INFLUENCE OF IRRIGATION INTERVALS AND DIFFERENT SOURCES OF ORGANIC MANURE ON PEA GROWTH AND YIELD UNDER NEWLY RECLAIMED SOIL CONDITIONS

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Abstract

Two field experiments were carried out during two successive winter seasons of 2007/2008 and 2008/2009 at the Experimental Farm, El Kassasein Research Station, Ismailia Governorate, to investigate the effect of two irrigation intervals (every two days and every four days) and five sources of different organic fertilizer(rabbit, horse, goat, farmyard manure and chicken manure)and their interactions on plant growth, dry weight, leaf pigments, yield and chemical constituents of pea (*Pisum sativum* L.) cv. Victory freezer. Irrigation every two days was superior compared with four days intervals. It recorded maximum values of plant height, number of leaves / plant, leaf area, total dry weight, number of pods / plant and yield / plant, as well as photosynthetic pigments in both seasons.

Plant growth, yield, photosynthetic pigments and chemical constituents were significantly affected by using different sources of organic manure, the best source that gave the highest values was chicken manure as compared to other different sources. In general, the best interaction treatment between irrigation intervals and different sources of organic manure was irrigation every two days with fertilization of chicken manure at a rate of 10 m^3 / fed. or FYM at a rate of 30 m^3 / fed. as compared to other interaction treatments.

Key words: pea, irrigation intervals, organic manure, yield

INTRODUCTION

Pea (*Pisum sativum* L.) is one of the important leguminous vegetable crops, which could be grown in wide types of the Egyptian soils especially in the newly reclaimed soils. 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.

Irrigation is one of the important factors for pea production for both an economic and rotational perspective view. Maximizing the production of pea requires suitable cultural practices. Such as the favorable quantity and quality of irrigation water requires as well as the favorable type of fertilizers. In that regard, White *et al.* (1982) found that pea plants irrigated at flowering and pod swelling recorded the

highest vine length, green yield and seed yield. El-Mansi *et al.* (1999), on pea plants showed that stem length, number of leaves, leaves content of chlorophyll a, b, total chlorophyll and carotenoids as well as yield and its components were significantly affected by applied irrigation water. Sawan *et al.* (2002), on sugar pea reported that increasing irrigation rates increased vegetative growth and yield and yield components.

Dawa *et al.* (2008) found that increasing water quantity up to 1200m^3/fed. led to a significant increase of plant growth, dry weight and yield and its components of pea plants. Irrigation pea plants every 30 days increased number of branches/plant, plant height, pod length, number of pods/plant, number of seeds/pod and fresh pod yield /fed. (Mohamed and Abd El-Hady, 2009).

Newly reclaimed sandy soil had unfavorable physical, chemical and biological conditions, high pH, low water holding capacity and high ability to erosion and scarcity of amended water. Thus, addition of organic manures to sandy soil is very important to increase soil acidity and soil exchange capacity, provide energy for micro-organisms activity, increase water holding capacity and buffering of the soil infiltration (Hsieh and Hsu, 1993).Organic manure also, contains many species of living organisms which release phyto-hormones as GA, IAA and CYT which stimulate plant growth (Reynders and Vlassak, 1982). Thus, application of hens manure improved vegetative growth, weight of pod, number of seeds/pod and total carbohydrate of pea plant as compared to cattle or sheep manure (El-Gizy, 1994). Hanna and El-Gizy 1999 studied the effect of different manure sources (pigeon, chicken and duck manure) on bean, the results showed that all treatments significantly increased vegetative growth and total yield as compared to inorganic treatments.

Santos *et al.* (2004) evaluated the effect of poultry, cattle, goat and earthworm manures on snap bean. They pointed out that the average weight of pods was affected by poultry manure up to 20m^3/ ha. followed by cattle manure up to 40m^3/ ha. Using chicken manure at rate of 10m^3/fed. significantly increased vegetative growth, chlorophyll a, b and total chlorophyll as well as yield and its components and protein seeds content (Soubeih, 2005). Abd El-hady (2009) on cowpea revealed that using farmyard manure at rate of 20 m^3/ fed. significantly increased plant height, number of branches/plant, number of seeds/pod, number of pods/ plant and seed yield as compared to control.

This work aimed to investigate the effect of irrigation intervals and different sources of organic fertilizer on growth, dry weight, leaf pigments, yield and chemical constituents of pea plants grown under sandy soil conditions.

MATERIALS AND METHODS

The present investigation was conducted at the Experimental Farm, El Kassasein Horticultural Research Station, Ismailia Governorate, during two winter seasons of 2007/2008 and 2008/2009, to study the effect of two irrigation intervals (every two days and every four days) and different five sources of organic manure (rabbit, horse, goat, farmyard and chicken manure) on growth , yield and chemical constituents of pea plants (*Pisum sativum* L.) c.v. Victory freezer grown under sandy soil conditions using drip irrigation system. The physical and chemical properties of the experimental soil are presented in Table 1.

Table 1. The physical and chemical properties of the tested soil during 2007/2008and 2008/2009 seasons.

Physical properties			Chemical properties		
	2007/2008	2008/2009		2007/2008	2008 /2009
Sand (%)	96.5	95.6	Organic matter	0.03	0.08
Silt (%)	1.7	1.6	Available K (ppm)	52	64
Clay	1.8	2.8	Available P (ppm)	5.5	6.2
Field capacity	6.5	6.8	Available N (ppm)	5.4	6.9
Wilting point	2.4	2.5	Calcium carbonate %	0.18	0.26
Available water	4.5	4.5	pH	8.1	8.1
Water holding capacity	13.8	14.5			

This experiment included 10 treatments, resulted from the interaction between two irrigation intervals and five different sources of organic manure. The treatments were arranged in a split plot design with three replicates. Irrigation intervals were assigned at random in the main plots, while sub-plots were devoted to organic manure sources as follows:

Main plots (irrigation intervals); i.e., every two and four days.

Sub-plots (five different sources of organic manure); i.e., rabbit manure at a rate of $20m^3$/fed., horse manure at a rate of $30m^3$/fed., goat manure at a rate of $20m^3$/fed., farmyard manure at a rate of $30m^3$/fed., and chicken manure at a rate of $10m^3$/fed. (which these rates contained the same nitrogen level according to the chemical analysis of the used organic manures).

The chemical analysis of used organic manures was scheduled in Table 2. Also, nitrogen amount in each of one m^3 of different organic manure was shown in Table 3.

Table 2. Chemical analysis of used organic manure during 2007/2008 and 2008/2009 seasons.

Type of analysis	Kind of manure									
	Rabbit		Goat		Horse		FYM		Chicken	
Season	1ST	2ND	1ST	2ND	1ST	2ND	1ST	2ND	1ST	2ND
O.M.%	50.88	52.80	47.04	51.27	42.84	46.81	30.32	33.38	58.38	59.81
N%	1.59	1.65	1.47	1.56	0.84	0.90	0.56	0.63	2.19	2.31
P%	0.43	0.51	0.38	0.49	0.35	0.37	0.31	0.36	0.51	0.53
K%	1.26	1.29	1.05	1.14	1.02	1.05	0.93	0.96	1.28	1.33

Table 3. Nitrogen amount in different organic manure (Kg/m3) .

Kind of manure	2007/2008	2008/2009
$1m^3$Rabbit (243Kg)	3.86	4.01
$1m^3$Goat (297Kg)	4.36	4.62
$1m^3$Horse (190Kg)	1.60	1.71
$1m^3$FYM (486Kg)	2.72	3.06
$1m^3$Chicken (243Kg)	7.67	8.09

Seeds of pea cv. Victory freezer were obtained from Horticultural Research Institute, Agriculture Research Center, Egypt. Seeds were sown in hills 25 cm apart on one side of ridges and two seeds per hill on November 7th and 9th in 2007/2008 and 2008/2009, respectively. The area of experimental plot was $10.5m^2$ and it contained 3 dripper lines with 5m length for each with 70cm in between, moreover the distance between emitters was 25 cm, thus each experimental unit contained 60 emitters. One line was used to measure the vegetative growth parameters and the other two lines were for yield determination.

All experimental units received equal amounts of irrigation water; i.e., 1200 m^3 / feddan, irrigation treatments started at 10 days after emergence and were added in the morning along plant life. The amounts of calculated water were added to different treatments, express through drippers (2L/hr.) at one bar to give such amounts of water which presented in schedule 1.

Schedule 1. The irrigation intervals, the time needed to gave such amounts and amounts of water supply at every irrigation.

Irrigation intervals	Irrigation number	Irrigation time in every irrigation(min.)	Water quantity (m^3/fed.) in every irrigation	Water quantity (m^3/plot) /10.5m^2 in every irrigation
Every two days	70	21.25	17.14	0.04285
Every four days	35	42.50	34.28	0.08570

Organic manure treatments were applied at soil preparation in mid row and covered with 10cm soil. All treatments received 50% of recommended fertilization rates; i.e., 150 kg/ fed. Ammonium nitrate (33.5%N) was added in two equal applications at 30 and 45 days after sowing, the normal cultural practices were followed according to Agriculture Ministry recommendations for snap pea.

Data recorded

1. Growth parameters

A random sample of three plants from each experimental unit were taken at 90 days after sowing in both seasons of study for measuring the growth characters of pea plants expressed as follows: plant height (cm), number of both leaves and branches / plant, total dry weight (leaves + branches) / plant (g) and leaf area (the samples were dried in an electric oven at 70°C till constant weight).

2. Yield and its components

Mature green pods were continuously harvested at suitable maturity stage and the following data were calculated :- number of pods/plant, average pod weight (g), weight of 100 seeds(g), number of seeds/ pod, average weight of green pods/plant (g), green pod yield/fed. (ton) and netting (%).

3. Leaf pigments

Disk samples from the fourth upper leaf were taken at 90 days after sowing to determine chlorophyll a, b and total chlorophyll (a+b) as well as carotenoids according to Wettestein (1957).

4. Pod chemical constituents

Dried seeds were finely ground separately and digested with sulfuric acid and percholoric acid (3:1). Nitrogen, phosphorus and potassium were determined according to the method described by Kock and Mc-Meekin (1924), Murphy and Riley (1962) and Brown and Lilliland (1946), respectively.

5. Total crude protein (%)

The previously determined nitrogen of dry seeds was used for calculating total crude protein by multiplying N- values by 6.25 (A.O.A.C., 1980).

7. Statistical analysis

The collected data were subjected to statistical analysis of variance using the normal (F) test and the means separation were compared by using Least Significant Difference (L.S.D.) at 5% level according to Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

Plant Growth

Effect of irrigation intervals

Data presented in Table 4 show the effect of irrigation intervals on vegetative growth characters of pea plant at 120 days after sowing represented as plant height, number of both leaves and branches / plant, total dry weight and leaf area. It is clear that irrigation intervals showed significant effect on all vegetative growth characters except number of branches and leaf area.

Irrigation treatment every two days was superior compared with four days intervals since it gave the uppermost values, while irrigation at four days intervals recorded the lowermost values. The increment in plant height by increasing the irrigation levels could be explained by either increasing the number of cell layers in the cell expanding zone and cambial zone according to high level of irrigation, or as a result of water availability that increased cell enlargement and cell division as mentioned by Abe and Nakai (1999). Moreover, Kozlowski (1971) concluded that interval water stress influences shoot growth through its effect on cell expansion of preformed shoots primordial and development of new primordial. Also water stress depresses RNA level and consequently retards growth.

These results are in harmony with those reported by white *et al.* (1982), El-Mansi *et al.* (1999), Dawa *et al.* (2008) and Mohamed and Abd El-Hady (2009) all worked on pea and Sawan *et al.* (2001) on sugar pea.

Table 4. Effect of irrigation intervals and different sources of organic manure on vegetative growth and dry weight of pea plants during 2007/2008 and 2008/2009 seasons.

Treatments	Growth characters / plant									
	Season 2007/2008					Season 2008/2009				
Irrigation intervals	Plant height(cm)	Leaves No.	Branches No.	Total dry weigh (g)	Leaf area (cm^2)	Plant height(cm)	Leaves No.	Branches No.	Total dry weigh (g)	Leaf area (cm^2)
2 days	78.9	56.9	6.6	23.62	1071.2	74.7	57.9	6.3	25.25	1114.4
4 days	64.3	53.8	6.1	20.99	990.5	60.4	55.7	6.1	22.79	1066.
LSD at 0.05 level	6.25	1.5	N.S	1.63	N.S	4.0	0.9	N.S	2.45	N.S
Organic manure										
Rabbit	72.7	54.0	5.0	23.15	1108.1	68.5	55.7	5.5	24.34	1169.7
Horse	63.7	50.5	6.7	19.68	913.0	60.8	52.5	6.5	20.96	940.0
Goat	64.5	50.2	6.5	20.91	946.2	59.7	51.7	6.3	22.43	997.8
FYM	74.7	58.7	6.7	23.02	1038.0	70.8	59.3	6.2	24.44	1090.1
Chicken	82.5	63.5	7.0	24.75	1149.1	77.8	64.7	6.5	27.94	1253.5
LSD at 0.05 level	8.0	5.2	N.S	2.22	164.3	7.8	3.2	N.S	3.07	235.6

Effect of different sources of organic manure

Data presented in Table 4 show the effect of different sources of organic manure on different vegetative growth parameters; i.e., plant height, number of both leaves and branches / plant and total dry weight as well as leaf area. It is clear that there were significant differences among the tested organic manures in all measured growth expressed as plant height, number of leaves, total dry weight and leaf area except number of branches / plant. Obtained results were true during both seasons of study. Such data reveal that using chicken manure at a rate of $10m^3$/fed.significantly increased all different vegetative growth parameters during both seasons of growth compared with using rabbit manure or goat manure at a rate of $20m^3$/fed. and horse manure or farmyard manure at a rate of $30m^3$/fed.

On the contrary, the lowest values in all measured growth traits were recorded in case of using horse manure at a rate of $30m^3$/fed. and goat manure at a rate of $20m^3$/fed. during both seasons of study. The enhancing effect of farmyard and chicken manures on plant growth may be due to that such organic manures play a role as soil amendment which improves water holding capacity of sandy soils and increase macro and micro elements availability in the rhisospher around root system which in turn increased plant growth. However, application of goat manure increased the osmotic pressure of soil solution due to higher salinity and higher sodium ion content which adversely affects plant growth (Soubeih, 2005).

Obtained results are in conformity with those of El-Gizy (1994) and Soubeih (2005) on pea, Hanna and El-Gizy (1999) and Santos *et al.* (2001) on snap bean and Abd El-Hady (2009) on cowpea.

Effect of interaction between irrigation intervals and different sources of organic manure

Data in Table 5 illustrate the effect of interaction between irrigation intervals and different sources of organic manure on vegetative growth and dry weight of pea plant. It is seen that the interaction between irrigation every two days and using chicken manure or farmyard manure gave the best results on vegetative growth characters, but without reach to the statistical level.

In general, it could be concluded that irrigation every two days combined with fertilization with chicken manure at a rate of $10m^3$ / fed. was adjudged as the most favorable treatment.

Table 5. Effect of interaction between irrigation intervals and different sources of organic manure on vegetative growth and dry weight of pea plants during 2007/2008 and 2008/2009 seasons.

Treatments		Growth characters / plant									
		Season 2007/2008					Season 2008/2009				
Irrigation intervals	Organic manure	Plant height (cm)	Leaves No.	Branches No.	Total dry weigh (g)	Leaf area(cm2)	Plant height(cm)	Leaves No.	Branches No.	Total dry weigh (g)	Leaf area(cm2)
2 days	Rabbit	79.0	55.7	5.0	25.41	1147.7	75.3	57.3	5.7	27.80	1208.9
	Horse	76.3	51.3	7.0	20.36	951.1	72.3	52.7	6.7	21.61	969.8
	Goat	71.7	50.3	6.7	22.08	1013.7	66.7	51.7	6.3	22.85	1004.2
	FYM	82.0	61.0	7.0	23.88	1077.1	78.0	60.7	6.3	24.91	1106.6
	Chicken	85.7	66.3	7.3	26.36	1166.4	81.0	67.0	6.7	29.08	1282.3
4 days	Rabbit	66.3	52.3	5.0	20.89	1068.5	61.7	54.0	5.3	20.89	1130.4
	Horse	51.0	49.7	6.3	19.00	874.8	50.3	52.3	6.3	20.30	910.1
	Goat	57.3	50.0	6.3	19.73	878.6	52.7	51.7	6.3	22.00	991.4
	FYM	67.3	56.3	6.3	22.16	999.0	63.7	58.0	6.0	23.97	1073.5
	Chicken	79.3	60.7	6.7	23.15	1131.8	74.7	62.3	6.3	26.80	1224.7
LSD at 0.05 level		N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

Photosynthetic Pigments

Effect of irrigation intervals

The presented data in Table 6 indicate that chlorophyll a, b and total chlorophyll as well as carotenoids were significantly increased with extending irrigation intervals (irrigation every four days); these results are true during both seasons of study except carotenoids in the second season. The stimulative effect of long irrigation intervals on chlorophylls concentration in leaf tissues might be due to the wide irrigation intervals (every four days) increased dry matter percentage more than the pigments formation. In other words, the increase in dry matter of leaves with adding more water (every two days) was higher than the pigments formation.

The superior treatment that gave the highest values of chlorophyll in leaf tissues was irrigation every four days compared to irrigation every two days. Decreasing the applied water to pea plant by extending irrigation intervals resulted in lowering the water content in leaf tissues, and this in turn increased the intensity of the green color of leaves. These results agree with those reported by El-Mansi *et al.* (1999).

Effect of different sources of organic manure

Significant superiority in chlorophyll a, b and total chlorophyll values actualized from chicken manure treatment compared with other organic manure treatments in the two seasons, as shown in Table 6. These results may be due to the different specifying of nitrogen and magnesium content in chicken manure more than its contents in the other organic manure treatments (Soubeih, 2005). Obtained results contradict with those reported by Soubeih (2005) on pea.

Effect of interaction between irrigation intervals and different sources of organic manure

Obtained results recorded in table 7 reveal that chlorophyll a, b and total chlorophyll were significantly increased by the interaction treatments. In general, it could be concluded that irrigation every four days combined with fertilization with chicken manure at a rate of $10m^3$ / fed. was adjudged as the most favorable treatment.

The highest values of chlorophyll a, b and total chlorophyll were accomplished from irrigation every four days with fertilization with chicken manure followed with irrigation every four days with fertilization with farmyard manure. Meanwhile, the combination of irrigation every two days and horse manure at a rate of $30m^3$ / fed. recorded the lowest values of chlorophyll a, b and total chlorophyll.

Table 6. Effect of irrigation intervals and different sources of organic manure on photosynthetic pigments of pea plants during 2007/2008 and 2008/2009 seasons.

Treatments	Photosynthetic pigments							
	Season 2007/2008				Season 2008/2009			
Irrigation intervals	Chl.a (mg/g D.W.)	Chl.b (mg/g D.W.)	Total (a+b) (mg/g D.W.)	Carotenoids (mg/g D.W.)	Chl.a (mg/g D.W.)	Chl.b (mg/g D.W.)	Total (a+b) (mg/g D.W.)	Carotenoids (mg/g D.W.)
2 days	3.23	2.10	5.33	2.95	3.71	2.30	6.04	3.11
4 days	4.11	3.08	7.19	3.51	3.95	2.88	6.83	3.31
LSD at 0.05 level	0.26	0.12	0.27	0.16	N.S	0.23	0.58	N.S
Organic manure								
Rabbit	2.81	2.19	5.00	2.91	3.12	2.36	5.48	3.15
Horse	3.22	2.66	5.88	3.11	3.61	2.40	6.01	2.94
Goat	3.58	2.60	6.18	3.13	3.69	2.53	6.31	3.31
FYM	4.01	2.66	6.67	3.57	4.33	2.82	7.14	3.46
Chicken	4.72	2.85	7.57	3.43	4.40	2.85	7.25	3.21
LSD at 0.05 level	0.20	0.20	0.31	0.24	0.27	0.33	0.56	0.19

Table 7. Effect of interaction between irrigation intervals and different sources of organic manure on photosynthetic pigments of pea plants during 2007/2008 and 2008/2009 seasons.

Treatments		Photosynthetic pigments							
		Season 2007/2008				Season 2008/2009			
Irrigation intervals	Organic manure	Chl.a (mg/g D.W.)	Chl.b (mg/g D.W.)	Total (a+b) (mg/g D.W.)	Carotenoids (mg/g D.W.)	Chl.a (mg/g D.W.)	Chl.b (mg/g D.W.)	Total (a+b) (mg/g D.W.)	Carotenoids (mg/g D.W.)
2 days	Rabbit	2.63	2.12	4.75	3.09	2.95	2.3	5.28	3.33
	Horse	2.67	1.98	4.65	2.46	3.23	1.94	5.17	2.54
	Goat	3.18	1.94	5.12	2.54	3.88	2.30	6.36	3.32
	FYM	3.38	2.10	5.48	3.43	4.29	2.26	6.55	3.25
	Chicken	4.27	2.36	6.63	3.21	4.19	2.66	6.85	3.12
4 days	Rabbit	2.99	2.26	5.25	2.73	3.29	2.39	5.68	2.96
	Horse	3.77	3.34	7.11	3.75	3.98	2.86	6.84	3.33
	Goat	3.98	3.25	7.23	3.72	3.50	2.75	6.25	3.29
	FYM	4.63	3.22	7.85	3.71	4.36	3.37	7.73	3.67
	Chicken	5.17	3.33	8.50	3.65	4.61	3.03	7.64	3.29
LSD at 0.05 level		0.28	0.30	0.43	0.33	0.38	0.47	0.79	0.28

Yield and Its Components

Effect of irrigation intervals

Concerning yield and its components, presented data in Table 8 show clearly that irrigation intervals reflected significant effect on number of pods / plant and green pods yield / plant, these results were in the same trend in the first and second season. In general, irrigation every two days intervals gave the uppermost values of all the studied characters compared to irrigation every four days.

The total yield was 3.729 and 4.105 ton / fed. in the first and second seasons respectively, when plants were irrigated by two days intervals, whereas, the total yield was 3.543 and 3.726 ton / fed. in the first and second seasons, respectively, when plants were irrigated by four days intervals. That means that the total yield was reduced by 5.00 and 9.23 % in the first and second seasons, respectively, by extending irrigation period.

The noticed reduction in yield and its components under long irrigation intervals may be due to the depression in plant growth (Table 4). These results agree with those reported by white *et al.* (1982), El-Mansi *et al.* (1999), Dawa *et al.* (2008) and Mohamed and Abd El-Hady (2009) on pea as well as Sawan *et al.* (2001) on sugar pea.

Effect of different sources of organic manure

The results illustrated in Table 8 clearly indicate that green pods yield and its components were significantly affected when pea plants were fertilized with different studied organic manures. The superior treatment which gave the highest values was application of chicken manure compared with other organic manure sources. Increasing pea yield and its components as a result of chicken manure fertilization was due to the enhancing effect of chicken manure on vegetative growth (Table 4). Concerning the improving effect of organic manure on yield and its components, similar results were reported by El-Gizy (1994) and Soubeih (2005) on pea, Hanna and El-Gizy(1999) and Santos *et al.* (2001) on snap bean as well as Abd El-Hady (2009) on cowpea.

Table 8. Effect of irrigation intervals and different sources of organic manure on yield and its components of pea plants during 2007/2008 and 2008/2009 seasons.

Treatments	Yield and its components													
	Season 2007/2008							Season 2008/2009						
Irrigation intervals	No. of pods/ plant	Avr. pod Wt.(gm)	Wt.of 100 seeds	No. of seeds/pod	Green pods yield		Netting (%)	No. of pods/ plant	Avr. pod Wt.(gm)	Wt.of 100 seeds	No. of seeds/ pod	Green pods yield		Netting (%)
					gm / plant	tons /fed.						gm / plant	tons /fed.	
2 days	19.3	4.05	35.0	6.4	77.69	3.729	48.54	19.5	4.35	37.0	6.5	84.78	4.105	49.86
4 days	17.9	4.07	34.8	6.4	71.93	3.543	47.09	18.3	4.24	35.2	6.3	77.21	3.726	48.05
LSD at 0.05 level	0.5	N.S	N.S	N.S	2.30	N.S	N.S	0.6	N.S	N.S	N.S	2.52	N.S	N.S
Organic manure														
Rabbit	20.0	3.86	34.1	6.7	76.76	3.685	51.47	18.8	4.38	37.1	6.7	82.21	3.946	52.56
Horse	15.0	4.43	36.6	6.6	66.14	3.174	49.35	15.7	4.40	37.3	6.4	68.87	3.356	49.84
Goat	19.7	3.50	31.1	5.6	68.56	3.290	45.08	18.3	4.02	33.6	5.7	73.42	3.614	46.14
FYM	19.2	4.09	36.9	6.6	77.67	3.728	45.71	21.3	4.00	35.9	6.5	85.21	4.090	47.18
Chicken	19.3	4.41	36.1	6.8	84.93	4.076	47.44	20.3	4.69	36.8	6.9	95.28	4.573	49.07
LSD at 0.05 level	2.0	0.29	3.6	0.7	5.34	0.435	4.67	1.6	0.25	N.S	0.8	4.46	0.369	3.08

Effect of interaction between irrigation intervals and different sources of organic manure

According to the effect of interaction between irrigation intervals and different sources of organic manure on yield and yield components expressed as number of pods/plant, average pod weight, weight of 100 seeds, number of seeds/pod, green pod yield/plant and total yield / fed. it is obvious from such data in Table 9 that the interaction treatments reflected insignificant effect on all yield components except average pod weight. These results were true during both seasons of study. It is noticed that the interaction between irrigation every two days and fertilization with chicken manure was the superior interaction treatment.

Seed Chemical Constituents

Effect of irrigation intervals

Statistical analysis of data in Table 10 show clearly that, irrigation intervals (every two days and every four days) had insignificant effect on chemical constituents of pea seeds, i.e., nitrogen, phosphorus, potassium and protein (%) . These results are true in the two growing seasons.

Effect of different sources of organic manure

The results reported in Table 10 show the effect of different sources of organic manures (rabbit, goat, horse, FYM and chicken manure) on chemical constituents of pea seeds cv. Victory freezer expressed as nitrogen, phosphorus, potassium and protein (%), such results clearly indicate that organic manure application significantly affected chemical contents of pea seeds during both seasons of this experiment.

Table 9. Effect of interaction between irrigation intervals and different sources of organic manure on yield and its components of pea plants during 2007/2008 and 2008/2009 seasons.

Treatments		Yield and its components													
		Season 2007/2008							Season 2008/2009						
Irrigation intervals	Organic manure	No. of pods/ plant	Avr. pod Wt.(gm)	Wt.of 100 seeds	No. of seeds/pod	Green pods yield		Netting (%)	No. of pods/ plant	Avr. pod Wt.(gm)	Wt.of 100 seeds	No. of seeds/ pod	Green pods yield		Netting (%)
						gm / plant	tons /fed.						gm / plant	tons /fed.	
2 days	Rabbit	19.7	4.13	35.3	7.0	80.77	3.877	52.12	18.7	4.67	38.9	6.8	87.04	4.178	53.65
	Horse	16.0	4.19	34.9	6.6	66.94	3.213	50.41	16.3	4.45	36.7	6.5	72.73	3.491	50.82
	Goat	20.7	3.42	31.6	5.4	70.23	3.371	44.76	19.3	3.98	34.1	5.7	76.69	3.861	46.21
	FYM	21.3	3.80	36.2	6.3	81.10	3.893	46.86	22.0	3.99	36.9	6.5	87.81	4.215	48.46
	Chicken	19.0	4.71	37.1	6.8	89.40	4.291	48.54	21.3	4.67	38.3	7.0	99.65	4.782	50.14
4 days	Rabbit	20.3	3.59	32.9	6.3	72.75	3.492	50.82	19.3	4.08	35.2	6.5	77.38	3.714	51.47
	Horse	14.0	4.67	38.2	6.5	65.3	3.136	48.29	15.0	4.35	37.8	6.2	65.00	3.220	48.85
	Goat	18.7	3.59	30.6	5.8	66.88	3.210	45.39	17.3	4.06	33.0	5.6	70.15	3.367	46.07
	FYM	17.0	4.38	37.5	6.8	74.23	3.563	44.63	20.7	4.00	34.8	6.4	82.60	3.965	45.89
	Chicken	19.7	4.11	35.0	6.7	80.46	3.862	46.33	19.3	4.71	35.3	6.8	90.92	4.364	47.99
LSD at 0.05 level		N.S	0.41	N.S	N.S	N.S	N.S	N.S	N.S	0.35	N.S	N.S	N.S	N.S	N.S

Table 10. Effect of irrigation intervals and different sources of organic manure on chemical components constituents of pea plants during 2007/2008 and 2008/2009 seasons.

Treatments	Chemical constituents (%)							
	Season 2007/2008				Season 2008/2009			
Irrigation intervals	N	P	K	Protein	N	P	K	Protein
2 days	3.43	0.222	2.30	21.43	3.51	0.227	2.31	21.95
4 days	3.75	0.209	2.37	23.46	3.60	0.218	2.34	22.49
LSD at 0.05 level	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S
Organic manure								
Rabbit	3.62	0.210	2.21	22.60	3.34	0.219	2.22	20.85
Horse	3.48	0.224	2.36	21.72	3.71	0.223	2.35	23.16
Goat	3.48	0.211	2.26	21.72	3.39	0.222	2.30	21.16
FYM	3.46	0.217	2.33	21.63	3.31	0.218	2.35	20.69
Chicken	3.94	0.216	2.48	24.58	4.04	0.231	2.39	25.25
LSD at 0.05 level	0.34	N.S	0.08	2.14	0.52	N.S	0.10	3.26

Data indicate that the seeds obtained from plants grown in soil provided with chicken manure at a rate of 10 m^3 / fed. contained high amounts of nitrogen, potassium and protein followed by seeds of plants received farmyard manure at a rate of 30 m^3 / fed. these results were true in both seasons of this trial.

Concerning the effect of different sources of organic manure on chemical constituents of pea seeds, such data are in accordance with those obtained by El-Gizy (1994) and Soubeih (2005) on pea.

Effect of interaction between irrigation intervals and different sources of organic manure

According to the effect of the interaction between irrigation intervals (every two days and every four days) and organic manure treatments (rabbit, goat, horse, FYM and chicken manure) on chemical constituents of pea seeds expressed as nitrogen, phosphorus, potassium and protein (%), it is obvious from such data in Table 11 that the interaction treatments did not reflect any significant effect on all tested characters except nitrogen and protein (%) in 1st season only. However irrigation intervals every four days in combination with chicken manure seemed to be superior in this regard.

RECOMMENDATION

From the previous results of this investigation, it could be recommend that irrigation of pea plants grown under sandy soil conditions at two days intervals in combination with chicken manure at a rate of 10 m^3 / fed. or FYM at a rate of 30 m^3 / fed. were the superior treatments for enhancing growth, leaf pigments and yield and its components as compared with other treatments.

Table 11. Effect of interaction between irrigation intervals and different sources of organic manure on chemical constituents of pea plants during 2007/2008 and 2008/2009 seasons.

Treatments		Chemical constituents (%)							
		Season 2007/2008				Season 2008/2009			
Irrigation intervals	Organic manure	N	P	K	Protein	N	P	K	Protein
2 days	Rabbit	3.80	0.223	2.14	23.75	3.21	0.233	2.16	20.06
	Horse	3.28	0.229	2.28	20.50	3.73	0.221	2.28	23.31
	Goat	3.01	0.213	2.28	18.81	3.50	0.227	2.32	21.87
	FYM	3.19	0.219	2.30	19.94	3.24	0.221	2.35	20.25
	Chicken	3.87	0.225	2.48	24.16	3.88	0.231	2.41	24.25
4 days	Rabbit	3.43	0.198	2.28	21.44	3.46	0.204	2.28	21.63
	Horse	3.67	0.219	2.43	22.94	3.68	0.225	2.41	23.00
	Goat	3.94	0.208	2.30	24.63	3.27	0.217	2.28	20.44
	FYM	3.73	0.215	2.35	23.31	3.38	0.215	2.35	21.13
	Chicken	4.00	0.206	2.48	25.00	4.20	0.231	2.37	26.25
LSD at 0.05 level		0.48	N.S	N.S	3.02	N.S	N.S	N.S	N.S

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تأثير فترات الرى ومصادر مختلفة من السماد العضوى على النمو والمحصول فى البسلة تحت ظروف الأراضى المستصلحة حديثا

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أجريت تجربتان حقليتان خلال الموسم الشتوى لعامى ٢٠٠٧ / ٢٠٠٨و ٢٠٠٨ /٢٠٠٩ فى مزرعة التجارب البحثية بمحطة بحوث البساتين بالقصاصين ، محافظة الأسماعيلية ،وذلك لدراسة تأثير فترات الرى (الرى كل يومين ، الرى كل أربعة أيام) وخمسة مصادر مختلفة من الأسمدة العضوية (سماد الأرانب، سماد الماعز، سماد الخيول ، السماد البلدى و سماد الدواجن) والتفاعل بينهما ، على النمو والوزن الجاف والصبغات النباتية والمحصول والمحتوى الكيماوى لنباتات البسلة صنف فيكتورى فريزرتحت ظروف الأراضى الرملية.

سجلت معاملة الرى كل يومين أعلى القيم بالنسبة لإرتفاع النبات ، عدد الأوراق/نبات ، الوزن الجاف الكلى للنبات ، عدد القرون/ نبات ، متوسط محصول النبات والمحصول الكلى للفدان ، بينما أعطت فترة الرى كل أربعة أيام أعلى القيم بالنسبة للكلوروفيلات فى نسيج الورقة بالمقارنة بالرى كل يومين.

أدى إستخدام سماد الدواجن بمعدل ١٠م^{٣} / فدان إلى تسجيل أعلى القيم بالنسبة لإرتفاع النبات ، عدد الأوراق/نبات ، الوزن الجاف الكلى للنبات ، عدد البذور/ قرون، متوسط محصول النبات والمحصول الكلى للفدان ، كما أعطى أعلى القيم بالنسبة للكلوروفيلات فى نسيج الورقة بالمقارنة بمصادر التسميد الأخرى.

سجلت معاملات التفاعل بين فترة الرى كل يومين وإستخدام سماد الدواجن بمعدل ١٠م^{٣} / فدان أو السماد البلدى بمعدل بمعدل ٣٠م^{٣} / فدان أعلى القيم بالنسبة لقياسات النمو الخضرى ، ومحتوى الأوراق من الكلوروفيلات والمحصول الكلى ومكوناته وأيضا محتوى القرون من البروتين.