean seed under Assiut conditions.

Materials and methods

Field experiments were conducted during the two consecutive seasons of 2004/2005 and 2005/2006 in the clay soil of the Experimental Farm, Faculty of Agriculture, Assuit University, Assiut; to study the effect of sowing dates and plant spacing on three common bean cultivars i.e, Giza 6, Nebraska (Mecca seed-company. Egypt) and Swiss Blane (El korma seed-company. Egypt). sowing dates were Aug., 25, Sept., 15 and Oct., 10 in 2004 and Aug., 28, Sept., 18 and Oct., 15 in 2005 year. The plant spacings studied were 10, 20 and 30 cm within each planting date.

Experiments were laid out in a split-split plot design with three replicates where the cultivars contributed as the main plots, while the plant spacing and sowing dates were assigned in the sub and sub-sub plots, respectively.

For preparing the experimental site, the soil was ploughed and ridged at 60 cm apart. Three ridges of 3.5 m long were included in each plot (1/600 fed.). Prior to sowing, seeds were inoculated by Rhizobium (ARC, Dokke, and Giza). Wet planting method was followed at all sowing dates.

Sowing was done on northern and southern side at the summer and autumn plantings, respectively. Four to five seeds were placed per hill at the tested plant spacing. After complete emergence, plants were thinned to two plants per hill.The normal agricultural practices i.e., irrigation, tillage, fertilization, weeding and pest control were followed as recommended for dry bean production.

Data Recorded:

1-Time to maturity (days): Number of days to develop about 50% plants bearing dry pods.

2-Percentage of final plant stand: After plant thinned, it was calculated on plot basis as

$$\frac{\text{Number of plants survived}}{\text{Total number of plants emerged}} \times 100$$

3.-Number of pods/plant; All pods in each plot were counted and averaged by total number of plants survived.

4.-Dry seed yield /plant (g.): Calculated as:

$$\frac{\text{Total dry seed yield obtained from each plot}}{\text{Total number of plants survived in the same plot}}$$

5- Total dry yield (kg. /fed.): Estimated on plot basis.

Data on average daily temperature and Relative Humidity (R.H) prevailing during the Experimental period are indicated in Table (1).

Statistical Analysis:

All data were subjected to statistical analysis according to Gomez and Gomez, 1984. The least significant differences (L. S. D) at 5% was used for testing the significance of the differences among the mean values of the tested cultivars, sowing dates, plant spacings and their interactions .

Experimental results and discussion

Date of maturity:

Average number of days lapsed to develop about 50% plants bearing dry pods in the tested cultivars of common bean as affected by plant spacing and sowing date is presented in Table 2 . Significant differences were found among cultivars during both seasons. Nebraska cv. was generally the earliest cultivar to mature in all seasons and dates.

The effect of plant spacing on maturity date was significant during all seasons. Plants of October sowing were the earliest to mature, while those of August plantings were the latest during both seasons. Significant cultivars x sowing date interaction was found .Each cultivar had different response according to sowing date.

Percentage of final plant stand:

The performance of the tested cultivars regarding percentage of final plant stand is presented in Table 3. Significant differences were found. Nebraska cv. was the highest in number of plant survived. Plant spacing insignificantly affected percentage of final plant stand in all tested treatments. There were significant effect for planting date on percentage of final plant stand was obvious during both seasons. Plants sown on Oct.,10 and 18 was the greatest although plants were subjected to the chilling hazarders prevailed during December resulting in no flowering and fruiting during both seasons respectively. Plants sown on Aug. 25 and 28 during both seasons respective showed the lowest number of plant survived..

Number of pods/plant:

Average number of pods per plant in the tested cultivars of common bean as effected by plant spacing and sowing dates is presented in Table 4. Significant differences among cultivars were

Table(1): Average day and night temperature (°C) and Relative Humidity (R.H) prevailed during the Experimental period in and Autumn seasons in 2004 and 2005.

Season	2004						2005					
Experimental period	H. Temp.	L. Temp.	Aver. Day Temp.	Aver. Night Temp.	Aver. High R.H	Aver. Low R.H	H. Temp.	L. Temp.	Aver. Day Temp.	Aver. Night Temp.	Aver. High R.H	Aver. Low R.H
Aug.	41.6	19.8	36.9	27.2	70	31	41.4	12	37.5	22.8	73	31
Sept.	40.6	16.8	35.6	19.5	72	29	38.4	12.8	35.4	17.6	75	30
Oct.	37.4	16.2	34.1	17.1	72	28	36.4	15.7	32.8	18.8	79	28
Nov.	35.4	5.6	28.7	11.8	81	35	33.6	7	26.3	9.5	82	34
Dec.	25.8	4.6	21.5	6.6	90	39	32.7	5.6	22	8.4	92	43

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Table(2): Maturity date (days) in three cultivars of common bean as affected by plant spacing and sowing date during the autumn planting of 2004 and 2005 seasons.

Cultivar, (A)	Plant Spac., (cm) (B)	Sowing date, (C) 2004 season				Sowing date,(C) 2005 season			
		Aug., 25	Sept, 15	Oct.,10	Mean	Aug.,28	Sept.,18	Oct.,15	Mean
Giza 6	10	119.00* (10.90)**	109.33 (10.46)	0 (0.71)	76.11 (7.36)	114.00 (10.65)	104.33 (10.22)	0 (0.71)	72.78 (7.19)
	20	117.33 (10.85)	105.33 (10.29)	0 (0.71)	74.22 (7.25)	112.33 (10.60)	104.33 (10.20)	0 (0.71)	72.22 (7.17)
	30	117.33 (10.80)	104.67 (10.25)	0 (0.71)	74.00 (7.25)	109.67 (10.48)	101.67 (10.05)	0 (0.71)	70.45 (7.08)
Mean		117.89 (10.85)	106.44 (10.33)	0 (0.71)	74.78 (7.30)	112.00 (10.58)	103.44 (10.16)	0 (0.71)	71.82 (7.15)
Swiss Blanc	10	114.67 (10.68)	106.00 (10.32)	0 (0.71)	73.56 (7.24)	112.33 (10.58)	104.33 (10.25)	0 (0.71)	72.22 (7.18)
	20	113.67 (10.66)	108.00 (10.42)	0 (0.71)	73.33 (7.26)	110.33 (10.50)	103.67 (10.20)	0 (0.71)	71.33 (7.13)
	30	112.67 (10.58)	107.33 (10.34)	0 (0.71)	73.33 (7.21)	109.67 (10.50)	102.33 (10.17)	0 (0.71)	70.67 (7.13)
Mean		113.67 (10.64)	107.11 (10.36)	0 (0.71)	73.59 (7.24)	110.78 (10.53)	103.44 (10.21)	0 (0.71)	71.40 (7.15)

Table(2): cont,

Cultivar, (A)	Plant Spac., (cm) (B)	Sowing date, (C) 2004 season				Sowing date,(C) 2005 season			
		Aug., 25	Sept, 15	Oct.,10	Mean	Aug.,28	Sept.,18	Oct.,15	Mean
Nebraska	10	112.33	97.67	0	70.22	110.33	99.00	0	69.78
		(10.60)	(9.88)	(0.71)	(7.06)	(10.50)	(10.00)	(0.71)	(7.07)
	20	112.00	98.00	0	70.00	111.67	97.00	0	70.22
		(10.90)	(9.90)	(0.71)	(7.17)	(10.58)	(9.90)	(0.71)	(7.06)
	30	111.33	97.67	0	97.67	112.33	97.67	0	70.00
		(10.54)	(9.89)	(0.71)	(7.05)	(10.63)	(9.90)	(0.71)	(9.08)
Mean		111.89	97.78	0	69.67	111.59	97.89	0	70.00
		(10.68)	(9.89)	(0.71)	(7.09)	(10.57)	(9.93)	(0.71)	(7.07)
B X C	10	115.33	104.33	0	73.22	112.22	102.55	0	71.59
		(10.73)	(10.22)	(0.71)	(7.22)	(10.58)	(10.16)	(0.71)	(7.15)
	20	114.33	103.78	0	72.70	111.44	101.67	0	71.04
		(10.80)	(10.20)	(0.71)	(7.24)	(10.56)	(10.10)	(0.71)	(7.12)
	30	113.78	103.22	0	72.33	110.56	100.56	0	73.70
		(10.64)	(10.17)	(0.71)	(7.17)	(10.54)	(10.04)	(0.71)	(7.10)
Mean		114.48	103.78	0		111.41	101.59	0	
		(10.72)	(10.20)	(0.71)		(10.56)	(10.10)	(0.71)	
L.S.D 0.05		A = 0.49	B = 1.00	C = 1.28		A = N.S	B = N.S	C = 3.02	
		AB = 0.62	BC = N.S			AB = 2.13	BC = N.S		
		AC = 0.74	ABC =0.50			AC = N.S	ABC = N.S		

*, ** Original (upper) and transformed (down) data ,respectively

Table(3): Perecntages of final plant stand in three cultivars of common bean as affected by plant spacing and sowing date during the autumn planting of 2004 and 2005 seasons.

Cultivar, (A)	Plant Spac., (cm)(B)	Sowing date, (C) 2004 season				Sowing date,(C) 2005 season			
		Aug., 25	Sept.,15	Oct.,10	Mean	Aug.,28	Sept.,18	Oct.,15	Mean
Giza 6	10	66.34* **(54.80)	82.33 (65.40)	86.44 (68.40)	78.37 (62.86)	56.04 (48.46)	74.73 (59.82)	84.67 (67.04)	71.81 (58.44)
	20	75.12 (60.65)	82.82 (66.15)	85.33 (67.68)	81.09 (64.83)	62.43 (52.22)	69.21 (57.37)	80.44 (63.76)	70.69 (57.78)
	30	73.72 (59.33)	86.26 (68.11)	80.89 (64.07)	80.29 (63.84)	42.70 (40.80)	57.17 (49.12)	81.84 (64.81)	60.57 (51.58)
Mean		71.73 (58.26)	80.47 (66.55)	84.22 (66.72)	78.81 (63.84)	53.72 (47.16)	67.04 (55.44)	82.32 (71.04)	67.69 (57.88)
Swiss Blanc	10	58.17 (49.49)	76.19 (60.80)	87.00 (68.90)	73.79 (59.73)	74.68 (59.87)	73.54 (59.09)	76.78 (61.19)	75.00 (60.05)
	20	65.25 (56.11)	84.24 (66.65)	85.44 (67.54)	78.31 (63.43)	66.58 (54.71)	72.90 (58.86)	78.56 (62.63)	72.68 (58.73)
	30	68.71 (56.29)	76.06 (60.80)	81.00 (64.17)	75.26 (60.42)	65.28 (54.04)	71.57 (58.03)	80.98 (64.35)	72.61 (58.81)
Mean		64.04 (53.96)	78.83 (62.75)	84.48 (66.87)	75.79 (61.19)	68.85 (56.21)	72.67 (58.66)	78.77 (62.72)	73.43 (59.20)

Table(3): cont.

Cultivar, (A)	Plant Spac., (cm)(B)	Sowing date, (C) 2004 season				Sowing date,(C) 2005 season			
		Aug., 25	Sept.,15	Oct.,10	Mean	Aug.,28	Sept.,18	Oct.,15	Mean
Nebraska	10	71.04 (57.48)	78.83 (62.33)	92.22 (73.97)	80.53 (64.57)	76.69 (61.17)	73.83 (59.23)	78.55 (62.41)	76.36 (60.94)
	20	68.49 (55.98)	75.45 (60.33)	84.89 (67.15)	76.28 (61.15)	75.13 (60.07)	62.12 (52.03)	87.89 (66.69)	75.05 (59.60)
	30	73.14 (58.79)	81.55 (64.66)	81.11 (64.25)	78.60 (62.57)	59.11 (51.87)	71.00 (57.78)	84.67 (66.96)	71.59 (58.87)
Mean		70.89 (57.42)	78.45 62.44)	86.07 (68.44)	78.47 (62.77)	70.31 (57.70)	68.98 (56.35)	83.70 (65.35)	74.33 (59.80)
B X C	10	65.18 (53.92)	78.95 (62.84)	88.55 (70.42)	77.56 (62.39)	69.14 (56.50)	74.03 (59.38)	80.00 (63.55)	74.39 (59.81)
	20	69.62 (57.58)	81.98 (64.38)	85.22 (67.46)	78.94 (63.14)	68.05 (55.67)	68.08 (56.09)	82.30 (64.33)	72.81 (58.70)
	30	71.86 (58.14)	81.29 (64.52)	81.00 (64.16)	78.05 (62.27)	55.70 (48.90)	66.58 (54.98)	82.50 (65.37)	68.26 (56.42)
Mean		68.89 (56.55)	80.74 (63.91)	84.92 (67.35)		64.30 (53.69)	69.56 (56.82)	81.60 (64.42)	
L.S.D 0.05		A = 2.65 AB = N.S AC = N.S	B = N.S BC= 2.17 ABC = N.S	C =5.45		A = 2.42 AB = N.S AC = N.S	B = N.S BC =3.70 ABC =2.57	C = 6.05	

*, ** Original (upper) and transformed (down) data ,respectively

found. Nebraska cv. produced the greatest number of pods/plant, while Swiss Blanc cv. followed by Giza 6 cv. gave the lowest values during both seasons. Significant effect for planting date on number of pods/plant was clear in Table 4. In both seasons, average number of pods/plants for plants sown Sept.15 was the greatest. All forms of the interaction effects among the studied factors were significant, except for the interaction cultivar x plant spacing in the 2nd season.

Balathier (1987) in comparisons for *Phaseolus vulgaris L.* cultivars reported that number pods/plant decreased and pods/m² increased with increasing plant density and decreasing spacing, while insignificant differences in seed yield were found. Ozcan and Ozdemir (1996) reported that An increase above 40x10 cm spacing in within-row spacing increased pod number /plant, seed/plant and seed number per unit area more closely related to seed yield at higher plant densities. Mozumder *et al* (2003) reported that wider spacing gave higher number of pods and pod yield per plant, but closer spacing gave higher number of pods and pod yield per unit area.

Seed yield /plant:

Table 5 shows data concerning seed yield/plant during autumn planting of both seasons of study. Significant differences among cultivars were found. On average, Nebraska cultivar produced the greatest yield/plant, while the lowest seed yield/plant was obtained from Swiss Blanc and Giza cultivars in the 1st and 2nd seasons, respectively.

However, this trait was significantly affected by plant spacing. Significant effect for planting date on seed yield/plant was obvious during both seasons. Average of seed yield/plant for plants sown on September 15 was the greatest, while plants sown on October 18 failed to produce dry seed yield. All forms of the interaction effects among the studied factors were significant, except for the cultivar x plant spacing interaction. However, plants sowing on Sept. 15 at 30 cm. spacing significantly enhanced production of dry seed yield/plant (11.08 gr.). Thus, Nebraska cultivar sown on Sept. 15 at 30 cm spacing produced the greatest seed yield/plant (16.64 gr.), while all of the tested cultivars failed to give dry seed yield when sown on October.

Arias (1980) found that seed yields/plant was highest (12.5 g/plant) at the lowest density (10 cm between plants in rows 60 cm apart), and decreased with increasing plant density. Seed yields/ha were highest with plants 5 or 10 cm apart in rows 30 cm apart (2839 and 2826 kg/ha, respectively).

Table (4): Number of pods/plant for three cultivars of common bean as affected by plant spacing and sowing date during the autumn planting of 2004 and 2005 seasons.

Cultivar (A)	Plant Spac. (cm) (B)	Sowing date, (C) 2004 season				Sowing date,(C)2005 season			
		Aug.,25	Sept.,15	Oct.,10	Mean	Aug.,28	Sept.,18	Oct.,15	Mean
Giza 6	10 cm	4.89* **(2.72)	6.00 (2.86)	0.5 (0.71)	3.80 (2.10)	3.67 (2.04)	6.51 (2.64)	0.5 (0.71)	3.56 (1.80)
	20 cm	5.04 (2.74)	6.57 (3.30)	0.5 (0.71)	4.04 (2.25)	3.75 (2.05)	3.94 (2.10)	0.5 (0.71)	2.73 (1.62)
	30 cm	9.36 (3.14)	8.92 (3.06)	0.5 (0.71)	6.26 (2.30)	4.27 (2.18)	7.09 (2.07)	0.5 (0.71)	3.95 (1.66)
Mean		6.43 (2.87)	7.16 (3.07)	0.5 (0.71)	4.70 (2.22)	3.90 (2.09)	5.85 (2.27)	0.5 (0.71)	3.42 (1.69)
Swiss Blanc	10 cm	4.82 (4.57)	10.61 (3.33)	0.5 (0.71)	5.31 (2.11)	3.50 (2.00)	3.99 (2.12)	0.5 (0.71)	2.66 (1.61)
	20 cm	4.57 (2.25)	7.41 (2.76)	0.5 (0.71)	4.16 (1.91)	4.70 (2.26)	6.69 (2.67)	0.5 (0.71)	3.96 (1.88)
	30 cm	3.08 (1.89)	7.07 (2.75)	0.5 (0.71)	3.55 (1.78)	4.40 (2.21)	8.98 (3.07)	0.5 (0.71)	4.63 (1.99)
Mean		4.16 (2.14)	8.36 (2.95)	0.5 (0.71)	4.34 (1.93)	4.20 (2.16)	6.55 (2.62)	0.5 (0.71)	3.75 (1.83)

Table (4): cont.

Cultivar (A)	Plant Spac. (cm) (B)	Sowing date, (C) 2004 season				Sowing date,(C)2005 season			
		Aug.,25	Sept.,15	Oct.,10	Mean	Aug.,28	Sept.,18	Oct.,15	Mean
Nebraska	10 cm	5.44 (2.42)	7.73 (2.87)	0.5 (0.71)	4.56 (2.00)	3.99 (2.11)	6.29 (2.61)	0.5 (0.71)	3.59 (1.77)
	20 cm	6.90 (2.71)	10.15 (3.26)	0.5 (0.71)	5.85 (2.23)	5.99 (2.54)	6.99 (2.72)	0.5 (0.71)	4.49 (1.99)
	30 cm	10.90 (3.37)	17.24 (4.20)	0.5 (0.71)	9.55 (2.70)	11.25 (3.43)	11.68 (3.49)	0.5 (0.71)	7.81 (2.54)
Mean		7.75 (2.83)	11.71 (3.44)	0.5 (0.71)	6.57 (2.33)	7.08 (3.84)	8.32 (2.94)	0.5 (0.71)	5.30 (2.10)
B x C	10 cm	5.05 (2.48)	8.11 (3.02)	0.5 (0.71)	4.55 (2.07)	3.72 (2.05)	5.60 (2.46)	0.5 (0.71)	3.27 (1.74)
	20 cm	5.50 (2.57)	8.04 (3.11)	0.5 (0.71)	4.68 (2.13)	4.81 (2.18)	5.87 (2.42)	0.5 (0.71)	3.73 (1.78)
	30 cm	7.78 (2.80)	11.08 (3.34)	0.5 (0.71)	6.45 (2.28)	6.64 (2.61)	9.25 (2.88)	0.5 (0.71)	5.46 (2.07)
Mean		6.11 (2.62)	9.08 (3.16)	0.5 (0.71)		5.06 (2.31)	6.91 (2.61)	0.5 (0.71)	
L.S.D 0.05		A = 0.40 AB = 0.16 AC = 0.22	B =N.S BC = 0.19 ABC = 0.14	C = 0.35		A = 0.18 AB = N.S AC = 0.21	B = N.S BC = 0.22 ABC =0.12	C = 0.24	

*, ** Original (upper) and transformed (down) data ,respectively

Table(5): Seed yield/plant (g) in three cultivars of common bean as affected by plant spacing and sowing date during the autumn planting of 2004 and 2005 seasons.

Cultivar, (A)	Plant Spac., (cm) (B)	Sowing date, (C) 2004 season				Sowing date,(C) 2005 season			
		Aug.,25	Sept.,15	Oct.,10	Mean	Aug., 28	Sept., 18	Oct.,15	Mean
Giza 6	10	*7.98 **(2.90)	8.33 (2.96)	0.50 (0.71)	5.44 (2.19)	4.47 (2.23)	7.68 (2.85)	0.50 (0.71)	4.05 (1.93)
	20	8.38 (2.97)	11.78 (3.50)	0.50 (0.71)	6.72 (2.39)	4.83 (2.31)	4.82 (2.30)	0.50 (0.71)	3.22 (1.77)
	30	11.52 (3.47)	9.42 (3.14)	0.50 (0.71)	6.98 (2.44)	5.20 (2.39)	7.63 (2.85)	0.50 (0.71)	4.28 (1.98)
Mean		9.29 (3.11)	9.84 (3.20)	0.50 (0.71)	6.38 (2.34)	4.83 (2.31)	6.71 (2.67)	0.50 (0.71)	3.85 (1.89)
Swiss Blanc	10	6.08 (2.56)	10.72 (3.35)	0.50 (0.71)	5.60 (2.21)	4.67 (2.27)	5.03 (2.35)	0.50 (0.71)	3.23 (1.78)
	20	5.65 (2.48)	8.85 (3.01)	0.50 (0.71)	4.83 (2.07)	6.47 (2.63)	7.63 (2.85)	0.50 (0.71)	4.70 (2.06)
	30	3.56 (2.01)	7.18 (2.77)	0.50 (0.71)	3.58 (1.83)	5.87 (2.52)	10.57 (3.32)	0.50 (0.71)	5.48 (2.18)
Mean		5.10 (2.35)	8.92 (3.04)	0.50 (0.71)	4.67 (2.03)	5.67 (2.47)	7.74 (2.84)	0.50 (0.71)	4.47 (2.01)

Table(5): cont.

Cultivar, (A)	Plant Spac., (cm) (B)	Sowing date, (C) 2004 season				Sowing date,(C) 2005 season			
		Aug.,25	Sept.,15	Oct.,10	Mean	Aug., 28	Sept., 18	Oct.,15	Mean
Nebraska	10	6.80 (2.68)	8.55 (3.01)	0.50 (0.71)	5.12 (2.13)	5.04 (2.36)	6.96 (2.73)	0.50 (0.71)	4.00 (1.93)
	20	8.20 (3.00)	10.94 (3.38)	0.50 (0.71)	6.38 (2.34)	7.82 (2.88)	8.48 (2.98)	0.50 (0.71)	5.43 (2.19)
	30	12.97 (3.66)	16.64 (4.13)	0.50 (0.71)	9.87 (2.83)	12.37 (3.59)	12.74 (3.64)	0.50 (0.71)	8.37 (2.65)
Mean		9.32 (3.11)	12.04 (3.51)	0.50 (0.71)	7.12 (2.44)	8.41 (2.99)	9.39 (3.12)	0.50 (0.71)	5.93 (2.26)
B X C	10	6.95 (2.71)	9.20 (3.11)	0.50 (0.71)	5.55 (2.18)	4.73 (2.29)	6.56 (2.64)	0.50 (0.71)	3.93 (1.88)
	20	7.41 (12.82)	10.52 (3.30)	0.50 (0.71)	6.14 (2.28)	6.37 (2.61)	6.98 (2.71)	0.50 (0.71)	4.62 (2.01)
	30	9.35 (3.05)	11.08 (3.35)	0.50 (0.71)	6.98 (2.37)	7.81 (2.83)	10.31 (3.27)	0.50 (0.71)	6.21 (2.27)
Mean		7.90 (2.86)	10.27 (3.25)	0.50 (0.71)		6.30 (2.58)	7.95 (2.74)	0.50 (0.71)	
L.S.D 0.05		A =0.37 AB = 0.16 AC = 0.26	B = N.S BC = 0.28 ABC =0.15	C = 0.37		A = 0.26 AB = N.S AC = 0.16	B = N.S BC = 0.15 ABC = 0.10	C = 0.24	

*, ** Original (upper) and transformed (down) data , respectively .

Seed yield (kg/fed):

Table 6 shows data concerning seed yield. Differences among cultivars were significant. As an average, the tested plant spacing all over the studied sowing dates, Nebraska cv. produced the highest seed yield, while Swiss blane produced the lowest yield. Sowing date significantly affected seed yield, plants sown on Sept.,15 and 18 gave the highest seed yield (592.78 and 295.24kg/fed. respectively), while plants sown on Oct. failed to give yield.All forms of the interaction effects among the studied factors were significant, except for the cultivars x plant spacing interaction in the 2nd season. However. plants sown on September followed by August at 10 cm spacing gave the highest seed yield comparing with October planting, Nebraska cv. produced the highest seed yield, when plants sown on Sept.,15 and /or 18 at 10 cm spacing (824.71 and 414.53 kg./fed., respectively) during both seasons, respectively.

This response is in harmony with Abrahim (2002) who reported that the genotypes Vivian and S1 should be planted for green pod yield in summer and fall season, respectively. However, due to their white dry seeds, which are favourable to the Egyptian consumers, the author showed that genotypes Nebraska and Beljerssy RR17 may be preferred for dry seed production at summer and fall seasons as well as Beljrss RR17. Isasi and Busto (1985) and Ferândez (1982) showed that the optimum spacing for maximum seed (pulse) yield of common bean cultivars was 10 cm apart with 70 cm between rows.

Plants sown at Oct. 10 falid to produce dry seeds may be as a result of cold weather in the time of flowering and seed production. These responses agree with Rosales-serna *et al* (2001) reported that low temperature resulted in yield loss, due to low temperatures and frosts at the end of the growing season. Dickson and Boetger (1984) reported that yield was lowest with day/night temperature of 30/8°C, low nigh temperature appeared to inhibit ovule viability. In contrast high temperature reduced pollen viability. Lusse *et al* (1996) reported that average seed yield were the highest at 28/18°C day/night. An increase to 31°C and 34°C decreased pod set by 10% and seeds/pod by 10% and 20% respectively, therefore decreased yield by 14% and 30%, respectively. Isasi and Busto (1985) and Ferândez (1982) showed that the optimum spacing for maximum seed (pulse) yield of common bean cultivars was 10 cm apart with 70 cm between rows. Isasi and Busto (1985) reported significant differences in yield between year and cultivar and significant density x cultivar interactions with the highest yield obtained at 10 cm between plants. Grafton *et. al.* (1988) reported that

Table(6): Seed yield (kg/fed.) in three cultivars of common bean as affected by plant spacing and sowing date during the autumn planting of 2004 and 2005 seasons.

Cultivar., (A)	Plant Spac (cm)(B)	Sowing date, (C) 2004 season				Sowing date,(C) 2005 season			
		Aug., 25	Sept., 15	Oct., 10	***Mean***	Aug., 25	Sept., 18	Oct., 15	Mean
Giza 6	10	*294.65 **(17.18)	677.09 (25.88)	0.5 (0.71)	323.91 (14.59)	238.76 (15.46)	404.93 (20.18)	0.5 (0.71)	214.73 (12.12)
	20	434.27 (20.83)	674.80 (25.97)	0.5 (0.71)	369.69 (15.84)	241.31 (15.51)	189.70 (13.60)	0.5 (0.71)	143.84 (9.94)
	30	452.82 (21.24)	435.55 (20.83)	0.5 (0.71)	296.12 (14.26)	136.98 (11.72)	200.02 (14.14)	0.5 (0.71)	112.50 (8.86)
Mean		393.91)19.75(	595.81)24.22(	0.5 (0.71)	329.91 (14.90)	205.68)14.23(	264.88)15.97(	0.5 (0.71)	157.02)10.30(
Swiss blanc	10	353.43 (18.77)	689.25 (26.20)	0.5 (0.71)	347.56 (15.25)	274.13 (16.52)	253.08 (15.50)	0.5 (0.71)	175.74 (10.91)
	20	229.89 (16.92)	477.25 (21.66)	0.5 (0.71)	235.71 (13.10)	234.84 (15.12)	219.74 (14.82)	0.5 (0.71)	151.53 (10.21)
	30	127.32 (11.30)	296.97 (17.23)	0.5 (0.71)	141.43 (9.75)	122.82 (11.06)	293.81 (17.16)	0.5 (0.71)	138.88 (9.64)
Mean		236.88)15.66(	487.82)21.69(	0.5 (0.71)	241.57 (12.70)	210.60)14.23(	255.54)15.83(	0.5 (0.71)	155.38 (10.25)

Table(6): cont.

Cultivar., (A)	Plant Spac (cm)(B)	Sowing date, (C) 2004 season				Sowing date,(C) 2005 season			
		Aug., 25	Sept., 15	Oct., 10	***Mean***	Aug., 25	Sept., 18	Oct., 15	Mean
Nebraska	10	524.72 (22.60)	824.71 (28.67)	0.5 (0.71)	449.81 (17.33)	361.60 (19.01)	414.53 (20.30)	0.5 (0.71)	258 88 (13.34)
	20	407.98 (20.11)	672.49 (25.88)	0.5 (0.71)	360.16 (15.59)	316.01 (17.75)	356.75 18.12)(	0.5 (0.71)	224.42)12.19(
	30	367.53 (18.95)	586.93 (24.18)	0.5 (0.71)	319.25 (17.82)	319.25 (17.82)	324.60 (17.97)	0.5 (0.71)	214.78 (12.17)
Mean		433.41)20.55(	694.68)26.24(	0.5 (0.71)	376.03 (15.84)	332.29)18.19(	365.29 18.80)(	0.5 (0.71)	232.69)12.57(
B x C	10	390.93 (19.78	730.35 (27.03)	0.5 (0.71)	373.76 (15.84)	291.50 (17.00)	357.51)18.66(	0.5 (0.71)	216.50 (14.30)
	20	357.38 (18.92)	608.18 (24.67)	0.5 (0.71)	321.85 (14.77)	264.05 (16.13)	255.40 15.51)(	0.5 (0.71)	173.32)10.68(
	30	315.89 (17.79)	439.82 (20.98)	0.5 (0.71)	251.90 (13.16)	193.02 (13.53)	272.81)16.42(	0.5 (0.71)	155.44 (10.22)
Mean		354.73 (18.83)	592.78 (24.23)	0.5 (0.71)		249.52)15.55(	295.24 16.86)(	0.5 (0.71)	
L.S.D 0.05		A =3.14 AB = 2.15 AC = 1.84	B =3.37 BC = 1.75 ABC = 0.88	C = 2.65		A = 1.37 AB = N.S AC =1.63	B = N.S BC = 1.5 ABC = 1.08	C = 2.35	

*, ** Original (upper) and transformed (down) data , respectively.

dry edible bean (*Phaseolus vulgaris L.*) genotypes varied in their seed yield in response to row spacing. Significantly higher yields were obtained as row spacing decreased

Chatterjee and Som (1981) reported that *Phaseolus vulgaris L.* cultivar Contender sown in mid-Sept., mid-Oct. or mid-Dec. gave average seed yield of 1.99, 0.94 and 0.49 t/ha, respectively. Seeds obtained from crops sown on these three dates showed 86.5, 82.0 and 81.5 % germination respectively. Crops sown from Jan. to Aug. failed to produce seeds.

Conclusion

From the previous results it could be concluded that under conditions similar to those of the present work, the best favourable planting date to grow common bean for dry seed (pulse) yield was during the autumn season especially on Sept.,15 and/or18. In addition, among the tested cultivars in this study, Nebraska cultivar proved to be the best, where it gave the highest values in most of the studied traits especially seed yield. Therefore, it is recommended for planting under our conditions for white dry seed production at autumn season. Moreover, the best plant spacing to grow common bean cultivars (*Phaseolus vulgaris L.*) for dry seed (pulse) yield was 10 cm spacing between plants.

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تأثير ميعاد ومسافة الزراعة علي النمو و المحصول البذري الجاف لثلاثة أصناف من الفاصوليا في الزراعة الخريفية تحت ظروف أسيوط

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أجرى هذا البحث بمزرعة كلية الزراعة جامعة أسيوط خلال العروة الخريفية عامي 2004/ 2005 و2005/ 2006 وذلك لدراسة تأثير ميعاد ومسافة الزراعة علي المحصول البذري الجاف لثلاثة أصناف من الفاصوليا هي جيزة 6 وسويس بلانك ونبراسكا. زرعت النباتات علي مسافة 10 -20 و30 سم . أظهرت الدراسة فروقا معنوية بين الأصناف المختبرة في معظم الصفات المدروسة.كان الصنف نبراسكا ألأبكر في إنتاج البذور الجافة . أيضا أعطي أعلي القيم من عدد القرون للنبات و المحصول البذري للنبات و المحصول البذري المحسوب للفدان. أظهر ميعاد الزراعة 15 و 18 سبتمبر أعلي القيم من حيث عدد القرون للنبات و العدد النهائي للنباتات التي صمدت حتي الحصاد ومحصول النبات ونسبة أنبات البذور. أظهرت الزراعة علي مسافة 10 سم أعلي محصول بذري للفدان . أعطت النباتات المنزرعة علي 30 سم أعلي عدد للنباتات عند الحصاد وعدد القرون للنبات و المحصول البذري للنبات.