Scientific J. Flowers & Ornamental Plants
www.ssfop.com/journal
ISSN: 2356-7864

EFFECT OF IRRIGATION WATER SALINITY LEVELS AND DIFFERENT ORGANIC MANURES COMBINED WITH BIO-FERTILIZERS ON GROWTH OF *CONOCARPUS ERECTUS* L. TRANSPLANTS

Hanan E. Ibrahem

Ornamental Plants and Landscape Gardening Res. Dept., Hort. Res. Inst., ARC, Giza, Egypt.

Scientific J. Flowers & Ornamental Plants, 3(2):135-146 (2016).

Received:
1/6/2016

Revised by:
Prof. Dr. E.S. Nofal, Kafr El-Sheikh Univ.

Prof. Dr. Boshra A. El-Sayed, Hort. Res. Inst., ARC.

ABSTRACT: A pot experiment was conducted in the Orman Botanical Garden, Giza, Egypt, during two successive seasons of 2014 and 2015 to study the effect of different saline water levels (970, 5000, 8000 and 12000 ppm) and organic manure (cattle manure and chicken manure) combined with bio-fertilizers on *Conocarpus erectus* L. transplants productivity. The results indicated that there were decreases due to the effect of irrigation water levels salinity and organic manures in plant height (cm), root length (cm), stem diameter (cm), No. of leaves, fresh and dry weight of roots (g)/plant, fresh and dry weights of vegetative parts of *Conocarpus erectus* transplants with increasing water salinity. On the other hand, chlorophyll a, b and carotenoids content in the leaves decreased with increasing irrigation water levels with or without organic manures. The N, P and K percentages in the leaves were increased with decreasing irrigation water salinity and organic manures, while the Na^+, Cl^- and proline concentration in the leaves increased with increasing irrigation water salinity and organic manures. It can be concluded that *Conocarpus erectus* L. transplant can tolerate salinity up to 8000 ppm in irrigation water and organic manures combined with bio-fertilizers.

Key words: irrigation water salinity, organic manures, bio-fertilizers, *Conocarpus erectus*.

INTRODUCTION

Demands of water are continually increasing especially for agriculture production, where water consumption is more than any other human activity sectors. Meantime, great amounts of saline water are normally available through seawater or produced from agricultural drainage or industrial production, of *Conocarpus erectus* (El-Mahrouk *et al.*, 2010). Maksimovic and Ilin (2012) reported that irrigation water salinity affects nutrient availability to plants in many ways. It modifies binding, retention and transformation of nutrients in soil and affects the uptake and/or absorption of nutrients by the root system of *Conocarpus erectus*. El-Kady and Borham (2013) showed that the accumulation of Na^+ and Cl^- in soil solution may be due to their increased levels by increasing irrigation water salinity which, consequently increase their contents in plant leaves of *Conocarpus erectus*. Muhammad *et al.* (2014) indicated that increasing of water salinity level led to decrease fresh weight of roots, fresh weight of leaves, dry and fresh weights of stem. Hasan (2010) studied the response of *Conocarpus* plant to saline irrigation water at salinity levels of 1500, 2500, 3500 and 4500 ppm and found that by increasing salinity level the relative growth of the plant was significantly decreased.

Certain strains of microbes are referred to as plant growth-promoting rhizobacteria (PGPR), which can be used as inoculants bio-fertilizers (Kennedy *et al.*, 2004).

Branzini *et al.* (2009) showed that at the end of the incubation period, the total activity of microorganisms was significantly increased by the application of organic amendments and a negative relationship was observed between salinity and CO_2.

Organic application to soil is important to increase N and P contents in the soil and could accelerate the decomposition of the organic matter in the soil and increase crop production, (Cleveland and Townsend, 2006). Chicken manure is preferred amongst other animal wastes because of its high concentration of macro-nutrients (Duncan, 2005). Addition of chicken manure increased available P with application rate for all soil types as well as, the increase of P and N concentration due to chicken manure addition was significant. Oagile and Namasiku (2010) and Muhammad and Khattak (2009) reported that organic manures may increase soil fertility and thus the crop production potential possibly by changes in soil physical and chemical properties including nutrient bio-availability, soil structure, water holding capacity, soil pH and activity of microbial community. Sarwar *et al.* (2010) found that the combined application of both organic and inorganic fertilizers improved chemical properties of soil and enriched the fertility status of soil. Khaled *et al.* (2011) indicated that the application of organic farm increases microbial activity in the soil, which may increase the organic matter contents in soil compared with control. Also, the application of organic farm fertilizer decreases soil pH, soil salinity and because the organic farm could improve the soil physical properties i.e. (increase soil porosity, aggregation practical size and activity of microorganism).

Bio-fertilizers are essential component of organic farming. The preparations containing live or latent cells of efficient strains of nitrogen fixing, phosphate solubilizing or cellulolytic micro-organisms used for application to seed, soil or composting. The objective of increasing number of such micro-organisms and accelerate those microbial processes which augment the availability of nutrients that can be easily assimilated by plants. Biofertilizers play a very significant role in improving soil fertility by fixing atmospheric nitrogen, both, in association with plant roots and without it, solubilize insoluble soil phosphates and produce plant growth substances in the soil. They are in fact being promoted to harvest the naturally available, biological system of nutrient mobilization (Venkatashwarlu, 2008).

This investigation was carried out to study the effect of irrigation water salinity and organic manures (5 g/pot) combined with bio-fertilizers (5 g/pot) on *Conocarpus erectus* productivity, quality and chemical compositions.

MATERIALS AND METHODS

A pot experiment was conducted in the Orman Botanical Garden, Giza, Egypt, during two successive summer seasons of 2014 and 2015 to study the effect of saline water levels (970, 5000, 8000 and 12000 ppm) and using organic manure (Cattle and Chicken manures) combined with bio-fertilizers (*Rhizobcterein sp* strain) nitrogen fixation and *Bacillus megatherium* (dissolving phosphate) on growth of *Conocarpus erectus* L. transplants. Planting of *Conocarpus erectus* L. transplants was in February to October 2014 and 2015 seasons. The transplant was 35 cm length with 3-5 leaves. The daily temperature during the both seasons ranged from 20 to 36^{o}C.

Before planting was undertaken a soil sample of the experimental soil was air–dried, ground, good mixed, sieved through a 2 mm sieve, kept and analyzed for some physical and chemical properties and its content of available macro and micronutrients according to the methods described by Page *et al.* (1982) and Kim (1996). Physical and chemical properties of the studied soil are presented in Table (1).

Table 1. Physical and chemical properties of the soil of the experiment.

Coarse sand (%)	Fine sand (%)	Silt (%)	Clay (%)	Texture	O.M (%)	$CaCO_3$ (%)
4.30	17.60	33.82	44.28	Clayey	0.75	2.67

pH (1:2:5)	EC (dS/m)	Cations (meq/l)				Anions (meq/l)		
		Ca^{++}	Mg^{++}	Na^{+}	K^{+}	HCO^{-}_3	Cl^{-}	$SO^{=}_4$
8.02	2.14	5.50	3.23	11.83	0.84	2.28	6.88	12.24

Available of Macronutrients (mg/kg)		
N	P	K
41.25	3.76	180.92

The transplants were home planted in plastic pots of 40 cm diameter. The experiment was conducted in a complete randomized block design with 3 replicates and each replicates contained five plants.

All experimental pots were divided into two groups the first group was treated with chicken manure mixed with clay soil by (1:2 v/v) and second group was treated with cattle manure mixed with clay soil by (1:2 v/v). The organic manures (chicken manure and cattle manure) were applied mixed with soil 12 days before planting.

Physical and chemical characteristics of the organic amendments used in the study are shown in Table (2).

Bio-fertilizers of *Rhizobacterein sp.* strain for nitrogen fixation and phosphorein of *Bacillus megatherium* dissolving phosphate were obtained from Unit Department of Microbiology Soils, Water and Environment Res. Inst., Agric. Res. Center, Giza, Egypt. The bio-fertilizers were applied at 5 g/pot in the soil before irrigation water every month of planting.

The transplants were irrigated with saline water at levels of 970, 5000, 8000 and 12000 ppm, respectively. Plants were irrigated after two weeks from transplanting with 500 ml of saline water levels per pot, whereas the control was irrigated with Nile water (970 ppm).

Water analysis (Table 3) was carried out during the two growing seasons according to the methods described by Cottenie *et al.* (1982).

Table 2. Physical and chemical properties of the organic manure (cattel and chicken manures which were used in the study.

Organic amendments	pH	EC (dSm^{-1})	Bulk density (mg/m^3)	Organic C (%)	Available macronutrients (%)		
					N	P	K
Cattle manure	7.58	2.79	0.82	30.14	2.24	0.28	2.36
Chicken manure	7.62	2.94	0.66	27.16	2.10	0.21	2.28

Table 3. Chemical properties of the irrigation water which were used.

Irrigation water Salinity (dSm^{-1})	pH	Available macronutrients (mg/kg)			
		NO3- N	NH4- N	P	K
0.97	7.78	12.84	9.25	4.25	7.95
5	7.94	10.69	6.55	3.58	7.14
8	8.03	7.99	5.41	3.10	6.38
12	8.05	6.21	4.00	2.94	5.94

The data recorded at the end of experiments on October 10th for both seasons:

- Plant height (cm)
- Root length (cm)
- Stem diameter (cm)
- No. of leaves/plant
- Fresh weight of roots (g)
- Dry weight of roots (g)
- Fresh weight of vegetative parts (g)
- Dry weight of vegetative parts (g)

Macro content (N, P and K) in plant leaves were determined according to Ryan *et al*. (1996). Chlorophyll (a, b) and carotenoids were estimated in fresh leaves as described by Witham *et al.* (1971). Proline content in the leaves was estimated according to the method described by Bates *et al*. (1973).

The obtained results were subjected to statistical analysis according to Snedecor and Cochran (1990). The least significant differences (LSD at 0.05) was used to compare the treatment means.

RESULTS AND DISCUSSION

Effect of irrigation water salinity and organic manures on *Conocarpus erectus* vegetative parameters

1. Plant height

Data presented in Table (4) show that the irrigation water salinity levels and applied organic manure combined with bio-fertilization significantly increased plant height of *Conocarpus erectus* L. transplants especially with decreasing of irrigation water salinity. The interaction between saline water levels and organic manure combined with bio-fertilizers caused significant decrease in plant height with increasing water salinity. These results are in agreement with those of Muhammad *et al.* (2014) who suggested that plant height of *Conocarpus erectus* was decreased with increasing irrigation water salinity. The maximum decrease of plant height was 42.16 cm in the first season and 36.00 cm in the second one recorded with water level salinity of 12000 ppm and without organic manures. Corresponding relative decrease the mean values of plant height (cm) was 6.53% for irrigation water salinity of 5 dSm^{-1}; 19.60% for irrigation water salinity of 8 dSm^{-1} and 26.89 % for irrigation water salinity of 12 dSm^{-1} respectively, in the first season and 5.97% for irrigation water salinity of 5000 ppm; 19.57% for irrigation water salinity of 8000 ppm and 31.99 % for irrigation water salinity of 12000 ppm respectively, in second one compared with control irrigation water of 970 ppm and organic manures combined with bio-fertilizers. The decrease in plant height due to high salinity levels can be elucidated by the reduction in osmotic potential and decrease of nutrients. Muhammad *et al.* (2014) reported that the water salinity irrigation decreased plant height due to the closure of stomata and inactivation of enzymatic system occurred owing to the decrease in internal and external osmotic potential. The metabolic pathway is changed by accumulation of salts in cell wall; elasticity of cell well decreased and ultimately reduced the plant height (Hameed *et al.*, 2010).

2. Root length

The effect of irrigation water salinity levels with or without cattle and chicken manures combined with bio-fertilizers on root length (cm) of *Conocarpus erectus* transplants is presented in Table (4). Generally the root length (cm) was significantly inhibited by increasing water salinity levels with or without organic manures.

For the interaction between irrigation water salinity levels and organic manures combined with bio-fertilizers caused significant increment in root length with decreased irrigation water level with organic manures than without organic manures.

Table 4. Effect of organic amendments and saline water levels on growth parameters of *Conocarpus erictus* L. transplants in two seasons.

Organic amendments (A)	EC (ppm)of irrigation water (B)	First season				Second seasons			
		Plant height (cm)	Root length (cm)	Stem diameter (cm)	No. of leaves	Plant height (cm)	Root length (cm)	Stem diameter (cm)	No. of leaves
Control		54.30	40.33	1.20	157	58.00	52.48	1.32	164
FYM + bio	**970**	62.00	50.00	1.27	178	60.00	56.94	1.38	169
Ch. M+ bio		56.33	48.33	1.22	163	66.00	54.00	1.34	166
Mean (B1)		57.54	46.22	1.23	166	61.33	54.47	1.35	166.33
Control		53.24	37.67	1.13	149	54.00	49.42	1.20	158
FYM + bio	**5000**	58.45	48.00	1.22	162	63.00	51.61	1.27	165
Ch. M+ bio		49.66	44.36	1.14	157	56.00	50.32	1.25	162
Mean (B2)		53.78	43.34	1.16	156	57.67	50.45	1.24	161.67
Control		47.33	36.22	1.05	137	46.00	43.55	1.19	149
FYM + bio	**8000**	49.67	44.77	1.13	143	52.00	48.32	1.23	155
Ch. M+ bio		41.77	40.12	1.08	137	50.00	44.32	1.20	151
Mean (B3)		46.26	40.37	1.09	139	49.33	45.40	1.21	151.67
Control		42.16	33.65	1.10	116	36.00	41.02	1.16	147
FYM + bio	**12000**	43.77	38.21	1.06	128	48.12	43.98	1.22	153
Ch. M+ bio		40.28	33.11	1.03	122	41.00	42.10	1.18	142
Mean (B4)		42.07	34.99	1.06	122	41.71	42.37	1.19	147.33
(A1) Mean of control		49.26	36.97	1.12	139.75	48.50	46.62	1.22	154.50
(A2) Mean FYM		53.47	45.25	1.17	152.75	55.78	50.21	1.28	160.50
(A3) Mean Ch. M		47.01	41.48	1.12	144.75	53.25	47.69	1.24	155.25
LSD 5% Water salinity		2.35	2.66	0.050	0.77	3.20	2.41	0.087	1.47
LSD 5% Organic		2.04	2.30	0.042	0.67	2.77	2.10	NS	1.27
Interaction		2.53	3.44	0.10	1.58	7.51	3.05	NS	5.17

A1: Mean control without amendments, A2: Mean of FYM, A3: Mean of Ch. M, B1: irrigation water salinity 970 ppm, B2: irrigation water salinity 5000 ppm, B3: irrigation water salinity 8000 ppm and B4: irrigation water salinity 12000 ppm.

On the other hand, increasing salinity water levels from 8000 to 12000 ppm decreased the mean root length (cm) from 40.37 cm to 34.99 cm in the first season and from 45.40 to 42.37 cm in the second one. The relative decreases in mean values root length were 6.23, 12.66 and 24.30% for irrigation water levels of 5000; 8000 and 12000 ppm respectively, in the first season and 7.38, 16.65 and 22.21% for irrigation water salinity of 5000, 8000 and 12000 ppm with or without organic manures respectively in the second one, compared with control irrigated with fresh water of 970 ppm. Generally there was a inhibitory effect on root length of *Conocarpus erectus* L. by using salinity water and this may be attributed to high osmotic pressure in soil solution which restricted the absorption of water by plant roots. Abd El-Aziz *et al.* (2011) found that various compost treatments and different water salinity levels significantly decreased root length with increasing water salinity.

3. Stem diameter

Data presented in Table (4) show that the stem diameter (cm) was significantly increased with decreased irrigation water levels throughout the two growing seasons. The application of organic manures combined with bio-fertilizers had a significant effect on stem diameter (cm) in the first season, while a non significant effect in second one. The interaction between irrigation water salinity and organic manures combined with bio-fertilization significantly increased stem diameter (cm) with decreasing irrigation water salinity. The highest values of stem diameter 1.27 cm and 1.38 cm were resulted from the cattle manure and irrigation water of (970 ppm) in the first and second seasons, respectively. The relative decreases of mean values of stem diameter (cm) were 5.69, 11.38 and 13.82% in the first season and 8.15, 10.37 and 11.85% in the second one compared with control. Irrigation water salinity conditions led to reduce the ability of plants to absorb water causing rapid reductions in stem diameter (cm). These results are in agreement with those of Abd El-Aziz *et al.* (2011) who showed that under the irrigation water salinity at the different levels, it is clear that under increasing salinity levels significantly decreased stem diameter. It can be mentioned that the depression in stem by salt stress may be attributed to the plant withdraw from the soil, even in moist soil. Muhammad *et al.* (2014) revealed that with increasing salinity, stem diameter was reduced. The stem diameter decreased due to the reduction in turgor potential and division of cells.

4. Number of leaves per plant

Data presented in Table (4) show that irrigation water salinity levels and organic manures (cattle manure and chicken manure combined with bio-fertilization) had significant effects on number of leaves per plant of *Conocarpus erectus*. The interaction between irrigation water at different salinity levels and organic manures caused significant increase in number of *Conocarpus erectus* leaves with decreased water salinity. The least mean values of No. of leaves per plant was obtained from plants irrigated by 12000 ppm in the first season and 147.33 in second one for water salinity at level of 12000 ppm. The relative decreases of mean values of No. leaves was 6.02, 16.27 and 26.51% in the first season and 2.80, 8.81 and 11.42% in the second one for plants treated with irrigation water levels of 5000, 8000 and 12000 ppm compared with control (970 ppm) with or without organic manures. These results are in agreement with the findings of Loutfy and Ibrahim (2005) who reported that the high salt concentration in irrigation water levels reduced No. leaves of *Conocarpus erectus* compared with those in low salt concentration. Muhammad *et al.* (2014) suggested that the No. leaves per plant of *Conocarpus erectus* decreased by the increased saline stress.

Generally it is concluded that the use of organic manure (cattle) combined with bio-fertilizers led to the best morphological characters of *Conocarpus erectus* under used irrigation water conditions compared with applied chicken manure combined with bio-fertilizers.

4. Fresh and dry weights of roots

Data presented in Table (5) show that the weight of the fresh and dry roots of *Conocarpus erectus* were decreased by increasing salinity water alone or treated with organic manures combined with bio-fertilizers. The maximum increase of mean value of roots fresh and dry weights was 63.91 and 36.07 g in the first season and 66.46 and 41.48 g in the second one, respectively obtained from control as compared with other treatments. The effect of irrigation water salinity, organic manures and their interaction on roots fresh weight significantly increased with decreased irrigation water salinity in both seasons, while roots dry weight had a non significant effect by irrigation water salinity levels in the first season. Also, organic manures combined with bio-fertilizers and the interaction between irrigation water salinity and organic manures significantly affected fresh and dry weight of roots. The relative decrease of mean values weight of fresh and dry roots were 15.85 and 6.60% in the first season and 11.44 and 7.30% in the second one as affected by irrigation water salinity + organic manures compared with control + organic manures. Mohammad *et al*. (2015) evaluated the effect of saline irrigation water at five levels of 0, 5, 10, 15 and 20 grams per liter of sodium chloride salt on the roots wet and dry weight of *Conocarpus* plant. The results showed that the fresh and dry roots

Table 5. Effect of organic amendments and saline water levels on fresh and dry weights of *Conocarpus erictus* L. roots and vegetative parts in two seasons.

Organic amendments (A)	EC (ppm) of irrigation water	First season				Second seasons			
		W.f.r (g)	W.d.r (g)	W.f.v. (g)	W.d.v. (g)	W.f.r (g)	W.d.r (g)	W.f.v. (g)	W.d.v. (g)
Control		58.10	32.83	105.60	59.55	62.48	39.84	112.63	58.33
FYM + bio	970	68.29	38.12	117.32	64.63	70.69	42.95	119.85	64.96
Ch. M+ bio		65.33	37.26	115.60	60.14	66.21	41.64	116.76	61.52
Mean (B1)		63.91	36.07	112.84	61.44	66.46	41.48	116.41	61.60
Control		52.30	31.65	99.65	48.81	57.65	37.88	104.86	51.86
FYM + bio	5000	56.58	36.68	105.62	59.18	60.59	39.47	113.65	58.33
Ch. M+ bio		52.46	33.83	103.10	57.61	58.34	38.00	107.96	53.19
Mean (B2)		53.78	34.05	102.79	55.20	58.86	38.45	108.82	54.46
Control		41.69	29.17	78.69	47.68	49.33	31.85	85.94	44.58
FYM + bio	8000	44.85	33.56	98.25	55.13	55.25	37.29	99.52	51.58
Ch. M+ bio		43.00	31.25	95.66	49.52	51.96	35.94	94.91	49.00
Mean (B3)		43.18	31.33	90.87	50.78	52.18	35.03	93.46	48.39
Control		27.24	19.10	60.72	38.31	45.23	29.88	77.69	41.52
FYM + bio	12000	38.69	27.77	95.00	47.81	49.36	34.26	82.17	48.62
Ch. M+ bio		32.48	25.63	82.17	44.22	46.28	31.96	78.23	45.00
Mean (B4)		32.80	24.17	79.30	43.45	46.96	32.03	79.36	45.05
(A1) Mean of control		44.83	28.19	86.17	48.59	53.67	34.86	95.28	49.07
(A2) Mean FYM		52.10	34.03	104.05	56.69	58.97	38.49	103.80	55.87
(A3) Mean Ch. M		48.32	31.99	99.13	52.87	55.70	36.89	99.47	52.18
LSD5% Water salinity		2.68	NS	1.62	1.16	2.31	1.40	NS	1.24
LSD5% Organic		2.32	7.41	1.40	1.10	2.00	1.20	14.21	1.07
Interaction		2.55	2.62	4.25	2.17	3.82	3.43	NS	2.84

A1: Mean control without amendments, A2: Mean of FYM, A3: Mean of Ch. M, B1: irrigation water salinity 970 ppm, B2: irrigation water salinity 5000 ppm, B3: irrigation water salinity 8000 ppm and B4: irrigation water salinity 12000 ppm. W.f.r = root fresh weight, W.d.r = root dry weight, W.f.v.= fresh weight of vegetative parts and W.d.v. =dry weight of vegetative parts.

weight was decreased by increasing the different salinity levels and organic manures.

5. Fresh and dry weights of vegetative parts

Data presented in Table (5) show that, applying organic manures combined with bio-fertilizers and saline irrigation water had significant effects in the first season on fresh and dry weight of vegetative parts, while the irrigation water salinity only had no significant effects in the second one for fresh weight of vegetative parts. Concerning the interaction between water salinity and organic manures on fresh and dry weights of vegetative parts they were significant in the first season, while fresh weight of vegetative parts was no significant in the second one. The relative decreases of mean values fresh and dry weight of vegetative parts were 8.91 and 10.16% in the first season and 6.62 and 11.62% in the second one for water salinity of 5000 ppm, respectively compared with control. On the other hand the relative decreases of mean values were 19.47 and 17.35% in first season and 19.71 and 21.44% in the second one for water salinity of 8000 ppm, respectively compared with control. Also, the relative decreases mean values of fresh and dry weight of vegetative parts were 29.72 and 29.28% in the first season and 31.83 and 26.87% in the second one for water salinity of 12000 ppm, respectively compared with control.

Effect of organic amendments and saline water levels on photosynthesis (mg/g f.w.) in leaves and proline

Data presented in Table (6) show that the increment in chlorophyll (a and b) and carotenoids contents in the leaves of *Conocarpus erectus* plants was significant with decreasing of salt concentration in irrigation water. The plants treated with organic manures (chicken manure and cattle manure combined with bio-fertilizers) showed that the effect on chlorophyll a and b and carotenoids contents in the leaves of *Conocarpus erectus* plants was greater than without organic manures. Also, the effect of interaction between salinity of water and organic manures on chlorophyll a and b and carotenoids contents in the leaves of *Conocarpus erectus* plants was significant in both seasons. The relative decrease of mean values chlorophyll (a and b) and carotenoids contents in the leaves of *Conocarpus erectus* plants were 27.67, 13.37 and 9.76% in the first season and 27.83, 17.20 and 24.51% in the second season for salinity water of 5000 ppm; 30.58, 1.79 and 24.39% in the first season and 30.87, 25.48 and 34.51% in the second one for salinity water of 8000 ppm and 32.04, 7.14, 26.83% in first season and 36.52, 33.12 and 37.25% in second one for salinity water of 12000 ppm, respectively. These results are in agreement with those of Shanan (2015) who indicated that the increasing salinity concentration causes reduction in total chlorophyll content.

Table 6. Effect of organic amendments and saline water levels on phytothynases and proline (mg/g f.w.) in leaves of *Conocarpus erectus* L. in two seasons.

Organic amendments (A)	EC (ppm)of irrigation water	First season				Second seasons			
		Ch. a	Ch. b	Carot.	Proline (mg/g f.w)	Ch. a	Ch. b	Carot.	Proline (mg/g f.w)
Control		1.92	0.92	0.64	0.71	2.25	1.32	0.99	0.75
FYM + bio	970	2.16	1.35	0.97	0.75	2.39	1.84	1.05	0.77
Ch. M+ bio		2.10	1.08	0.85	0.78	2.27	1.54	1.02	0.82
Mean (B1)		2.06	1.12	0.82	0.75	2.30	1.57	1.02	0.78
Control		1.40	0.72	0.61	0.79	1.53	1.14	0.69	0.81
FYM + bio	5000	1.60	1.45	0.95	0.93	1.88	1.53	0.86	0.95
Ch. M+ bio		1.47	0.73	0.66	0.98	1.58	1.22	0.75	0.99
Mean (B2)		1.49	0.97	0.74	0.90	1.66	1.30	0.77	0.92
Control		1.30	0.99	0.50	0.95	1.47	1.10	0.56	1.08
FYM + bio	8000	1.58	1.26	0.78	1.85	1.75	1.23	0.80	1.18
Ch. M+ bio		1.42	1.05	0.57	1.77	1.55	1.17	0.64	1.23
Mean (B3)		1.43	1.10	0.62	1.52	1.59	1.17	0.67	1.16
Control		1.29	0.80	0.49	0.99	1.36	0.98	0.52	1.28
FYM + bio	12000	1.56	1.40	0.77	1.88	1.63	1.14	0.79	1.39
Ch. M+ bio		1.35	1.39	0.53	1.86	1.40	1.03	0.60	1.55
Mean (B4)		1.40	1.20	0.60	1.58	1.46	1.05	0.64	1.41
(A1) Mean of control		1.48	0.86	0.56	0.86	1.65	1.14	0.69	0.98
(A2) Mean FYM		1.73	1.37	0.87	1.35	1.91	1.44	0.88	1.07
(A3) Mean Ch. M		1.59	1.06	0.65	1.35	1.70	1.24	0.75	1.15
LSD5% Water salinity		0.027	0.031	0.024	0.016	0.013	0.021	0.028	0.140
LSD5% Organic		0.024	0.027	0.021	0.013	0.012	0.018	0.024	0.130
Interaction		0.012	0.005	0.041	0.028	0.022	0.036	0.048	NS

A1: Mean control without amendments, A2: Mean of FYM, A3: Mean of Ch. M, B1: irrigation water salinity 970 ppm, B2: irrigation water salinity 5000 ppm, B3: irrigation water salinity 8000 ppm and B4: irrigation water salinity 12000 ppm.

The highest values of chlorophyll (a and b) and carotenoids contents in the leaves of *Conocarpus erectus* plants were found in plants treated with cattle manures combined with bio-fertilizers compared with other treatments. From the results it was observed that the decrease of this chlorophyll (a and b) and carotenoids reflected in increasing salinity water levels. This decrease may be due to the inhibitory effect of chloride on the activity of Fe containing enzymes, cytochrome oxidase which in turn may decrease the rate of chlorophyll biosynthesis process (Hammad *et al*., 2010). Muhammad *et al.* (2014) suggested that the stomata become closed under saline stress because turgor pressure decreased which leads to decrease the photosynthesis.

Proline content in the leaves of *Conocarpus erectus* transplants was increased with increasing water salinity; as these results are presented in Table (6). The effect of organic manures and irrigation water salinity levels on proline content in the leaves of *Conocarpus erectus* plants was significant in both seasons with increasing irrigation water salinity. The interactions between different salinity levels for irrigation water and organic manures were significant for proline content in the first season, while no significant in the second one. On the other hand, the relative increase of mean values proline content in the leaves of *Conocarpus erectus* plants was 20.00, 102.67 and 110.67% in the first season and 17.95, 48.72 and 80.77% in the second one for plants treated with irrigation water levels of 5000, 8000 and 12000 ppm with or without organic manures compared with control. Increasing proline in plant is considered as indicator for some mechanism to resist the salinity stress (Jampeetong and Brix, 2009). The increase level of proline content enables the plants to maintain osmotic balance when growing under salinity and acts as a major reservoir of energy and nitrogen for utilization by plants subjected to salinity stress (Shanan, 2015).

Effect of irrigation water salinity and organic amendments on N, P, K, Na and Cl for *Conocarpus erectus* plants

The presented data in Table (7) show that the N, P, K, Na^+ and Cl^- concentrations (%) in the leaves of *Conocarpus erectus* plants of two seasons were decreased with increasing irrigation water salinity levels. The effect of saline water levels and organic manures on N, P, Na^+ and Cl^- concentrations in the leaves were significant in the first season while the N and Na^+ were non significant in the second one. The interaction effects between different levels salinity irrigation water and added two organic manures on N, P, K, Na^+ and Cl^- were significant as increased with decreasing irrigation water salinity and used organic manures in both seasons, while the N concentration in the leaves was non significant in the second one.

The corresponding relative decreases of mean values of N, P, K, Na^+ and Cl^- concentrations the in the leaves of *Conocarpus erectus* transplants were 8.22, 9.52, 5.29, 0.76 and 74.65% in the first season and 3.62, 8.70, 4.58, 2.76 and 9.88% in the second one for irrigation water level salinity of 5 dSm^{-1}; 8.68, 14.29, 7.05,2.27 and 82.71 in the first season and 4.98, 15.22, 5.83, 6.90 and 45.45% in the second one for irrigation water level salinity of 8000 ppm and 9.13, 40.48, 17.18, 9.85 and 109.95 in the first season and 7.24, 30.43, 12.08, 8.97 and 60.87% in the second one for irrigation water salinity of 12000 ppm respectively, compared with control. Salinity of irrigation water levels may cause nutrient decrease or imbalance, due to the competition of Na and Cl with nutrients such as K and N. Abd El-Wahab (2006) found that the increased NaCl concentration has been reported to induce increases in Na and Cl as well as decreases in N, P and K in fennel plants. Abd El-Kader *et al.* (2006) indicated that the N, P and K concentration in the leaves were decreased with increasing salinity stress. The decrease in P and K could be interpreted by the effect of the increased level of Na whereas the effect of Cl on N uptake should be considered.

Table 7. Effect of organic amendments and saline water levels on macronutrients concentration in leaves of *Conocarpus erectus* L. transplants in two seasons.

Organic amendments (A)	EC (ppm) of irrigation water (B)	First season					Second season				
		N (%)	P (%)	K (%)	Na (%)	Cl (%)	N (%)	P (%)	K (%)	Na (%)	Cl (%)
Control		1.97	0.40	2.10	1.30	23.19	1.99	0.48	2.32	1.43	28.18
FYM + bio	970	2.34	0.44	2.41	1.35	26.25	2.36	0.46	2.52	1.51	26.16
Ch. M + bio		2.27	0.42	2.30	1.32	25.35	2.29	0.44	2.35	1.40	23.10
Mean (B1)		2.19	0.42	2.27	1.32	24.93	2.21	0.46	2.40	1.45	25.81
Control		1.82	0.34	2.05	1.38	27.16	1.95	0.42	2.25	1.46	31.55
FYM + bio	5000	2.13	0.41	2.21	1.32	53.35	2.28	0.44	2.34	1.53	29.14
Ch. M+ bio		2.08	0.38	2.19	1.28	50.11	2.17	0.41	2.28	1.49	24.39
Mean (B2)		2.01	0.38	2.15	1.33	43.54	2.13	0.42	2.29	1.49	28.36
Control		1.80	0.33	2.01	1.42	31.20	1.92	0.38	2.21	1.52	42.11
FYM + bio	8000	2.16	0.39	2.18	1.34	55.23	2.24	0.42	2.30	1.58	37.52
Ch. M+ bio		2.05	0.36	2.14	1.30	50.22	2.13	0.37	2.27	1.54	33.00
Mean (B3)		2.00	0.36	2.11	1.35	45.55	2.10	0.39	2.26	1.55	37.54
Control		1.78	0.29	1.85	1.49	45.98	1.88	0.35	2.18	1.55	44.51
FYM + bio	12000	2.13	0.25	1.91	1.45	57.25	2.19	0.33	2.10	1.62	41.96
Ch. M+ bio		2.05	0.21	1.88	1.42	53.78	2.09	0.29	2.06	1.58	38.10
Mean (B4)		1.99	0.25	1.88	1.45	52.34	2.05	0.32	2.11	1.58	41.52
(A1) Mean of control		1.84	0.34	2.00	1.40	31.88	1.94	0.41	2.24	1.49	36.59
(A2) Mean FYM		2.19	0.37	2.18	1.37	48.02	2.27	0.41	2.32	1.56	33.70
(A3) Mean Ch. M		2.11	0.34	2.13	1.33	44.87	2.17	0.38	2.24	1.50	29.65
LSD5% Water salinity		0.027	0.024	ns	0.030	3.001	NS	0.012	0.030	NS	1.138
LSD5% Organic		0.024	0.021	0.097	0.025	2.60	NS	0.011	0.026	0.025	0.985
Interaction		0.047	0.042	0.168	0.052	4.50	NS	0.020	0.044	0.043	1.96

A1: Mean control without amendments, A2: Mean of FYM, A3: Mean of Ch. M, B1: irrigation water salinity 970 ppm, B2: irrigation water salinity 5000 ppm, B3: irrigation water salinity 8000 ppm and B4: irrigation water salinity 12000 ppm.

CONCLUSION

The results of the present study indicated that the possibility using the irrigation water salinity levels of 5000 and 8000 ppm and cattle manure combined with bio-fertilizer led to slight increase for all growth parameters of *Conocarpus erectus* transplants. The used of irrigation water salinity led to increase Na, Cl and proline contents in the leaves. We can conclude that *Conocarpus erectus* L. transplants tolerate salinity up to 5000 ppm for irrigation water and organic manures.

REFERENCES

Abd El-Aziz, N.G.; Mazher, A.A.M. and Mahgoub, H. (2011). Influence of using organic fertilizer on vegetative growth, flowering and chemical constituents of *Matthiola incana* plant grown under saline water irrigation. J. World of Agric. Sci., 7(1):47-54.

Abd El-Kader, A.A.; Mohamedin, A.A.M. and Ahmed, M.K.A. (2006). Growth and yield of sunflower as affected by different salt affected soils. Inter. J. of Agric. and Biology, 8(5):583-578.

Abd El-Wahab, M.A. (2006). The efficiency of using saline and fresh water irrigation as alternating methods of irrigation on the productivity of *Foeniculum vulgare* Mill subsp. vulgare var. vulgare under North Sinai conditions. Res. J. Agric. Biol. Sci., 2(6):571-577.

Bates, L.S.; Waldren, R.P. and Teare, I.D. (1973). Rapid determination of free proline under water stress studies. Plant and Soil, 39:205-207

Branzini, A.; Zubillaga, M.S. and Zubillaga, M.M. (2009). Microbial response to the application of amendments in a contaminated soil with trace elements. Am. J. Environ. Sci., 5(1):94-98.

Cleveland, C.C. and Townsend, A.R. (2006). Nutrient additions to a tropical rain forest drive substantial soil carbon dioxide losses to the atmosphere. Proceedings of the National Academy of Sciences, 103:10316-10321.

Cottenie, A.; Verloo, M.; Kiekens, L.; Velghe, G. and Camerlynck, R. (1982). Chemical Analysis of Plants and Soils. Laboratory of Analytical and Agrochemistry, State Univ., Ghent,Belgium.

Duncan, J. (2005). Composting Chicken Manure. WSU Cooperative Extension, King County Master Gardener and Cooperative Extension Livestock Advisor.

EL-Kady, A.F.Y. and Borham, T. (2013). Hydrogel amendment effects on the performance of buttonwood (*Conocarpus erectus* L.) transplants growth under saline irrigation water. J. Applied Sci. Res., 9(10):6557-6566.

El-Mahrouk, M.E., El-Nady, M.F. and Hegazi, M.A. (2010). Effect of diluted seawater irrigation and exogenous proline treatments on growth, chemical composition and anatomical characteristics of *Conocarpus erectus* L. J. Agric. Res., Kafer El-Sheikh Univ., 36:420-446.

Hameed, M.; Ashraf, M.; Ahmad, M.S.A. and Naz, N. (2010). structural and functional adaptations in plants for salinity tolerance. J. Plant. Adap. Phyton., 1:151-170.

Hammad, S.A.R.; Shaban, Kh.A. and Tantawy, M.F. (2010). Studies of salinity tolerance to two peanut cultivars in relation to growth, leaf water content, some chemical aspects and yield. J. of Applied Sci. Res., 6(10):1517-1526.

Hasan, P.H. (2010). Examining the effect of saline water on quantitative and qualitative characteristics of seeds in medicinal herb. Agriculture and Agronomy Journal, 6(2):13-20.

Jampeetong, A. and Brix, H. (2009). Nitrogen nutrition of *Salvinia natans*: effects of inorganic nitrogen form on growth, morphology, nitrate reductase activity and uptake kinetics of ammonium and nitrate. Aquat. Bot., 90:67-73.

Kennedy, I.R.; Choudhury, A.T.M.A. and Kecskes, M.L. (2004). Nonsymbiotic bacterial diazotrophs in crop-farming systems: can their potential for plant growth promotion be better exploited? Soil Biology and Biochemistry, 36(8):1229–1244.

Khaled, A. Sh.; Mona, G.A. and Seham, M.E. (2011). Evaluation of organic farm and compost combined with urea fertilizers on fertility and maize productivity in newly reclaimed. Res. J. of Agric. and Biol. Sci., 7(5):388-397.

Kim, H.T. (1996). Soil Sampling, Preparation and Analysis. Marcel Dekker Inc., New York, 391 pp.

Loutfy, I.E. and Ibrahim, M.A. (2005). Interactive effects of low water supply and high salt concentration on the growth and dry matter partitioning of *Conocarpus erectus* transplants. Saudi J. of Biol. Sci., 12(2):147-157.

Maksimovic, I. and Ilin, Z. (2012). Effects of Salinity on Vegetable Growth and Nutrients Uptake, Irrigation Systems and Practices in Challenging Environments, T.S. Lee (Ed.).

Mohammad, J.; Abdolhpour, M. and Amineh, H. (2015). Effect of saline water on morphological characteristics of *Conocarpus* plant for using in green space warm and arid cities. Biolo. Foeum-An Inter. J., 7(2):31-34.

Muhammad, A.; Muhammad, S.; Balal, Y.; Muhammad, A.; Yousaf, A.; Athar, A. and Daniyal, S. (2014). Growth and ionic composition of buttonwood (*Conocarpus erectus* L.) in response to soil salinity and water stress. Advances in Life Sci. and Tech., 19:42-52.

Muhammad, D., R.A. Khattak, (2009). Growth and nutrient concentration of maize in pressmud treated salinesodic soils. Soil Environ., 28:145-155.

Oagile, D. and Namasiku, M. (2010). Chicken manure enhanced soil fertility and productivity: Effect of application rates. J. of Soil. Sci and Environ. Management, 1(3):46-54.

Page, A.L.; Miller, R.H. and Keeney, D.R. (1982). Methods of Soil Analysis. II. Chemical and Microbiological Properties. 2nd Ed. Madison, Wisconsin, U.S.A.

Ryan, J.; Garabet, S.; Harmsen, K. and Rashid, A. (1996). A Soil and Plant Analysis. Manual Adapted for the West Asia and North Africa Region. ICARDA, Aleppo, Syria, 140.

Sarwar, G.; Schmeisky, H.; Tahir, A.; Iftikhar, Y. and Sabah, N. (2010). Application of green compost for improvement in soil chemical properties and fertility status. Journal of Animal & Plant Sciences, 20(4):258-260.

Shanan, N. (2015). Alleviation of salt stress by stimulative compound in *Matthiola incana* L. plants. Inter. J. of Advanced Res., 3(9):335-375.

Snedecor, G.W. and Cochran, W.G. (1990). Statistical Methods. 8th Ed., Iowa State Univ. Press, Ames, Iowa, USA.

Venkatashwarlu, B. (2008). Role of bio-fertilizers inorganic farming: Organic farming in rain fed agriculture: Central Institute for Dry Land Agriculture, Hyderabad, 85-95.

Witham, F.H.; Blaydes, D.F. and Devin, P.M. (1971). Experiments in Plant Physiology. Van Nosland Reihold. Co. New York, 55-58.

تاثير مستويات ملوحة مياه الرى والسماد العضوى المتحد مع السماد الحيوى على انتاجية شجيرات الكونوكاربس

حنان عز الدين ابراهيم
قسم بحوث الزينة وتنسيق الحدائق، معهد بحوث البساتين، مركز البحوث الزراعية، الجيزة، مصر.

أجريت تجربة فى حديقة الاورمان بالجيزة – مصر خلال موسمين زراعين متتالين ٢٠١٤ و ٢٠١٥ لدراسة تاثير مستويات من ملوحة مياه الرى (٩٧٠ و ٥٠٠٠ و ٨٠٠٠ و ١٢٠٠٠ جزء فى المليون) فى وجود او عدم وجود التسميد العضوى (مخلفات الماشية ومخلفات الدواجن) المتحد مع التسميد الحيوى الفسفورين والميكروبين على انتاجية وجودة شجيرات الكونوكارس. أجريت التجربة فى اصص قطر ٤٠ سم

أظهرت النتائج ان زيادة ملوحة مياه الرى ادت الى انخفاض فى صفات نبات *Conocarpus erectus* L. مثل طول النبات، قطر الساق، عدد الاوراق، وزن الجذور رطباً وجافاً والوزن الخضرى رطباً وجافاً. من ناحية اخرى ظهر نقص فى مكونات الكلوروفيل أ +ب والكاروتينويدات فى النباتات المروية بمياه ذات ملوحة عالية وزاد تركيز البرولين بزيادة ملوحة مياه الرى. لوحظ ان زيادة تركيز النتروجين – الفوسفور البوتاسيوم فى النباتات المروية بمياه رى منخفضة الملوحة فى حين زاد كل من العناصر الصوديوم والكلوريد بزياده ملوحة مياه الرى. ممكن ان نستخلص من هذه الدراسة انه يمكن استخدام مياه ذات ملوحة حتى ٨٠٠٠ جزء فى المليون مع استخدام خليط من السماد العضوي والحيوي لانتاج شجيرات *Conocarpus erectus* L.