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WATER REQUIERMENT OF SOME PEA CULTIVARS PLANTED AT DIFFRANT SOWING DATES UNDER DRIP IRRIGATION SYSTEM

1- Plant growth and yield

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ABSTRACT

Two field experiments were carried out during winter season of 2005-2006 and 2006-2007, in EL- Kassasien Horticulture Research Station, Ismailia Governorate. It aimed to study the effect of three irrigation water quantities (800, 1000 and 1200 m^3/fed.) combined with three sowing dates (20th Sep.,10th Oct. and 1st Nov.) on two cultivars (Victory freezer and Lincoln) of pea (*Pisum sativum L.*) grown under sandy soil condition using drip irrigation system. The result indicated that increasing water quantity up to 1200 m^3/fed. led to a significant increase of plant growth (plant height, number of branches , leaves per plant and dry weight) and yield and its components (number of seeds per pod, weight of 100 seeds, net ratio and Green pod yield per fed.).Sowing pea plants on 10th Oct gave the highest value of plant height, number of branches and leaves per plant, dry weight of branches and leaves per plant and yield and its components. Victory freezer cultivar recorded the highest value of plant height, number of branches and leaves per plant, dry weight of branches and leaves per plant and yield and it components. Sowing Victory freezer cultivar on10th Oct. with application of 1200 m^3/fed.was the best interaction treatment for increasing plant height, number of branches and leaves per plant, dry weight of branches and leaves per plant and yield and its components.

INTRODUCTION

Pea (*Pisum sativum* L.) is a very popular vegetable crop and considered one of the most important legume crops in Egypt for local consumption and exportation. This crop is widely used as a source of protein in human diets due to its high content of protein, ascorbic acid, carbohydrates, balanced amino acids composition and good digestibility. In general, this crop gives high yield and ensures high profits, especially when cultivated for green pods. Therefore, it occupies a prominent position among other legumes in the Egyptian agriculture.

Many investigators reported that increasing irrigation rates increased plant height, number of branches and leaves per plant, dry weight of branches and leaves per plant and yield and its components (White *et al.*, 1982; Prasad *et al.*, 1987; Nour,1999) on pea (Sawan *et al.*,2002) on sugar pea, (Ismail, 2000, 2004)on snap been and (Abd El-Ati ,2000, Nour, 2005, EL-Tantawy and EL-Beik, 2007; Nour *et al.* ,2007) on cowpea. Sowing dates have a considerable effect on world agriculture. Unsuitable sowing dates resulted in reducing plant growth and productivity of pea plants, as mentioned by many investigations. Khalil (1990) found that planting date (Oct.1st) gave higher values of plant growth and yield than earlier (Sept.15th) or later

planting date (Oct.15th).In the same line El-Gamiely et al., (1998) found that Nov. 15th sowing date significantly increased plant growth and yield of pea plant as compared to Oct.15th and Dec.15th. Abd-Alla (2000) showed that the delay of sowing date from Sept.1st to Oct. 1st increased plant growth and yield of pea plants. Shoker (2000) indicated that planting peas on 15th Oct. increased the plant growth and yield .On the other hand; the lowest values of all characteristics were obtained when planting was at Dec. In the same line, Mansour (2006) showed that sowing peas on 15th Oct. gave the maximum values of plant growth and yield as compared to other sowing date treatments (15th Sep. and 15th Nov.).

MATERAILS AND METHODS

Two field experiments were carried out during winter season of 2005-2006 and 2006-2007 in EL- Kassasien Horticulture Research Station, Ismailia Governorate. It aimed to study the effect of water quantity combined with sowing date on two cultivars of pea (*Pisum sativum L.*) grown under sandy soil condition using drip irrigation system. Soil samples were taken from 25 cm soil surface. The physical and chemical properties of the experimental soil are presented in Table (1).

Table (1): The physical and chemical properties of the experimental soil.

Physical properties	First season (2005-2006)	Second season (2006-2007)
Sand (%)	88..24	83.0
Silt (%)	4.25	13.0
Clay (%)	7.51	3.32
O.M (%)	0.44	0.68
F.C. (%)	11.21	7.7
W.P. (%)	2.24	2.8
Texture	sandy	sandy
Chemical properties		
pH	8.1	7.9
E.C. (mmohs/cm)	1.78	1.66
HCO3-	2.00	2.50
Cl-	7.00	8.00
SO4--	9.48	7.46
Ca++	4.56	4.68
Mg++	2.00	2.04
Na+	7.16	6.48
K+	.70	0.58
Available N (ppm)	1.30	1.23
Available P (ppm)	2.00	1. 99
Available K (ppm)	4.94	5.19

1-O.M.: Organic matter **2- FC: Field capacity**
3- WP: Wilting point **4- E.C: Electric conductivity**

Local meteorological data at El-Kassasin region during winter season of 2005-2006and2006-2007 were given in Table (2).

Table (2): the monthly air temperature and relative humidity during winter season of 2005-2006and2006-2007.

season	(2005-2006)				(2006-2007)			
Month	Temperature(°c)			RH%	Temperature(°c)			RH%
	Max.	Min.	Mean		Max.	Min.	Mean	
Sep.	32.9	22.03	27.25	52.99	34.18	23.22	28.80	53.16
Oct.	29.32	20.68	24.72	59.71	31.33	19.8	25.50	60.75
Nov.	22.07	14.52	18.21	56.67	23.51	14.87	18.71	61.78
Dec.	20.15	12.92	16.64	60.10	18.23	9.85	14.44	60.12
Jan.	18.94	9.92	14.89	60.41	18.76	9.75	14.52	59.07
Feb.	20.18	9.82	15.58	59.95	20.81	9.80	15.96	58.30
Mar.	24.77	13.19	18.87	55.82	25.11	14.05	20.25	53.75
Apr.	28.11	16.36	22.39	50.68	23.34	12.67	17.97	55.34

1-Layout of the experiment and treatments:

The experiment included 18 treatments, which were combination between irrigation water quantities, three sowing dates and two cultivars of peas as follows:

A. Irrigation water quantities:

800 m^3/ fed., 1000 m^3/ fed. and 1200 m^3/fed.

B. Sowing date:

20th September, 10th October and 1st November.

C. Cultivars:

Victory freezer and Lincoln.

The treatments were arranged in split-split plot design with three replicates. Irrigation treatments were assigned at random in the main plots, while sub plots were devoted to sowing dates and cultivars were allotted in sub-sub plots. The seeds of cultivars were obtained from Horticultural Research Institute, Agriculture Research Center.

The experimental unit area was 9.6 m^2 and it contains 4 dripper lines with 4m length for each and 60cm width, and the distance between drippers was 25cm, thus each replicate contains 64 drippers. The seeds (3seeds / hill) were sown after inoculation with root nodules bacteria (*Rhizobium leguminosarum*) and spaced at 20 cm on the ridges.

All experimental units received equal amounts of water during germination (50 m^3 / fed). The irrigation treatments started 10 days after emergence and were added three days intervals in the morning along plant life. The water was added using water counter.

Data were recorded on plant growth and yield and its components as follow:

A. Plant growth parameters.

Three plants were taken at random from each plot at 70 days after sowing to evaluate the following vegetative characters. (Plant height, number of branches / plant, number of leaves/plant and Dry weight).

B. Yield and its components.

Mature green pods were continuously harvested at suitable maturity stages and the following data were calculated. (Number of seeds / pod, Average weight of 100 seeds, Netting percentage and Total yield per fed. Tons / fed).

RESULTS AND DISCUSSION

1. Plant growth.

1.1 Effect of drip irrigation rates.

Data in Table (3) show the effect of drip irrigation rates on vegetative characters of pea plants during 2005-2006 and 2006-2007 seasons expressed as plant height, number of branches per plant and number of leaves per plant.

It is obvious from such data that plant height, number of branches and leaves per plant were significantly increased with increasing amount of applied irrigation water up to the highest level, i.e., 1200m^3 / fed. in both seasons .

Application of 1200 m^3 water / fed. being the most effective treatment and recorded the greatest increments of plant height, number of branches and leaves per plant in both seasons.

The reduction in plant growth under conditions of low soil moisture level(800 m^3 / fed) as compared with the higher levels (1000 & 1200 m^3) may be due to that water stress causes losses in tissue water which reduce turger pressure in the cell, thereby inhibition enlargement and division of cells as concluded by Hsiao and Acevedo (1974).Also, the decrease in enlargement and division of cells decrease leaf area and hence the effectiveness of photosynthetic surface (Jain and Misra, 1970).

The obtained results are in harmony with those reported by several workers who indicated the importance of water supply along plant life for increasing plant growth (Nour, 1999; Merghany, 1999; Abd El-Ati, 2000; Ismail 2000, 2004; Amer *et al.* 2002; Sawan *et al.*, 2002; Nour 2005, EL-Tantawy and EL-Beik, 2007 and Nour *et al.*, 2007). They concluded that plant height, number of leaves and branches per plant of legume crops were increased with increasing soil moisture content (available soil water) or irrigation rates (water quantity).

1.2. Effect of sowing dates.

Data in Table (3) show the effect of sowing date on vegetative characters of pea plants during 2005-2006 and 2006-2007 seasons, expressed as plant height, number of branches per plant and number of leaves per plant.

It is obvious from such data that sowing pea plant on 10th Oct. generally gave the best values of plant height, number of leaves per plant and branches per plant in both seasons. Such results may be due to the suitable temperature range (20-25°C) as showed in Table (2) during germination and plant growth during the vegetative phase. Moreover, prevailing high temperature during the early sowing date (20th Sept.) pushed the plants to enter the reproductive phase before they complete their normal vegetative growth cycle, resulting in significant reduction in plant height, leaves and branches number. The obtained results are in harmony with those reported by several workers indicated the importance of sowing date along plant life for increasing plant growth (Abd-Alla, 2000, Shoker, 2000, Mansour, 2006) they concluded that plant height, number of leaves and branches per plant of pea plants were increased with sowing seeds at October.

1.3. Effect of cultivars.

Data in Table (3) show the effect of cultivars on vegetative characters of pea plants during 2005-2006 and 2006-2007 seasons, expressed as plant height, number of branches per plant and number of leaves per plant. Such results indicate that the highest values of plant height were recorded with Victory freezer cultivar) in both seasons. While number of branches per plant and number of leaves per plant were not significantly affected by the two cultivars in both growing seasons.

The difference between cultivars may be due to their variations in nutrient use efficiency habits. Another explanation is that the different behavior observed in these characters might reflect the differential expressivity of certain genes during ontogenetic processes, which may interact with the developmental and environmental factors in relation to water relationships, and indicated that genes responsible for the biosynthesis of such characters might be varied in their action (Yarnell, 1962 and Arisha, 1982) on pea plants.

The obtained results agree with those reported by Mohammed and Qandil 1998 and Shoker 2000. on pea plants.

Table (3): Effect of drip irrigation rates, sowing dates, cultivars on vegetative characters during 2005-2006 and 2006-2007 seasons.

Characters	Plant height (cm)		No. of Branches / plant		No. of Leaves / plant	
Treatments	Season					
	2005	2006	2005	2006	2005	2006
Water quantity m^3/ fed.						
800	41.030	55.989	2.461	2.622	16.139	20.711
1000	48.489	61.206	2.556	2.922	22.367	25.572
1200	66.811	69.061	3.633	4.044	25.822	36.822
L.S.D 0.05	12.374	5.510	0.715	1.222	9.317	8.472
Sowing date						
20th Sep.	48.152	3.483	16.694	55.067	3.472	27.850
10th Oct.	65.417	4.622	30.756	70.378	3.817	31.828
1st Nov.	44.761	2.378	16.878	60.811	2.300	23.428
L.S.D 0.05	9.310	0.778	4.672	6.752	0.791	7.166
Cultivars						
Vic.	51.379	2.978	22.293	63.530	3.270	27.570
Lin.	46.433	2.789	20.593	60.641	3.122	27.833
L.S.D 0.05	2.447	N.S	N.S	2.484	N.S	N.S

Vic.: Victory freezer. Lin.: Lincoln.

1.4 Effect of interaction

Concerning the effect of interaction between drip irrigation rates and sowing dates on vegetative characters of pea plants during 2005-2006 and 2006-2007 seasons in Table (4). It is evident that interaction between drip irrigation rates and sowing dates had a significant effect on number of branches and leaves per plant in both growing seasons except number of branches in the first season. The highest values of number of branches and leaves per plant were recorded when seeds of pea were sown on 10th Oct. and irrigated with 1200 m^3 / fed.

Generally, increasing plant growth in early sowing dates with adding highest level of irrigation water decreased the unsuitable effects of high temperature at the early sowing date on plant growth, while at medium sowing date, the plant responded better to the moderate levels of irrigation water and this might be attributed to the low temperature and low solar radiation in this period than the earlier sowing. These results are in agreement with those reported by Nour, 1999 on pea plants.

Results in Table (4) show the effect of interaction between drip irrigation rates and cultivars on vegetative characters of pea plants.

Such results indicate that interaction between drip irrigation rates and cultivars had a significant effect on all the vegetative characters in first season except number of leaves, while the second season had no significant effects were obtained on all vegetative characters except number of leaves.

The highest values of plant height were recorded when victory freezer plants were irrigated with 1200 m^3 / fed., while the highest values of number of branches and leaves per plant were recorded when Lincoln plants were irrigated with 1200 m^3 / fed. These results are in agreement with those reported by (Ismail, 2000, Sawan *et al.*, 2001, Nour, 2005) on legume crops.

Regarding, the effect of interaction between sowing dates and cultivars on vegetative characters of pea plants not significant effect on all vegetative characters in both seasons were detected except number of branches in the first season as shown in Table (4).

Concerning the effect of interaction among drip irrigation rates, sowing dates and cultivars on vegetative characters, in Table (5),the results showed that all interaction treatments did not significantly affect vegetative characters of pea plants under study.

2. Dry weight

2.1. Effect of drip irrigation rates.

The effect of drip irrigation rates on dry weight of different organs of pea plants during 2005-2006 and 2006-2007 seasons is presented in Table (6). It is obvious from such data that dry weight of different organs of pea plants was significantly affected by different amounts of irrigation water.

Increasing amount of irrigation water significantly increased dry weight of different plant organs of pea plants, i.e., branches and leaves in both seasons. Application of 1200 m^3 / fed. being the most effective treatment and recorded the greatest increments of branches and leaves dry weights in both seasons.

Table (4): Effect of interaction between drip irrigation rates and sowing dates, drip irrigation rates and cultivars and interaction between sowing dates and cultivars on vegetative characters during 2005-2006 and 2006-2007 seasons.

Drip irrigation rates and sowing dates.

Treatments: Characters		Plant height (cm)		No. of Branches / plant		No. of Leaves / plant	
Water quantity (m^3/fed)	Sowing date	Season					
		2005	2006	2005	2006	2005	2006
800	20th Sep.	41.357	47.483	2.933	2.633	15.300	21.717
	10th Oct.	45.983	62.283	3.333	3.317	18.083	20.867
	1st Nov.	35.75	58.200	2.317	1.917	15.033	19.550
1000	20th Sep.	44.400	55.683	3.367	3.300	17.250	28.183
	10th Oct.	55.533	70.617	4.900	3.150	32.600	26.933
	1st Nov.	45.533	57.317	1.983	2.317	17.250	21.600
1200	20th Sep.	52.700	62.033	4.150	4.483	17.533	33.650
	10th Oct.	61.400	78.233	5.633	4.983	41.583	47.683
	1st Nov.	53.000	66.917	2.833	2.667	18.350	29.133
L.S.D at 0.05		N.S	N.S	N.S	1.119	6.607	10.135

Drip irrigation rates and cultivars.

Water quantity (m^3 /fed.)	Cultivars	Season					
		2005	2006	2005	2006	2005	2006
800	Vic.	42.449	59.189	2.822	2.456	16.467	21.767
	Lin.	39.611	52.789	2.900	2.789	15.811	19.656
1000	Vic.	50.411	60.622	3.444	2.978	23.933	25.567
	Lin.	46.567	61.789	3.389	2.867	20.800	25.578
1200	Vic.	58.278	70.778	4.200	4.378	26.478	35.378
	Lin.	53.122	67.344	4.211	3.711	25.167	38.267
L.S.D at 0.05		8.332	N.S	1.076	N.S	N.S	3.657

Sowing dates and cultivars.

Sowing date	Cultivars	Season					
		2005	2006	2005	2006	2005	2006
20th Sep.	Vic.	47.938	55.567	3.022	3.789	17.156	28.944
	Lin.	44.367	54.567	3.644	3.156	16.233	26.756
10th Oct.	Vic.	55.722	72.344	3.333	3.722	32.244	31.311
	Lin.	52.889	68.411	2.544	3.911	29.267	32.344
1st Nov.	Vic.	47.478	62.678	2.578	2.300	17.478	22.456
	Lin.	42.044	58.944	2.178	2.300	16.278	24.400
L.S.D at 0.05		N.S	N.S	1.076	N.S	N.S	N.S

Vic.: Victory freezer. Lin.: Lincoln.

Table (5): Effect of interaction among drip irrigation rates, sowing dates and cultivars on vegetative characters during 2005-2006 and 2006-2007 seasons.

Treatments / Characters			Plant height (cm)		No. of branches/ plant		No. of Leaves / plant	
Water quantity (m^3/fed)	Sowing d	Cultivars	Season					
			2005	2006	2005	2006	2005	2006
800	20th Sep.	Vic.	41.613	50.000	2.433	2.533	15.333	23.133
		Lin.	41.100	44.967	3.433	2.733	15.267	20.300
	10th Oct.	Vic.	48.100	66.500	3.400	2.867	18.200	21.067
		Lin.	43.867	58.067	3.267	3.767	17.967	20.667
1000	1st Nov.	Vic.	37.633	61.067	2.633	1.967	15.867	21.100
		Lin.	33.867	55.333	2.000	1.867	14.200	18.000
	20th Sep.	Vic.	46.933	53.733	2.867	3.300	18.400	29.500
		Lin.	41.867	57.633	3.867	3.300	16.100	26.867
	10thOct.	Vic.	58.667	69.800	5.367	3.200	34.667	26.667
		Lin.	52.400	71.433	4.433	3.100	30.533	27.200
1200	1st Nov.	Vic.	45.633	58.333	2.100	2.433	18.733	20.533
		Lin.	45.433	56.300	1.867	2.200	15.767	22.667
	20th Sep.	Vic.	55.267	62.967	3.767	5.533	17.733	34.200
		Lin.	50.133	61.100	4.533	3.433	17.333	33.100
	10th Oct.	Vic.	60.400	80.733	5.833	5.100	43.867	46.200
		Lin.	62.400	75.733	5.433	4.867	39.300	49.167
	1st Nov.	Vic.	59.167	68.633	3.000	2.500	17.833	25.733
		Lin.	46.833	65.200	2.667	2.833	18.867	32.533
L.S.D 0.05			N.S	N.S	N.S	N.S	N.S	N.S

Vic.: Victory freezer. Lin.: Lincoln.

The favorable effect of water supply on dry weight of pea plant may be attributed to the favorable soil moisture condition which led to an increase in plant growth which might contribute much for the superiority in dry weight. Unfavorable effect of drought on dry matter production may be due to the reduction in the uptake of nutrition elements thus causing a disturbance in the physiological processes needed for plant growth (Slatyer, 1969) or to the reduction in leaf area and photosynthetic rate (Fisher and Hogan, 1965). and a reduction in Co_2 assimilation due to stomata closure (Hsiao and Acevedo, 1974). The photosynthetic efficiency in *Phaseolus vulgaris* began to decrease with a slight deficit in the soil moisture content due to the decrease in the mesophyll photosynthetic activity at high xylem water potential (Gawish 1992) and this in turn might explain the reduction in dry matter of pea plants with decreasing water irrigation under this study. The obtained results are in harmony with those reported by several workers (Nour, 1999; Ismail, 2000, 2004; Amer *et al*,. 2002 a&b, Nour, 2005, El-Tantawy and El-Beik 2007, Nour *et al*., 2007) on legume crops.

2.2. Effect of sowing dates.

The effect of sowing date on dry weight of different organs of pea plants 2005-2006 and 2006-2007 seasons is presented in Table (6).

It is obvious from such data that dry weights of different organs of pea plants are significantly affected by sowing dates in both seasons .Pea sowing on 10th Oct. recorded the greatest increments of branches dry weight and leaves dry weight in both seasons.

It is well known the suitable temperature range to pars thrive (20-25°C) that prevailing during October sowing date (Table 3).The higher temperature and solar radiation in sandy soil may be affect photosynthetic activity and this in turn affect dry matter accumulation .Any factor affect plant metabolism may affect plant growth and this in turn affect photosynthetic surface and thereby dry matter accumulation. (Jain and Misrs, 1970).

The obtained results are in harmony with those reported by Khalil (1990), Shoker (2000) and Mansour (2006) on pea plants.

2. 3.Effect of cultivars.

The effect of cultivars on dry weight of different organs of pea plants during 2005-2006 and 2006-2007 seasons is presented in Table (6).It is obvious from such data that dry weight of different organs of pea plants was significantly affected by cultivars in the first season only.

The highest values of dry weight of branches and leaves were recorded with sowing cv. Victory freezer.

Simler results were obtained with those reported by (Mohammed and El-Kabany, 1999, Ismai, 2000, Shoker, 2000, Amar *et al.*, 2002 b, El-Assiouty, 2004 and Nour 2005 on legume crops.

2.4 Effect of interaction

Concerning the effect of interaction between drip irrigation rates and sowing dates on dry weight of pea plants as shown in Table (7), it is evident that no significant effect on dry weight of branches and leaves in both growing seasons except dry weight of leaves in the second season.

Generally, the obtained results indicated that planting peas seeds on 10th Oct. gave high values of dry weights with all applied water quantities.

Table (6): Effect of drip irrigation rates, sowing dates and cultivars on dry weight during 2005-2006 and 2006-2007 seasons.

Characters	*D.W. of branches/ plant (gm)*		*D.W. of leaves/ plant (gm)*	
Treatment	Season			
	2005	2006	2005	2006
Water quantity m^3/ fed.				
800	2.276	2.917	2.953	4.136
1000	2.384	3.280	4.038	5.684
1200	3.182	5.035	5.494	7.688
L.S.D 0.05	0.722	2.706	1.856	1.190
Sowing date				
20th Sep.	2.132	4.085	3.276	5.513
10th Oct.	3.290	4.369	5.251	7.318
1st Nov.	2.419	2.777	3.958	4.677
L.S.D 0.05	0.606	1.899	1.311	.703
Cultivars				
Vic.	2.737	3.723	4.304	5.933
Lin.	2.490	3.765	4.019	5.738
L.S.D 0.05	0.162	N.S	0.046	N.S

Vic.: Victory freezer. Lin.: Lincoln.

Table(7): Effect of interaction between drip irrigation rates and sowing dates, drip irrigation rates and cultivars and interaction between sowing dates and cultivars on dry weight during 2005-2006 and 2006-2007 seasons.

Drip irrigation rates and sowing dates.					
Characters / Treatments		D.W. of branches/ plant (gm)		D.W. of leaves/ plant (gm)	
Water quantity (m^3/fed.)	Sowing date	Season			
		2005	2006	2005	2006
800	20th Sep.	2.010	3.227	2.348	4.225
	10th Oct.	2.765	3.160	3.708	4.397
	1st Nov.	2.053	2.363	2.803	5.890
1000	20th Sep.	1.882	3.513	3.327	5.658
	10th Oct.	2.967	3.763	4.695	6.902
	1st Nov.	2.303	2.563	4.093	4.260
1200	20th Sep.	2.505	5.515	4.153	6.424
	10th Oct.	4.138	6.185	7.350	10.654
	1st Nov.	2.902	3.405	4.978	5.985
L.S.D at 0.05		N.S	N.S	N.S	1.826
Drip irrigation rates and cultivars.					
Water quantity (m^3/fed.)	Cultivars	Season			
		2005	2006	2005	2006
800	Vic.	2.388	2.876	2.962	4.087
	Lin	2.164	2.958	2.944	4.184
1000	Vic.	2.454	3.224	4.084	5.734
	Lin	2.313	3.336	3.992	5.633
1200	Vic.	3.370	5.069	5.867	7.978
	Lin	2.946	5.001	5.121	7.397
L.S.D at 0.05		N.S	N.S	0.656	N.S
Sowing dates and cultivars.					
Sowing date	Cultivars	Season			
		2005	2006	2005	2006
20th Sep.	Vic.	2.164	4.039	3.234	5.815
	Lin	2.100	4.131	3.318	5.211
10th Oct.	Vic.	3.517	4.329	5.598	7.378
	Lin	3.063	4.410	4.904	7.257
1st Nov.	Vic.	2.531	2.801	4.081	4.607
	Lin	2.308	2.753	3.836	4.747
L.S.D at 0.05		N.S	N.S	N.S	N.S

Vic.: Victory freezer. Lin.: Lincoln.

The highest values of dry weight of branches and leaves were recorded when pea plants were sown on (10th Oct. and irrigated with 1200 m^3 / fed.).The increase in dry matter content with interaction between drip irrigation rates and sowing dates took the same trend of growth attributes and this in turn explain the effect of this interaction on dry matter content of pea plant. The suitable irrigation rate at different sowing dates may be explained

by the levels of temperature and solar radiation at the different sowing dates in sandy soil.

Results in Table (7) show the effect of interaction between drip irrigation rates and cultivars on dry weight of pea plants. It is evident that no significant effect on dry weight of branches and dry weight of leaves in both growing seasons, except dry weight of leaves in first season only.

Generally, the highest values of dry weight of leaves were recorded with cv. victory freezer were irrigated with 1200 m^3 / fed.

The obtained results are in harmony with those reported by Ismail (2000) and Nour (2005) on legume crops.

Results in Table (7) show that the interaction between sowing dates and cultivars did not significantly affected on dry weight of branches and leaves at both season as shown in Table (7).

It is obvious from such data that dry weight of different organs of pea plants were not significantly affected by the interaction among drip irrigation rates, sowing dates and cultivars in both seasons as shown in Table (8)

Table (8): Effect of interaction among drip irrigation rates, sowing dates and cultivars on dry weight during 2005-2006 and 2006-2007 seasons.

Characters / Treatments			D.W. of branches/ plan (gm)		D.W. of leaves/ plant (gm)	
Water quantity (m^3/fed.)	owing date	cultivars	Season			
			2005	2006	2005	2006
800	20th Sep.	Vic.	2.043	2.997	2.483	4.213
		Lin.	1.977	3.457	2.213	4.237
	10th Oct.	Vic.	3.063	3.063	3.773	4.443
		Lin.	2.057	3.257	3.643	3.603
	1st Nov.	Vic.	2.06	2.567	2.630	3.967
		Lin.	2.050	2.160	2.977	3.967
1000	20th Sep.	Vic.	1.880	3.683	3.150	5.943
		Lin.	1.883	3.343	3.503	5.837
	10th Oct.	Vic.	3.020	3.263	4.953	6.927
		Lin.	2.913	4.263	4.437	6.877
	1st Nov.	Vic.	2.463	2.727	4.150	4.333
		Lin.	2.143	2.4	4.037	4.187
1200	20th Sep.	Vic.	2.570	5.437	4.070	7.288
		Lin.	2.440	5.593	4.237	5.560
	10th Oct.	Vic.	4.467	6.660	8.067	10.763
		Lin.	3.810	5.710	6.633	10.546
	1st Nov.	Vic.	3.073	3.110	5.463	5.883
		Lin.	2.730	3.7	4.493	6.087
L.S.D at 0.05			N.S	N.S	N.S	N.S

Vic.: Victory freezer. Lin.: Lincoln

3. Yield and its components.

3.1. Effect of drip irrigation rates.

Data in Table (9) show the effect of drip irrigation rates on yield and its components, i.e., number of seeds per pod, weight of 100 seeds, net ratio and green pod yield per fed., of pea plants during 2005-2006 and 2006-2007 seasons.

The results show that there were significant effects on weight of 100 seeds in the second season only and net ratio and green pod yield per fed. in both seasons by applied irrigation water. The maximum values of net ratio in the first season and green pod yield per fed. in both seasons were recorded with 1200m^3 / fed.

Todd (1972) reported that water stress inhibit nitrate reeducates activity. Sangakara (1990) reported that nodulation was optimal when green bean plants were grown at higher soil moisture levels and nodule activity was reduced by moisture stress. Marschner (1995) stated that water stress depress nitrogenous activity, while, Streeter (1993) reported that a decrease in phloem solute import presumably inhibits N export and N_2 fixation by water limitation for xylem export. It could be concluded from these reports that water deficit decrease nodulation, nitrogen's and nitrate reeducate activities and N_2 fixation which in turn affect pea yield.

These results coincide with those reported by (Nour, 1999; Merghany, 1999; Ismail, 2000; Amer *et al.*, 2002 a&b; Sawan *et al.*, 2002; Ismail, 2004; Nour, 2005; EL-Tantawy and EL-Beik, 2007, Nour *et al.*, 2007) on legume crops.

3.2. Effect of sowing dates.

Data in Table (9) show the effect of sowing dates on yield and its components, i.e., number of seeds per pod, weight of 100 seeds, net ratio and green pod yield per fed. of pea plants during 2005-2006 and 2006-2007 seasons.

The results indicted that sowing dates had a significant effected on weight of 100 seeds, net ratio and green pod yield per fed. in both seasons.

In addition number of seeds per pod was not affected by sowing dates in both seasons of study. In

general, the greatest average weight of 100 seeds were recorded with 10th Oct. or 1st Nov. while 10th Oct. recorded the maximum values of net ratio and green pod yield per fed. the superiority in net ratio, green pod yield per fed. on 10th Oct. may be attributed to high plant growth parameters as previously in Tables (3) and (6) .

The results are in harmony with those reported by (Khalil, 1990; El-Gamiely *et al.* 1998; Nour, 1999; Abd-Alla, 2000; Shoker, 2000 and Mansour, 2006).

3.3. Effect of cultivars.

It is obvious from the data presented in Table (9) that there were significant differences between the two cultivars in weight of 100 seeds in the first season and number of seeds per pod, net ratio and green pod yield per fed. in the second season only. Victory freezer recorded highest values of number of seeds per pod and green pod yield per fed. in the second season.

The results are in harmony with those reported by (Ismail, 2000, Shoker, 2000, El-Assioty, 2004, Nour, 2005).

3.4. Effect of interaction.

Data in Table (10) show the effect of interaction between drip irrigation rates and sowing date on yield and its components ,i.e., number of seeds per pod, weight of 100 seeds, net ratio and Green pod yield per fed. of pea plants during 2005-2006 and 2006-2007 seasons.

It is clear from the data that the interaction between drip irrigation rates and sowing date had a significant effect in weight of 100 seeds in the first season only. In general, it could be saying that the best interaction treatment for increasing weight of 100 seeds was the application of 1200 m^3 /fed. and sown pea plant on 10th Oct.

It is evident that interaction between drip irrigation rates and cultivars had non significant effects on yield and its components both season as shown in table (10).

Data in table (10) show the effect of interaction between sowing date and cultivars on yield and its components, i.e., number of seeds per pod, weight of 100 seeds, net ratio and green pod yield per fed. of pea plants during 2005-2006 and 2006-2007 seasons.

It is evident that interaction among drip irrigation rates, sowing dates and cultivars had not significant effects yield and its components of pea plants. These results are true in the two growing seasons as shown in Table (11).

Table (9): Effect of drip irrigation rates, sowing dates, cultivars on yield and its components during 2005-2006 and 2006-2007 seasons.

Characters	No. of seeds/pod		Wt. of 100 seeds(gm)		Netting%		Green pod yield tons/fed.	
Treatments	Season							
	2005	2006	2005	2006	2005	2006	2005	2006
Water quantity m^3/ fed.								
800	6.089	5.933	39.344	39.717	46.444	49.000	4.729	4.767
1000	6.289	5.828	41.133	36.733	48.422	50.817	5.080	5.066
1200	6.389	6.222	39.483	41.289	53.072	53.383	5.180	5.209
L.S.D 0.05	NS	N.S	NS	3.894	5.521	3.635	0.246	0.275
Sowing date								
20th Sep.	5.972	6.117	37.506	42.356	48.589	49.883	4.862	4.892
10th Oct.	6.494	5.961	40.144	38.239	51.433	55.117	5.133	5.206
1st Nov.	6.300	5.906	42.311	37.144	47.917	48.200	4.994	4.945
L.S.D 0.05	N.S	N.S	4.725	2.779	3.595	4.949	0.233	0.175
Cultivars								
Vic.	6.189	5.804	39.870	40.122	50.052	51.893	5.023	5.060
Lin.	6.322	6.185	40.104	38.370	48.574	50.241	4.970	4.969
L.S.D 0.05	N.S	N.S	N.S	N.S	N.S	1.123	N.S	0.081

Vic.: Victory freezer. Lin.: Lincoln

Table (10): Effect of interaction between drip irrigation rates and sowing dates, drip irrigation rates and cultivars and sowing dates and cultivars on yield and its components during 2005-2006 and 2006-2007 seasons.

Drip irrigation rates and sowing dates.									
Treatments \ Character		No. of seeds/pod		Wt. of 100 seeds(gm)		Netting%		Green pod yield tons/fed.	
Water quantity (m^3/fed)	owing dat	Season							
		2005	2006	2005	2006	2005	2006	2005	2006
800	20th Sep.	6.100	5.900	37.60	43.30	46.05	48.30	4.620	4.656
	10th Oct.	6.083	6.133	41.30	38.71	47.60	51.28	4.839	4.894
	1st Nov.	6.083	5.767	39.13	37.13	45.68	47.41	4.728	4.752
1000	20th Sep.	5.967	6.150	36.47	38.43	47.76	49.95	4.896	4.944
	10th Oct.	6.783	5.667	40.17	34.46	50.20	54.18	5.197	5.256
	1st Nov.	6.117	5.667	46.77	37.30	47.30	48.31	5.148	4.998
1200	20th Sep.	5.850	6.300	38.45	45.33	51.95	51.40	5.070	5.076
	10th Oct.	6.617	6.083	38.96	41.53	56.50	59.88	5.364	5.466
	1st Nov.	6.700	6.283	41.033	37.00	50.76	48.86	5.106	5.085
L.S.D at 0.05		N.S	N.S	6.683	N.S	N.S	N.S	N.S	N.S
Drip irrigation rates and cultivars.									
Water quantity (m^3/fed.)	Cultivars	Season							
		2005	2006	2005	2006	2005	2006	2005	2006
800	Vic.	6.467	5.800	39.067	40.611	47.30	49.533	4.736	4.799
	Lin.	6.322	6.067	39.622	38.822	45.58	48.467	4.722	4.736
1000	Vic.	6.256	5.578	40.422	37.889	49.34	52.02	5.125	5.092
	Lin	6.533	6.078	41.844	35.578	47.50	49.611	4.822	5.040
1200	Vic.	6.244	6.033	40.122	41.867	53.51	54.122	5.208	5.288
	Lin	5.711	6.411	38.844	40.711	52.63	52.644	5.152	5.130
L.S.D at 0.05		N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S
Sowing dates and cultivars.									
Sowing date	Cultivars	Season							
		2005	2006	2005	2006	2005	2006	2005	2006
20th Sep.	Vic.	5.833	5.933	37.367	43.889	49.233	50.222	4.870	4.924
	Lin.	6.111	6.300	37.644	40.822	47.944	49.544	4.854	4.860
10th Oct	Vic.	6.600	5.644	39.289	38.833	52.344	56.644	5.167	5.255
	Lin	6.389	6.278	41.000	37.644	50.522	53.589	5.100	5.156
1st Nov.	Vic.	6.133	5.833	42.956	37.644	48.578	48.811	5.032	5.000
	Lin	6.467	5.978	41.667	36.644	47.256	47.589	4.956	4.890
L.S.D at 0.05		N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

Vic.: Victory freezer. Lin.: Lincoln.

Table (11): Effect of interaction among drip irrigation rates, sowing dates and cultivar on yield and its components during 2005-2006 and 2006-2007 seasons.

Characters / Treatments			No. of seeds/pod		Wt. of 100 seeds(gm)		Netting%		Green pod yield tons/fed.	
			Season							
Water quantity (m^3/fed.)	Sowing date	cultivars	2005	2006	2005	2006	2005	2006	2005	2006
800	20th Sep.	Vic.	5.667	5.800	38.200	36.867	46.700	48.400	4.602	4.692
		Lin.	6.533	6.000	37.000	39.733	45.400	48.200	4.638	4.620
	10th Oct.	Vic.	5.967	5.867	40.267	37.300	48.600	52.233	4.866	4.929
		Lin.	6.200	6.400	42.333	40.133	46.600	50.333	4.812	4.860
	1st Nov.	Vic.	5.500	5.733	38.733	37.667	46.600	47.967	4.740	4.776
		Lin.	6.667	5.800	39.533	36.600	44.767	46.867	4.716	4.728
1000	20th Sep.	Vic.	5.733	5.867	36.267	39.467	48.333	50.467	4.920	4.956
		Lin.	6.200	6.433	36.667	37.400	47.200	49.433	4.872	4.932
	10thOct.	Vic.	7.300	5.500	38.600	36.933	51.300	56.800	5.210	5.256
		Lin.	6.267	5.833	41.733	32.000	49.100	51.567	5.184	5.256
	1st Nov.	Vic.	5.933	5.367	46.400	37.267	48.400	48.800	5.244	5.064
		Lin.	6.300	5.967	47.133	37.333	46.200	47.833	5.052	4.932
1200	20th Sep.	Vic.	6.100	6.133	37.633	45.333	52.667	51.800	5.088	5.124
		Lin.	5.600	6.467	39.267	45.333	51.233	51.000	5.052	5.028
	10th Oct.	Vic.	6.533	5.567	39.000	42.267	57.133	60.900	5.424	5.581
		Lin.	6.700	6.600	38.933	40.800	55.867	58.867	5.304	5.352
	1st Nov.	Vic.	6.967	6.400	43.733	38.000	50.733	49.667	5.112	5.160
		Lin.	6.433	6.167	38.333	36.000	50.800	48.067	5.100	5.010
L.S.D at 0.05			N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

Vic.: Victory freezer. Lin.: Lincoln

REFERENCES

Abd-Alla, I.M., F.A. Abou Sedera, E.H. Abou El-Salehein and N.T. Mansour (2000). Physiological studies on pea. B- Effect of Rhizobium, Mycorrhyzae inoculation, nitrogen and phosphorus fertilizers on pea (*Pisum sativum*, L.) yield . J. Product. and Dev., 5 (1): 37-56 .

Abd El-Ati, Y. (2000). Growth and yield of cowpea as affected by irrigation regime, phosphorus application and VA-mycorrhizae infection treatments. Assiut J. of Agric. Sci. 31(2): 21-28.

Amer, A.H.; M. El-Desuki; O. M. Sawan and A.M. Ibrahim (2002b). 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.

Amer, A.H.; O. M. Sawan and S. R. Salman (2002a). Water requirements of snap bean (*Phaseolus vulgaris*, L.) as affected by sowing date under newly reclaimed soil at Shark El-Owinat region. J. Agric. Sci. Mansoura Univ., 27(9): 6097-6107.

El-Assiouty, F. M. M. (2004). Effect of some agricultural treatments on seed production and quality of cowpea. J. Agric. Sci. Mansoura Univ., 29(12): 7363-7384.

El-Gamiely, E. L.; H. M. Abd El-Naby ; Hala A. E. El-Sayed and A. E. Eata (1998). Effect of different planting dates and plant density on 1- Vegetative growth and leaf chemical composition of peas J. Agric. Sci. Mansoura Univ., 23 (1) 357-371.

El-Tantawy,E.M. and A.K. El-Beik (2007) Effect of irrigation intervals, organic manure rates and plant density on growth and yield of cowpea plant under north sinai conditions. Egy. J. Appl. Sci.,22 (1): 253-275.

Fisher, R.A. and R.M. Hogan (1965). Plant water relation, irrigation management and crop yield. Exp. Agric., 1: 161-177.

Gawish,R, A.. (1992). Effect of anti-transpirations application on snap bean (*Phaseolus vulgaris*, L.) growth under different irrigation regimes. Menofiya J. Agric. Res., 17(3): 1285-1308.

Hsiao, T. C. and E. Acevedo (1974). Plant response to water deficits, water use efficiency and drought resistance. Agric. Meteorology, 14: 59-84.

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

Ismail, T. B. A. (2004). Effect of drip irrigation rates, organic fertilization and plant denesity on yield and quallty of snap bean. Ph. D. Thesis, Fac. Agric., Suez Canal Univ., Egypt.

Jain, T.C. and D.K. Misra (1970). Effect of water stress on 1- Physiological activities of plants. Indian J. Agron., Vol. XV, 36-40.

Khalil, M. A. I. (1990) Evaluation of some cultivars under different planting dates Egypt. J. Appl. Sci., 5 (6) : 25 – 34 .

Mansour, N. T. S. (2006). Response of pea plants To biofertilization and plant density with different sowing dates under sandy soil conditions. Ph.D. Thesis,. Fac. of Agric. Suez Canal University.

Merghany, M.M. (1999). Response of snap bean to different rhizobium inculation methods and nitrogen levels under two drip irrigation regimes in new reclaimed sandy soil. Zagazig J. Agric. Res., 26 (4): 1091-1123.

Marschner, H. (1995). Mineral nutrition of higher plants (2 ed.) Academic Harcourt Brace and Company Puplisher New York, London, Tokyo 889.

Mohamed, F. I. and E. A. Y. El-Kabbany (1999). Studying the response of some new pea cultivars to NPK fertilization levels. Minufia. J. Agric. Res., 24 (3): 1047-1061.

Mohamed, F.I. and S.H. Qandil (1998):Effect of soil sulphur application on plant growth, yield componets and chemical constituents of pea cultivars . Egypt. J. Appl. Sci.,13 (4): 195-209.

Nour, E. M. E. (1999) Effect of some agricultural treatments on pea under sandy soil conditions . M. Sc. Thesis. Fac. of Agric. Zagazig Univ.

Nour, K. A. M. (2005). Response of some cowpea (*vegna ungiculata, L.)* cultivars to some irrigation levels by drip system and organic manure under sandy soil condition. Ph.D. Thesis,. Fac. of Agric. Mansuora Univ.

Nour, K. A. M; T. B. Ali and Fayza M. A.Darwesh (2007). Water requirement of cowpea as affected by organic fertilization rates under newly reclimed soil conditions. Egypt. J. Appl. Sci.,22 (8B): 482-496.

Prasad, D.; K. M. Singh; R. N. Katiyar and R. N. Singh (1987). Influence of irrigation on the crop growth, pest incidence and crop yield of pea, (*Pisum sativum,*L.) Indian J. Ent. 49(3): 330-344.

Sangakara, U.R. (1990). Response of selected legume companion crops to irrigation frequencies. Agric. Water Mang., 17 : 253-257.

Slatyer, R.O. (1969). Physiological significances of internal water relations to crop yield. Physiological aspects of crop yield, P. 53-88, Soc. Agron and Crop Sci., Madison, Wisconsin.

Shokr. M. M. B (2000).Response of pea (*Pisum sativum,* L) to planting dates and N P K fertilizing. Ph.D. Thesis,. Fac. of Agric. Mansuora Univ.

Streeter, J. G. (1993). Translocation, a key factor limiting the efficiency of nitrogen fixation in legume nodules. Physiol. Plant. 87, 616-623.

Todd, G. W. (1972). Water deficits and enzymatic activity. In Kozlowski, P. 117-216.

White, J. G.; G. W. Sheath and G. Meijer (1982). Yield of garden peas responses to variation in sowing rate and irrigation. New Zealand J. Exp. Agric. 10: 155-160.

الاحتياجات المائية لبعض أصناف البسلة المنزرعة في مواعيد زراعة مختلفة تحت نظام الري بالتنقيط:

١-النمو الخضري و المحصول ومكوناته.

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أجريت تجربتان حقليتان خلال موسمي ٢٠٠٥-٢٠٠٦ ، ٢٠٠٦-٢٠٠٧ بمزرعة محطة بحوث البساتين بالقصاصين ، محافظة الإسماعيلية, لدراسة تأثير معدلات مختلفة من الري بالتنقيط و مواعيد الزراعة والأصناف والتفاعل بينهم على النمو والمحصول ومكوناته لنباتات البسلة تحت ظروف الأراضي الرملية باستخدام نظام الري بالتنقيط.

ادي زيادة كمية مياه الري الي زياده معنوية في النمو (ارتفاع النبات وعدد الافرع و الاوراق للنبات , الوزن الجاف للافرع و الاوراق) وكذلك المحصول ومكوناته (عدد البذور للقرن ,وزن ١٠٠بذرة ,نسبة التصافي و محصول القرون الخضراء للفدان).ادي زراعة نباتات البسلة في ١٠ أكتوبر الي الي زياده معنوية في النمو (ارتفاع النبات وعدد الافرع و الاوراق للنبات , الوزن الجاف للافرع و الاوراق) وكذلك المحصول ومكوناته (عدد البذور للقرن ,وزن ١٠٠بذرة ,نسبة التصافي و محصول القرون الخضراء للفدان). سجل الصنف فيكتوريفر يزر أعلى القيم بالنسبة لمعدلات للنمو والمحصول ومكوناته. وكانت افضل التفاعلات لزيادة النمو الخضري و الوزن الجاف والمحصول ومكوناته هي زراعة الصنف فيكتوريفر يزر فى ١٠ اكتوبر والري بمعدل ١٢٠٠م^3 للفدان.