J. Agric. Sci. Mansoura Univ., 27 (9): 6135 - 6145, 2002

WATER REQUIREMENTS OF SNAP BEAN (*Phaseolus vulgaris*, L.) AS AFFECTED BY SOWING DATE UNDER NEWLY RECLAIMED SOIL AT SHARK EL-OWINAT REGION

Amer, A. H.*; Omaima M. Sawan and S. R. Salman****

* Hort., Res. Inst., Agric. Res. Center, Giza, Egypt.

** Hort. Res. Dept., National Research Center, Dokki, Egypt.

ABSTRACT

This work was conducted to study the effect of four sowing dates started on 8th Nov. with 30 days intervals and three drip irrigation levels i.e. 80, 100 and 120 % Ep* on cv. Paulista of snap bean growth, yield and pod quality. It was carried out at shark el-owinat region, southern Egypt during two growing seasons at 2000/2001 and 2001/2002 .

On the second sowing date (8th December) where plants were grown under low tunneles, growth parameters, minerals uptake (N, P and K) and yield components and attributes were significantly increased, but the 1st harvest time was significantly decreased.

Increasing water irrigation quantity from 80% up to 120% Ep gave significant increase in growth characters (plant height, number of leaves and branches and dry weight of leaves and branches) , minerals uptake , yield components (number of pods / plant , pod weight / plant , early yield and total yield) and pod quality i.e. pod diameter , length and weight .

Interaction between sowing date and irrigation level had significant effect on all characters of this study. High irrigation level under second sowing date gave significant increase in plant growth and minerals uptake as well as yield characters and earlier production

INTRODUCTION

Snap bean (*Phaseolus vulgaris, L.*) is one of the most important leguminous vegetable crops in Egypt for exportation and local consumption. Irrigation water is one of the most important factors, which greatly affect snap bean plant growth and productivity, especially under newly reclaimed soil. Therefore, the moisture content of the soil should be kept optimum. Many investigators reported that increasing irrigation rate increased growth and yield (Stone *et al.*, 1988; Loureiro *et al.*, 1990 ; Candilo *et al.*, 1991 and Amer *et al.*, 2002)

Snap bean growth and productivity are greatly influenced by environmental conditions, especially temperature and humidity. White and Mansfield (1978) reported that intensity light quality and temperature had different and specific effects on bean growth. Moreover, many investigators reported that the vegetative growth, yield and pod quality of snap bean were affected by sowing date (Abilan *et al.*, 1977 ; Saini and Negi , 1998 and Yaman , 1998)

* Ep = pan evaporation

MATERIALS AND METHODS

Two field experiments were conducted in 2000/2001 and 2001/2002 seasons at the Idial Farm of Ministry of Agriculture at Shark EL-Owinat region, EL-Wady EL-Gadid Governorate, Southeren Egypt. It was initiated to study the water requirements for snap bean cv. Paulista which was planted under three drip irrigation levels i.e. low, medium and high representing 80, 100 and 120 % of pan evaporation respectively in four sowing dates (8/11, 8/12, 8/1 and 8/2) as shown in table (A) and its effect on vegetative growth characteristics, chemical composition of plant foliage, yield and its quality. The soil of the experimental field was sandy in texture.

Table (A) : Sowing dates and irrigation levels

Sowing dates	Irrigation levels (m^3 / fed.)		
	High (120% Ep)	Medium (100% Ep)	Low (80% Ep)
First season			
8 / 11 / 2000	3559.78	2966.48	2373.18
8 / 12 / 2000	2831.52	2359.60	1887.68
8 / 1 / 2001	3491.21	2909.34	2327.47
8 / 2 / 2001	4702.31	3918.60	3134.88
Second season			
8 / 11 / 2001	2762.42	2302.02	1841.62
8 / 12 / 2001	2527.06	2105.88	1684.70
8 / 1 / 2002	3697.85	3081.64	2465.23
8 / 2 / 2002	4677.12	3897.60	3118.08

The treatments were arranged in split plot design with four replicates. Main plots were devoted for sowing date whereas, sub-plots were for drip irrigation levels. Each experimental plot included two irrigation lines. Each line was 10 m length and 0 75 m in width. The plot area was about 15 m^2. The first, third and fourth sowing dates were conducted under open field condition while the second one was carried out under low tunnels. Seeds of poulista cultivar were sown in hills 7.5 cm apart on both sides of irrigation line. The distance between the plantation rows was 30 cm apart. The normal agricultural practices required for snap bean production were applied as commonly followed in the farm.

Data recorded :

I. **Plant growth :** At full blooming stage i.e. 50 days from sowing Five plants were as a representative sample were taken from each experimental plot and the following data were recorded .
   1 – Plant height (cm).
   2 – Number of leaves and branches / plant
   3 – Dry weight of leaves and branches (g).

II. **Chemical composition of plant folige** : Uptake of total nitrogen, phosphorus and potassium in both leaves and branches were determined following the methods described by Black (1983). Trough and Mayers (1939) and Brown and Lilliland (1946) for N, P and K, respectively .

III. **Yield components and attributes :** The following data were recorded at harvesting time :

1 – Average number of pods per plant.
2 – Average weight of pods per plant
3 – Early yield (ton / fed.) .
4 – Total yield (ton / fed.) .
5– Time of the 1st harvest (number of days elapsed from sowing up to the first harvest).
6 – Pod parameters (length, diameter and average weight).

The data were subjected to the analysis of variance according to steel and torrie (1960). The differences between means were tested by LSD at 5 % level of significance. Some meteorological data were recorded as monthly mean temperature (C°), relative humidity (%) and evaporation (mm/day) at Shark EL-Owinat Region as shown in Table (B).

Table (B) : Meteorological data at Shark EL-Owinat Region .

Month	2000			2001			2002		
	C°	R.H. %	Evaporation mm / day	C°	R.H. %	Evaporation mm / day	C°	R.H. %	Evaporation mm / day
Nov.	19.0	34.36	10.07	18.2	45	6.8			
Dec.	14.2	42.51	6.30	13.9	48	5.2			
Jan.	13.6	30.83	7.31	13.3	36	6.6	10.8	54	4.4
Feb.	13.8	27.06	8.76	14.5	31	7.5	16.3	45	8.5
Mar.	18.1	25.35	12.47	21.7	25	9.1	21.2	32.4	11.4
April	25.9	22.73	16.39	26.0	21	16.5	24.9	27.4	13.3

Meteorological data were obtained from the meteorological station at Shark EL-Owinat .

RESULTS AND DISCUSSION

I. Vegetative growth :

I. 1. Effect of sowing date :

Data in Table (1) show that all growth parameters expressed as plant height, number of leaves and branches / plant as well as dry weight for leaves and branches were significantly affected by sowing dates. Planting on 8th Decmber (under low tunnels) led to highly significant increases in all growth parameters compared with the 1st and the 4th sowing date (8th Nov and 8th Feb). in addition, generally no significant differences can be noticed in all growth aspects between the 2nd and 3rd sowing date. In this respect, the vigour growth of plant under low tunnels may be due to the more relatively warm conditions and also increase the relative humidity. This could be mainly due to suitable temperatures during the growth period. In addition, White and Mansfield (1978) reported that light quality, intensity and temperature had effect on snap bean plant growth .

Table (1) : Effect of sowing date on snap bean growth parameters :

Sowing date	Plant height (cm)	Number of		Dry weight (g /plant)		
		Leaves	Branches	Leaves	Branches	Total
2000 / 2001						
8 / 11	23.50	11.39	5.39	4.82	3.79	8.61
8 / 12	34.22	15.00	6.50	7.97	5.81	13.78
8 / 1	26.56	14.22	6.39	7.43	4.72	12 15
8 / 2	25.17	10.72	4.91	4.02	3.11	7.13
L.S.D. 5%	2.038	2.028	0.672	1.313	0.683	1.662
2001 / 2002						
8 / 11	20.72	9.67	4.28	3.36	3.36	6.71
8 / 12	31.89	13.83	5.22	6.63	5.28	11.91
8 / 1	25.28	12.17	5.72	5.99	3.93	9.92
8 / 2	23.00	9.22	4.06	2.77	2.06	4.82
L.S.D. 5%	2.802	2.012	0.776	0.44	0.488	0.336

A. 2. Effect of irrigation levels:

Results in Table (2) reflected significant differences in the vegetative growth rate between the different irrigation treatments. It could be concluded that growth parameters (plant height, number of leaves and branches/plant, dry weight for leaves and branches and total dry weight per plant) were significantly increased with increasing of irrigation water amount from 80, 100 up to 120 % Ep. These results indicated the importance of water supply all along plant life for increasing plant growth. Shorting of plants and reduction in leaves number under soil moisture stress may be explained that water stress caused losses in tissues water which reduces turger pressure in cells. Water stress caused stomatal closure and significant decrease in photosynthetic rate as well as reduced the minerals uptake by plants Table (5) which concequently affect plant growth. These results coincide with those reported by Bergamaschi et al., (1988) , Singh (1989) , Sangakkara (1990) , Romic et al., (1994) and Ismail (2000) and Amer et al., (2002) all working on bean and Podsiadlo et al., (1996) on faba bean .

Table (2) :Effect of irrigation level on snap bean growth parameters :

Irrigation level	Plant height (cm)	Number of		Dry weight (g /plant)		
		Leaves	Branches	Leaves	Branches	Total
2000 / 2001						
High	29.75	14.46	6.73	6.98	4.88	11.86
Medium	26.04	12.50	5.90	5.73	4.40	10.13
Low	24.29	11.54	4.76	5.48	3.80	9.28
L.S.D. 5%	1.351	0.677	0.376	0.761	0.303	0.747
2001 / 2002						
High	26.96	12.75	5.29	5.40	4.18	9.58
Medium	26.13	11.17	5.00	4.46	3.69	8.15
Low	22.58	9.75	4.17	4.20	3.09	7.29
L.S.D. 5%	1.054	1.061	0.484	0.525	0.363	0.481

A.3. Effect of interaction between sowing date and irrigation level :

Results in Table (3) reflect significant differences in the vegetative growth during both grcwing seasons expect number of leaves and branches

in the 2nd season . From the same results, it is also clear that the highest level used showed the best morphological characters compared with other irrigation levels. The same data showed that the highest values of growth parameters were recorded when planting on 8th Dec. and applying high water level (120% Ep). On the other hand, the lowest values of growth parameters were recorded when planting on 8th Feb. and applying low water level (80% Ep).

Table (3): Effect of interaction between sowing dates and irrigation levels on snap bean growth :

Treatments		Plant height (cm)	Number of		Dry weight (g /plant)		
Sowing date	Irrigation level		Leaves	Branches	Leaves	Branches	Total
2000 / 2001							
8 / 11	High	25.00	13.67	6.67	5.07	4.10	9.17
	Medium	23.33	10.33	4.83	4.80	3.90	8.70
	Low	22.17	10.17	4.67	4.60	3.37	7.97
8 / 12	High	36.50	16.50	7.40	10.20	6.77	16.97
	Medium	34.17	15.33	6.93	7.03	5.97	13.00
	Low	32.00	13.17	5.17	6.67	4.70	11.37
8 / 1	High	30.50	14.83	6.83	8.50	5.17	13.67
	Medium	28.00	14.17	6.67	7.00	4.63	11.63
	Low	21.17	13.67	5.67	6.80	4.37	11.17
8 / 2	High	27.00	12.83	6.03	4.17	3.37	7.63
	Medium	26.67	10.17	5.17	4.07	3.10	7.17
	Low	21.83	9.17	3.53	3.83	2.77	6.60
L. S. D. 5%		2.70	1.35	0.75	1.52	0.61	1.49
2001 / 2002							
8 / 11	High	21.67	11.83	4.67	3.67	3.67	7.33
	Medium	21.00	9.00	4.33	3.47	3.47	6.93
	Low	19.50	8.17	3.83	2.93	2.93	5.87
8 / 12	High	33.50	14.83	5.83	8.53	6.30	14.83
	Medium	32.50	13.83	5.33	5.70	5.50	11.20
	Low	29.67	12.83	4.50	5.67	4.03	9.70
8 / 1	High	28.50	13.50	6.17	6.40	4.50	10.90
	Medium	26.67	12.33	6.00	5.93	3.70	9.63
	Low	20.67	10.67	5.00	5.63	3.60	9.23
8 / 2	High	24.17	10.83	4.50	3.00	2.27	5.27
	Medium	24.33	9.50	4.33	2.73	2.10	4.83
	Low	20.50	7.33	3.33	2.57	1.80	4.37
L. S. D. 5%		2.11	N. S.	N. S.	1.05	0.73	0.96

Table (4) : Effect of sowing date on minerals uptake of snap bean plants

Sowing date	N-Uptake (mg/plant)			P-Uptake (mg/plant)			K-Uptake (mg/plant)		
	Leaves	Branches	Total	Leaves	Branches	Total	Leaves	Branches	Total
200 / 2001									
8 /11	205 89	117.23	323.13	33.53	22 86	56 38	175.76	92.95	268 72
8 / 12	337.58	175.10	512.68	56.60	31.89	88.49	286.25	138 38	424.63
8 / 1	313 38	149 68	463.06	50.29	28.22	78.51	260.47	118.62	379.09
8 / 2	172.52	94.80	267.32	28 13	18 46	46 60	147.33	73.88	221.21
L S D 5%	61.291	22 337	69.934	9 57	5 427	11 423	46.742	18.456	49.906
2001 / 2002									
8 /11	138.85	97 55	236.40	26.23	21 41	47.63	123.45	82 36	205 81
8 / 12	270.80	152 44	423.23	50 31	32 86	83 17	239.52	130.26	369.79
8 / 1	245.82	113 91	359 73	44.67	24.64	69.30	218.28	98.14	316.43
8 / 2	114.67	59 92	174.59	21 25	13 84	35 09	106.44	53.36	159.80
L.S.D 5%	18 514	14 387	13.973	6 036	2 588	5 045	13.69	11.925	12.291

II. 2. Effect of irrigation level :

Data in Table (5) show the effect of irrigation amount on N, P and K uptake in snap bean leaves and branches. It is evident that increasing water quantity applied, generally enhanced N, P and K uptake, where the maximum values were obtained by adding the highest used irrigation level (120% Ep). These results agree with those reported by Hamma *et al.*, (1990) and Xia (1990) on broad bean, Sangakkara (1994) on mong bean, Xia (1997) and Amer *et al.*, (2002) on bean

Table (5) : Effect of irrigation level on minerals uptake of snap bean plants .

Irrigation level	N-Uptake (mg / plant)			P-Uptake (mg/plant)			K-Uptake (mg / plant)		
	Leaves	Branches	Total	Leaves	Branches	Total	Leaves	Branches	Total
200 / 2001									
High	288.05	148 24	436.29	50 01	29.82	79.82	243 54	125 62	369.16
Medium	247.03	136.57	383.60	40.07	24.43	64.50	213.20	102.10	315 30
Low	236 95	117 80	354 75	36.33	21.83	58.16	195.62	90.15	285.77
L.S D.5%	27 57	9.233	27.728	4.896	1.755	5.245	20.295	7.673	21.512
2001 / 2002									
High	212.85	121.76	334.61	40.81	26 89	67.71	188.26	109.35	297 61
Medium	188.77	110.95	299.72	34 24	23.27	57.51	170.74	89.77	260 51
Low	175 97	85.15	261 13	31 78	19 39	51 18	156 77	73.98	230.75
L S D 5%	21 25	9.793	18.233	3.339	1.572	3.319	17.621	9.157	14.616

B. 3. Effect of interaction between sowing date and irrigation level :

Significant differences were detected in minerals uptake due to the interaction between sowing date and irrigation level (Table, 6). The highest values of N, P and K uptake of plant parts were recorded under the second sowing date (8^{th} dec) combined with the highest irrigation level.

Table (6) : Effect of interaction between sowing date and irrigation level on minerals uptake of snap bean plants .

Treatments		N-Uptake (mg / plant)			P-Uptake (mg / plant)			K-Uptake (mg / plant)		
Sowing date	Irrigation level	Leaves	Branches	Total	Leaves	Branches	Total	Leaves	Branches	Total
2000 / 2001										
8/11	High	212.04	125.83	337.87	36.05	25.38	61.43	180.37	105.27	285.64
	Medium	206.20	120.41	326.61	34.19	23.28	57.47	174.21	92.30	266.51
	Low	199.44	105.45	304.90	30.34	19.91	50.25	172.72	81.29	254.01
8/12	High	416.38	202.18	618.56	73.69	39.78	113.47	346.64	172.17	518.80
	Medium	307.80	181.54	489.34	50.09	29.76	79.86	274.66	135.22	409.88
	Low	288.55	141.60	430.14	46.01	26.14	72.15	237.45	107.75	345.20
8/1	High	348.10	158.57	506.66	59.74	31.98	91.72	290.98	135.19	426.17
	Medium	302.17	149.09	451.27	48.10	27.19	75.29	258.32	111.15	369.47
	Low	289.88	141.38	431.26	43.01	25.49	68.50	232.12	109.50	341.62
8/2	High	175.68	106.39	282.07	30.54	22.13	52.67	156.20	89.83	246.03
	Medium	171.94	95.24	267.18	27.91	17.49	45.40	145.62	69.74	215.36
	Low	169.95	82.76	252.71	25.94	15.78	41.72	140.19	62.07	202.26
L S D 5%		55.140	18.466	55.456	9.793	3.510	10.490	40.591	15.346	43.024
2001 / 2002										
8/11	High	146.62	106.94	253.55	29.84	24.19	54.03	132.32	95.79	228.10
	Medium	147.61	104.09	251.70	25.94	22.19	48.13	128.39	82.05	210.44
	Low	122.32	81.62	203.95	22.90	17.84	40.74	109.63	69.26	178.89
8/12	High	335.13	182.40	517.52	63.36	39.32	102.68	288.56	161.61	450.18
	Medium	240.96	164.89	405.86	45.50	33.89	79.39	221.92	130.53	352.46
	Low	236.30	110.03	346.33	42.07	25.36	67.43	208.09	98.65	306.73
8/1	High	251.10	130.71	381.81	46.52	28.42	74.94	217.17	118.06	335.23
	Medium	251.45	111.70	363.15	44.65	23.24	67.88	226.46	93.13	319.58
	Low	234.91	99.31	334.22	42.83	22.25	65.09	211.22	83.24	294.46
8/2	High	118.57	67.00	185.56	23.54	15.64	39.18	114.99	61.95	176.93
	Medium	115.07	63.12	178.19	20.88	13.77	34.64	106.20	53.36	159.56
	Low	110.36	49.66	160.02	19.33	12.13	31.46	98.14	44.79	142.92
L S D. 5%		42.501	19.586	36.466	6.677	3.144	6.638	35.243	18.314	29.233

C – Yield components and attributes :

III. 1. Effect of sowing dates :

The results of sowing date as affecting yield and yield components as well as some yield attributes are given in Table (7) . Mean values of number and weight of pods / plant, early yield, total yield and time of the 1st harvest revealed highly significant differences under the studied sowing dates on the two growing seasons. It is evident that the second sowing date in both seasons of the study, resulted in the highest significant increase in total yield and its components as compared with other sowing dates. On the other hand, it is evident that the second sowing date in both seasons of study generally resulted in a significant decrease in the period to the first harvest. These results might be attributed to the favorable effect of temperature and light during the period of production processes Moreover, pods quality expressed as pod length, pod diameter and average pod weight significantly affected by the studied sowing dates In this regard, such differences faild to reach the level of 0.05% significance in case of pod length and weight during the second season of study In addition, the highest pod weight was obtained in case of seeding on 8th of Jan during both seasons of study. Similarly, Abilan *et al* (1977) found that yield of bean significantly related to energy factors in the climate

Table (7) : Effect of sowing dates on snap bean yield components and attributes .

Sowing date	No. of pods/ plant	Pods yield (g/plant)	Early yield (ton/fed.)	Total yield (ton/fed.)	Time of the 1st harvest (days)	Pod quality		
						Length (cm)	Diameter (cm)	Weight (g)
2000 / 2001								
8 / 11	20.04	62.99	1.67	5.40	75.22	11.18	0.67	3.09
8 / 12	22.74	66.28	2.09	6.06	64.67	12.06	0.68	3.11
8 / 1	21.18	61.47	1.76	5.16	68.67	11.13	0.64	3 12
8 / 2	20.48	67.37	1.68	5.32	57.56	11.31	0 64	3.10
L.S.D.5%	1.439	4.253	0.298	0.479	0.824	0.391	0.018	0 018
2001 / 2002								
8 / 11	20.56	63.99	1.92	5.03	64.67	11.16	0.64	3.10
8 / 12	24.02	75.11	2.09	5.66	53.33	11.43	0.66	3.10
8 / 1	23.36	72.94	1.87	5.30	67.11	11.40	0.63	3 11
8 / 2	22.34	63.30	1.63	5.01	56.67	11.42	0.66	3.10
L.S.D.5%	1.908	6.700	0.204	0.424	0.770	N. S.	0.018	N. S.

C. 2. Effect of irrigation level:

Data in Table (8) show the effect of irrigation level on yield components and attributes i.e. number and weight of pod / plant; total and early yield and pod quality during the two growing seasons of study. It is evident that water quantity has significant effect on yield and its components as well as attributes in both seasons. Moreover, increasing water quantity up to 120 % Ep gave the highest values of yield and its components. On the other hand, decrease in water quantity gave a shortest period to the first harvest. Such increments in total yield and its components are connected with those obtained on growth parameters (Table,1) and mineral uptake (Table,5) in this study. The obtained results are in agreement with Singh (1989), Romic *et al.*, (1994), Ismail (2000) and Amer *et al.*, (2002) on snap bean.

Table (8): Effect of irrigation level on snap bean yield components and attributes.

Irrigation level	No. of pods/ plant	Pods yield (g/plant)	Early yield (ton/fed.)	Total yield (ton/fed.)	Time of the 1st harvest (days)	Pod quality		
						Length (cm)	Diameter (cm)	Weight (g)
2000 / 2001								
High	29.63	91.43	2.55	8.32	73.00	12.08	0.69	3.14
Medium	20.81	63.87	1.79	5.38	65.25	11.42	0 65	3.09
Low	12.90	38.28	1.06	2.75	61.33	10.77	0.63	3.08
L.S.D. 5%	1.702	8.020	0.217	0.444	0.552	0.271	0.009	0.014
2001 / 2002								
High	34.25	107.80	2.60	7.14	63.08	11.99	0.67	3.14
Medium	22.40	69.34	1.96	5.81	59.75	11.40	0.64	3.10
Low	11.06	33.86	1.07	2.80	58.50	10.67	0.63	3.07
L.S.D. 5%	1.550	4.816	0.240	0.285	0.591	0.219	0.011	0.011

C. 3. Effect of interaction between sowing date and irrigation level :

Data in Table (9) cleared that the effect of interaction between sowing date and irrigation level on yield components and attributes. It is

evident that interaction between sowing date and irrigation level had significant effect on yield and its components in both growing seasons. The highest values of yield components and attributes were recorded from second sowing date (8th Dec.) which received the highest water quantity for irrigation (120 % Ep).

Obtained results may be explained on the base that increasing the applied water quantity increased moisture content in soil that reflects on plant metabolism and production of higher yield. On the other hand, light quality, intensity and temperature had effects on plant growth and yield.

Table (9) :Effect of interaction between sowing date and irrigation level on snap bean yield components and attributes .

Treatments		No. of pods/ plant	Pods yield (g/plant)	Early yield (ton/fed.)	Total yield (ton/fed.)	Time of the 1st harvest (days)	Pod quality		
Sowing date	Irrigation level						Length (cm)	Diameter (cm)	Weight (g)
2000 / 2001									
8 / 11	High	29.23	93.61	2.30	7.88	86.67	11.40	0.71	3.13
	Medium	18.43	56.36	1.66	5.17	75.00	11.37	0.66	3.06
	Low	12.47	38.98	1.06	3.14	64.00	10.77	0.63	3.07
8 / 12	High	30.77	92.81	2.97	8.82	68.67	12.63	0.73	3.15
	Medium	21.97	62.79	1.79	5.56	60.33	12.33	0.67	3.10
	Low	15.50	43.24	1.51	3.79	65.00	11.20	0.65	3.08
8 / 1	High	27.43	75.53	2.37	7.53	75.00	11.87	0.66	3.13
	Medium	25.60	77.83	2.15	6.17	70.33	10.87	0.63	3.12
	Low	10.50	31.04	0.75	1.79	60.67	10.67	0.63	3.10
8 / 2	High	31.07	103.77	2.57	9.06	61.67	12.40	0.67	3.14
	Medium	17.23	58.49	1.56	4.63	55.33	11.10	0.64	3.09
	Low	13.13	39.85	0.92	2.26	55.67	10.43	0.62	3.06
L.S.D. 5%		3.40	16.04	0.43	0.89	1.10	0.54	0.02	0.03
2001 / 2002									
8 / 11	High	32.80	103.04	2.97	6.81	69.00	11.50	0.66	3.14
	Medium	18.03	55.70	1.55	4.97	63.00	11.20	0.63	3.09
	Low	10.83	33.23	1.24	3.32	62.00	10.77	0.62	3.07
8 / 12	High	36.13	114.81	2.87	7.31	55.00	12.27	0.69	3.14
	Medium	23.60	72.79	2.14	6.34	52.00	11.50	0.65	3.09
	Low	12.33	37.74	1.25	3.34	53.00	10.53	0.65	3.07
8 / 1	High	31.73	100.21	2.12	6.22	71.33	11.93	0.64	3.16
	Medium	29.27	90.87	2.57	7.34	65.00	11.10	0.64	3.11
	Low	9.07	27.72	0.94	2.35	65.00	11.17	0.61	3.06
8 / 2	High	36.33	113.12	2.46	8.23	57.00	12.27	0.70	3.11
	Medium	18.70	58.02	1.59	4.60	59.00	11.80	0.66	3.10
	Low	12.00	36.76	0.84	2.21	54.00	10.20	0.62	3.09
L.S.D. 5%		3.10	9.63	0.48	0.57	1.18	0.44	0.02	0.02

REFERENCES

Amer, A. H. ; M. EL-Desuki ; Omaima, M. Sawan and M. A. Ibrahim (2002) : Potentiality of some snap bean (*Phaseolus vulgaris*, L) varieties under different irrigation levels at Shark El-Owinat region . Egypt. J. Appl. Sci ; 17 (1) 327 – 345 .

Abllan, C. E. ; F. L. A. Vives and Z. A. Chacon (1977) :Climatic influence on biomass and seed production in bean (*Phaseolus vulgaris*, L.) . Agricola Fabio Bauclrit. Field Crop 31, No. 8 (140) 26 pp.

Bergamaschi, H. ; J. Vieira; J. C. Ometto ; L. R. Locci and P. L. Libardi (1988) : Water deficit in beans, 1 – Growth analysis and phonology. Pesquiso Agropecuaria Brasileira, 33 (7): 733 – 743 .

Black, C. A. (1983): Methods of plant Analysis. Parts I and II. Amer. Soc. Agron. Inc. Publ. , Madison, Wisc, USA

Brown, J. D. and O. Lilleland (1946) : Rapid determination of potassium and sodium in plant material and soil extracts by flame photometry . Proc. Amer. Soc. Hort. Sci., 48 : 341-346 .

Candilo, M.; I. Giordano; V. Feati; N. Gaspari and A. D. Amato (1991) : Influence of various irrigation regimes on beans (*Phaseolus vulgaris*, L.) . Rivista di Agronomia, 25 (3) : 444 – 451 .

Hamma, S. A. ; E. E. Kaoud ; K. Matter and M. A. Khamis (1990) : Effect of soil and water management practices on broad bean in sand soil . Egyptian J. Soil Sci. . 30 (1) 341 – 355 .

Ismail, T. B. A. (2000) : Response of some snap bean varieties to drip irrigation rates under sand soil conditions. M. Sc. Thesis, Fac. Agric. Suez Canal Univ.

Loureiro, B. T. ; P. B. Machado ; W. Denicul and P. A. Ferreira (1990) : Effect of different water levels on yield of common bean (*Phaseolus vulgaris*, L.) . Revista Ceres, 37 (211) : 215 – 226 .

Podsiadlo, C. ; S. Karczmarczyk and Z. Koszanski (1996) : The effect of irrigation and nitrogen fertilizer application on the activity of some physiological processes and the yield of faba bean on light soil . Zeszyty Problemowe Postepow Nauk Rolniczych., 438 : 351 – 358 .

Romic, D.; F. Tomic; J. Barosic; D. Dolanjski; M. Romic; M. Jankovic; J. Marusic and D. Geres (1994) : Effect of irrigation on components of secondary crops yield in coroatia 17th (CID) European Regional Conf. On irrigation and drainage varna, BULGAIA 1, 19 – 28 .

Saini, J. P. and S. C. Negi (1998) : Effect of cultivar and date of sowing on growth and yield of French bean (*Phadeolus vulgaris*, L.) under dry temperate condition . indian J. of Agronomy, 43(1) : 110 – 113 .

Sangakkara, U. R. (1990) : Response of selected legume companion crops to irrigation frequencies. Agric. Water Management, 17 (1-3) . 257 – 263 .

Sangakkara, U. R. (1994) : Yield and seed quality on mung bean as affected by irrigation in a dry season .J. Agon. And Crop Sci , 172 (5) : 327 – 332 .

Singh, B P (1989) : Irrigation water management for buch snap bean production. Hort. Sci. , 24 (1) : 69 – 70 .

Steel, R. G. D. and J. H. Torrie (1960) : Principles and procedures of statistics with special reference to the biological sciences. New York, McGrow Hill Book, 481 p.

Stone, L. F. ; J. A. A. Moreira and S. C. D. A. Silva (1988) : Effect of soil water tension on the yield and growth of bean. 1 – Yield . Pesquiso Agropenuaraia Barasileira, 23 (2) : 161 – 167 .

Troug, E. and A. M. Meyer (1939) : Improvement in disness colorimetric method for phosphorus and aesenic 2nd Eng. Chem. Annals. Ed., 1: 136-139 .

White, J. C. and T. A. Mansfield (1978) : Correlative inhibition of lateral bud growth in Phaseolus vulgaris, L . influence of the environmental . Annals of Botay., 42 (177): 191 .

Xia, M. Z. (1990) : Phsiological effect of water stress during the flowering and poding stages of Vicia faba L. Plant Physiology, 90(1) :14-19 .

Xia, M. Z. (1997) : Effect of soil during the generative development phase on seed yield and nutrient uptake of bean . Australian J. Agric. Res., 48 (4): 447 – 451.

Yaman, M. (1998) : Effect of different sowing dates on yield and yield components of bean cultivars. Anadolu, 8 (1) : 63 – 81 .

الاحتياجات المائية للفاصوليا و تأثرها بمواعيد الزراعة تحت ظـــروف الأراضـــي حديثة الاستصلاح في شرق العوينات

عبد الحميد حبشى عامر(١) – اميمة محمد صوان(٢) – سمير رجب سلمان(٢)

(١) معهد بحوث البساتين - مركز البحوث الزراعية – جيزة – مصر.

(٢) قسم بحوث البساتين – المركز القومي للبحوث – الدقى – القاهرة .

أجري هذا البحث لدراسة تأثير أربعة مواعيد زراعة تبدأ في ٨ نوفمبر و بين كل ميعاد و أخـــر ٣٠ يوم ، و ثلاثة مستويات للري بالتنقيط (٨٠ ، ١٠٠ ، ١٢٠ % من معدل البخر نتح) و ذلك علي النمـو و المحصول في الفاصوليا صنف بوليستا . و قد أجري هذا البحث بمنطقة شرق العوينات بجنـــوب مصـــر خلال موسمي ٢٠٠٠/٢٠٠١ ، ٢٠٠١/٢٠٠٢ .

اعطت البيانات المتحصل عليها زيادة معنوية في قياسات النمو و محتوي النبات من العناصر(نتروجين – فوسفور – بوتاسيوم) و كذلك مكونات المحصول و جودة القرون عند الزراعة في الميعاد الثاني (تحـت الأنفاق البلاستيكية) إضافة إلى التبكير في بداية جمع المحصول .

وقد أدت الزيادة في معدلات الري من ٨٠ الي ١٢٠ % من معدل البخر نتح إلي زيادة معنويـــة فـــي قياسات النمو و كذلك محتوي النباتات من العناصر (نتروجين – فوسفور – بوتاسيوم) إضافة إلـــي زيـــادة معنوية في المحصول و مكوناته . كما أدت الزيادة في كمية الري إلي التأخر النسبي في بداية الجمع .

و كان التفاعل بين مواعيد الزراعة و معدلات الري معنويا و كانت أعلـــي القيـــم المتحصـــل عليـــها للصفات المدروسة عند الزراعة في الميعاد الثاني (تحت الأنفاق البلاستيكية) مع إضافـــة أعلـــي مســـتوي للري (١٢٠% من معدل البخر نتح) .