J. of Plant Production, Mansoura Univ., Vol. 10 (12): 949- 956, 2019

Journal of Plant Production

Journal homepage: www.jpp.mans.edu.eg
Available online at: www. jpp.journals.ekb.eg

Influence of Fish Culture Water Irrigation and Nitrogen Fertilization on Cowpea Growth and Yield in Clay Loam and Loam Sandy Soils.

Cross Mark

Aly, A. I.[1*] and Gehan Z. Mohamed[2]

[1]Self-Pollinated Vegetable Research Department - Horticulture Research Institute - ARC. Giza, Egypt
[2]Cross Pollinated Vegetables Research Department-Horticulture Research Institute - ARC. Giza, Egypt

ABSTRACT

The field experiments carried out in Ibshway (clay loam soil L1) and Tamiya (loam sandy soil L2) districts, Fayoum Governorate, Egypt, during 2016 and 2017 seasons to study the effect of water sources (Fish culture water, and Nile water) and nitrogen fertilization levels((20 – 40 – 60) kg N/ fed) on productivity of cowpea plants in two soil culture. Fish culture water (W_1) treatment had higher values than other Nile water (W_2) treatment in all aforementioned traits.N_{60} application have the significant maximum effects by (62.6 & 61.5%), (20.3 & 15.7%), (1(0.6 & 15.0%), (25.4 & 28.7%), (19.6 & 15.3%), (26.1 & 26.0%) and (10.5 & 11.6%) over the corresponding low nitrogen rate (N_{20}) treatment for Dry matter (g), Plant height (cm), No of pods, Pod length, Average 100-seeds weight, Yield and Protein (%) in both 1st and 2nd seasons, respectively in clay loam location. The combined analysis for two locations i.e. clay loam and loam sandy soil indicates significant differences between locations for 100-seeds weight (g), Yield/fed (kg), Dry matter and Protein (%). Also, highly significant differences among both water sources and nitrogen rates were existed for all studied traits except 100-seed weight which was not significantly affected by water sources. Cowpea plants cv. Teba fertilized with 60 kg N/fed. and irrigated by fish culture water produced significantly highest values for all studied traits in Ibshway (clay loam soil) compared with Tamiya (loam sandy soil) location with significantly differences between the two land types except pod length and100-seeds weight which exhibited no significant differences. On contrast, no significant differences were observed between the two locations (both old and new land types) for plant height, pod length, number of pods and 100 seeds weight when cowpea plants cv. Tiba fertilized with 60 kg N/fed. and irrigated with Nile water. The cowpea seeds irrigated with fish farm water contained some heavy metals namely lead, aluminum, arsenic, lithium and selenium. The concentration of each of these elements varied depending on the growing season and soil nature.

INTRODUCTION

The name "Cowpea" (Vignaunguiculata(L.)was first used in America. The earlier English name was covalence and was first used in West Indies. It is a leguminous crop grown through the African continent as well as in parts of south East Asia and Latin America Cowpea as a grain legume is an important source of food, income and livestock feed and forms a major component of tropical farming systems because of its ability to improve marginal lands through nitrogen fixation and as cover crop Sanginga *et al* (2003). The grain is a good source of human protein, while the haulms are valuable source of livestock protein Fatokum, (2002). It is a rich source of dietary proteins, calories and minerals. In India, it is mostly consumed as cooked whole seeds and immature seeds. Cultivars low in anti-nutritional factors and relatively rich in sulfur amino acids and digestible protein are nutritionally desirable. The protein distribution pattern was investigated in low and highprotein cultivars.It is generally believed by most cowpea growers that the production of legumes do not require inorganic fertilizer application Kan‟ankuk‟a,(1999). This is due to the excessive vegetation at expense of grain production of this crop under fertilized fields. Cowpea can fix about 40 kg N ha from nodules in the presence of right rhizobia strain which can satisfy the crop nitrogen requirements Singh *et al*., (1997).The estimates of N fertilizer replacement value for cowpea range from 10 kg N ha Carsky and Iwuafor, (1999) to 60 kg N ha. Cowpea is a leguminous crop especially adapted to semiarid region. It has litter dependence upon nitrogen fertilizer for optimum yield, since it can fix nitrogen fertilizer symbiotically with *Rhizobium*, Cowpea is nutritionally important in cereal based diets because the seeds have high (23%) protein content Norton *et al*., (1985).Fertilization of cowpea plants with mineral nitrogen gave the higher values of different dry weight of cowpea plants, yield and its components (Sarg and Hassan, 2003; Solieman *et al*., 2003; Mahmoud *et al*., 2010).Tropical soils are inherently low in nutrients particularly nitrogen (Haruna *et al*., 2011). The objective of this work was to study the effect of irrigation water sources and nitrogen fertilization rates on cowpea productivity under two land types.

MATERIALS AND METHODS

The experiment carried out during the summer season of 2016 and 2017 in two locations, the first 1st

[*] Corresponding author.
E-mail address: Ahmedalomda1967@gmail.com
DOI: 10.21608/jpp.2019.71507

location Abo-kosa Ibshway(clay loam soil, L_1) and the 2nd location Tamiya agriculture research station (loam sandy soil, L_2), Fayoum Governorate, Egypt to study the effect of irrigation water and levels of nitrogen fertilization on cowpea productivity under sandy and clay soil conditions. Soil samples were randomly collected from experimental sites during land preparation from the top layer (0 - 30 cm) for soil physical and chemical analyses. Soil physical properties were analyzed using the procedures described by klute (1986), while soil chemical analysis was determined according to Page *et al.* (1982) and P was determined according to Chapman and Pratt (1961). Soil physical and chemical properties presented in Table (1-a). Nitrogen analysis (ppm) in irrigation water and Fish culture water published in Tables (1-b). Heavy metal in Fish culture water (W1) in two different soil types in Tables (1-c) & (1-d).

Table 1-a. some initial physical and chemical soil properties of the studied soil in Abo-kosa (L_1) and Tamiya (L_2).

Location			L_1			L_2		
Physical properties	Organic matter (%)			1.6			0.74	
	Textural class			Clay Loam			L. Sand+	
	Particle size distribution		sand	slit	clay	sand	slit	clay
			14.2	24.6	49.5	79.0	6.6	15.4
Chemical properties								
pH				7.92			7.58	
Electric conductivity E.C. (ds/m)				0.9			3.43	
$CaCO_3$				2.32			7.72	
CEC (meq/100g) soil				39.01			9.78	
LSoluble ions, meq / L	Soluble anions, meq / L	HCO_3^-		1.4			2.66	
		CL^-		2.74			13.7	
		SO_4^{--}		8.3			20.4	
	Soluble cations, meq / L	Ca+		3.7			11.61	
		K^+		1.20			0.82	
		Na+		11.3			17.3	

Table 1-b. Analyses of nitrogen (ppm) in the irrigation water sources W1and W2 on two locations (Abo-kosa) L1 and (Tamiya) L2 in both seasons 2016 and 2017

No. of Irrigation	1		2		3		4		5		6		7		8	
Location	L_1	L_2	L_1	L_2	L_1	L_2	L_1	L_2	L_1	L_2	L_1	L_2	L_1	L_2	L_1	L_2
2016 season																
Date	1/4		15/4		30/4		15/15		30/5		14/6		4/7		26/7	
W_1	1.2	1.2	8	5	10	8	15	11	18	16	22	20	28	22	35	28
W_2	1.17	1.15	1.16	1.16	1.14	1.14	1.18	1.18	1.15	1.15	1.20	1.18	1.19	1.18	1.16	1.17
2017 season																
Date	5/4		20/4		5/5		20/5		5/6		20/6		18/7		5/8	
W_1	1.13	1.11	2.6	2.5	7	5	9	9	12	10	19	14	28	18	32	22
W_2	1.13	1.11	1.14	1.12	1.12	1.12	1.16	1.16	1.15	1.17	1.13	1.15	1.17	1.19	1.18	1.18

Table 1-c. Analyzes of heavy metals' (mg\L) in fish culture water irrigation (W1) Number (1&8) in both 1st and 2nd seasons in Abo-kosa (L_1)

Metal	W1 irrigation (1)		W1 irrigation (8)	
	1st Season	2nd Season	1st Season	2nd Season
Pb	3	3.3	5.1	5
Al	2.5	3.5	5	5
As	0.1	0.1	0.1	0.1
F	1	1	1.1	1
Cr	0.1	0.1	0.1	0.1
Ni	0.2	0.2	0.2	0.2
Li	2.5	2.2	2.6	2.5
Se	0.02	0.02	0.02	0.02
Co	0.05	0.05	0.06	0.05

Table 1-d. Analyzes of heavy metals (mg\L) fish culture water irrigation (W1) Number (1&8) both 1st and 2nd seasons in Tamiya (L_2)

Metal	W1 irrigation (1)		W1 irrigation (8)	
	1st Season	2nd Season	1st Season	2nd Season
Pb	3.6	3.5	5.7	5.8
Al	2.9	3.5	5.4	5.6
As	0.4	0.3	0.5	0.3
F	1.2	1.3	1.4	1.3
Cr	0.1	0.1	0.2	0.1
Ni	0.2	0.2	0.3	0.3
Li	2.7	2.3	2.7	2.5
Se	0.04	0.04	0.04	0.04
Co	0.05	0.05	0.07	0.06

This experiment in one location included 6 treatments, which were combination between two irrigation water sources and three nitrogen fertilization rats. These treatments were arranged in spilt-plot design with three replicates. Irrigation water sources were assigned in the plots, which sub plots were devoted to nitrogen fertilization rats. The experimental unit area was 12.6 m2 and it contains six rows with 3 m length and 0.7 m width, a guard row was left between two adjacent plots. . Seeds of Tiba cv were planted on the 1st week of April in both locations at both seasons, on one side of each row at a space of 0.1 m between plants. Fertilization of the experiments was 150 kg/fed. Calcium super phosphate (15% P_2O_5) added during preparation of the soil and 100 kg/fed Potassium sulphate (50 % K_2O) were divided into two equal parts added with the first irrigation and 40th days after planting.

Experimental treatments in both locations

A-Irrigation sources: fish cultural water (W_1) and Nile fresh water (W_2)

B-Nitrogen fertilization levels: (20 – 40 – 60) kg N/ fed

Data recorded: In the suitable maturing and ripening stage, the whole three plants from the middle rows of each sub-plot were collected for recording plant height(cm), number of pods/plant, pod length (cm), Average 100 seeds weight (g) and total yield (kg/fed.). Samples of cowpea plants were collected from different fertilizer treatments, dried and ground for further analysis to measure the dry matter according to AOAC (1990). The seed protein content was estimated using the microkjeldahl method described in AOAC (1984). This method involves protein digestion, distillation and determination of % nitrogen content of the distillate by titration and then multiplying the % nitrogen by a factor of 6.25 to obtain the corresponding protein content in %. A reference to heavy metals use the plasma dual emission spectrometer (CP) to analyses the heavy metals in water, soil and plant by Alloway (1995).

Statistical analysis:

All collected data for various parameters were statistically analyzed according to use the InfoStat computer software package (version, 2012). The differences among treatment means were compared by LSD as a post hoc test at ≤ 5% level of significance (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Clay loam soil in Ibshway location (L_1):

Data presented in Tables (5&6) show the effect of water sources, nitrogen rates and their interaction on dry matter, plant height, no. of pods/plant, Pod length, , 100-seeds weight, Yield/fed and Protein (%). Water sources data clearly indicated that both water sources had significant effect on all studied traits except 100-seeds weight at 1st season. However, fish culture water (W_1) treatment had higher values than other Nile water (W_2) treatment in all aforementioned traits.W_1 have the significant maximum effects by % (21.9 & 14.3%), (23.8 & 17.9%), (13.5 & 11.1%), (19.1 & 19.4%), (3.7 & 4.3%), (9.7 & 13.6%) and (8.2 & 10.0%) over the corresponding Nile water (W_2) treatments for Dry matter (g), Plant height (cm), No of pods, Pod length, Average 100-seeds weight, Yield and Protein (%) in both 1st and 2nd seasons, respectively.

It is clearly illustrated that all nitrogen applications significantly increased Dry matter (g), Plant height (cm), No of pods, Pod length, Average 100-seeds weight, Yield and Protein (%). However, it was noticed that the 60 kg nitrogen rate (N60) treatment had higher values than other N treatments in all aforementioned characters in both seasons. In this regard,N_{60} application have the significant maximum effects by (62.6 & 61.5%), (20.3 & 15.7%), (10.6 & 15.0%), (25.4 & 28.7%), (19.6 & 15.3%), (26.1 & 26.0%) and (10.5 & 11.6%) over the corresponding low nitrogen rate (N_{20}) treatment for Dry matter (g), Plant height (cm), No of pods, Pod length, Average 100-seeds weight, Yield and Protein (%) in both 1st and 2nd seasons, respectively. Table (6) show the changes of abovementioned studied traits of Cowpea plants as affected the interaction between two different water sources, *i.e.*, fish culture water (W_1) and Nile water (W_2) along with 3-nitrogen rates (N_{20}, N_{40} and N_{60}) applications. Irrigation the plants by fish culture water (W_1) with high nitrogen treatment (N_{60}), gave the highest values for dry matter, plant height, no. of pods/plant, Pod length, , 100-seeds weight, Yield/feddan and Protein (%) in both seasons [(24.6 & 21.3 g/plant), (77.8 & 70.6 cm), (46.7 & 43.7 pods), (17.7 & 18.3 cm), (14.8 & 14.3 g), (1077.4 & 967.1 kg/fed.) and (19.3 & 19.3 %) in 1st and 2nd season, respectively] with increment by (108.3 & 90.9%), (48 & 35.7%), (25.0 & 28.4%), (47.3 & 57.1%), (23.2&19.4%), (38.9&37.1%) and (19&22.4%) over the corresponding low interaction ($W_2 \times N_{20}$) treatment for the same traits in descending order at both 1st and 2nd seasons, respectively under the condition of clay loam soil Ibshway location. On contrast, the lowest values were produced by the interaction between Nile water and low nitrogen (N_{20}) treatment in all studied traits

Table 5. Effect of water sources, nitrogen fertilizers rates and their interaction on cowpea traits in the clay loam soil Ibshway location at both seasons 2017and 02018.

Treatments	Characters													
	Dry matter (g)		**Plant height (cm)**		**No of pods**		**Pod length (cm)**		**100-seeds Weight (g)**		**Yield (kg/fed)**		**Protein (%)**	
	Season 1	**Season 2**	**Season 1**	**Season 2**	**Season 1**	**Season 2**	**Season 1**	**Season 2**	**Season 1**	**Season 2**	**Season 1**	**Season 2**	**Season 1**	**Season 2**
Water (W)														
Fish culture water (W_1)	19.32	17.18	67.94	63.84	43.89	39.89	15.22	15.00	13.59	13.22.	930.59	882.13	18.37	18.12
Nile water (W_2)	15.85	15.03	54.87	54.14	38.67	35.89	12.78	12.56	13.11	12.67	848.32	776.64	16.98	16.47
LSD (5%)	1.49	0.40	2.30	1.72	4.85	1.66	2.39	1.26	ns	0.48	33.75	41.93	1.07	0.55
Nitrogen (N)														
N_{20}	13.33	12.13	56.43	55.17	39.17	35.50	12.50	11.83	12.17	12.00	793.01	727.96	16.78	16.37
N_{40}	17.75	16,60	59.89	57.99	41.33	37.33	13.83	13.67	13.33	12.83	875.48	843.03	17.68	17.24
N_{60}	21.67	19.59	67.90	63.82	43.33	40.83	15.67	15.23	14.56	13.83	999.88	917.17	18.55	18.27
LSD (5%)	1.45	0.82	1.82	2.01	0.84	1.50	0.44	0.49	0.76	0.74	54.94	23.27	0.29	0.31
Interaction (W×N)														
$W_1 \times N_{20}$	14.84	13.10	60.30	58.33	41.00	37.00	13.00	12.00	13.33	12.33	810.53	750.35	17.35	17.00
$W_1 \times N_{40}$	18.52	17.13b	56.75	62.63	44.00	39.00	15.00	14.67	13.67	13.00	903.84	927.90	18.45	18.10
$W_1 \times N_{60}$	24.62	21.30	77.77	70.57	46.67	43.67	17.67	18.33	14.78	14.33	1077.41	967.14	19.30	19.26
$W_2 \times N_{20}$	11.82	11.16	52.56	52.00	37.33	34.00	12.00	11.67	12.00	12.00	775.84	705.57	16.22	15.73
$W_2 \times N_{40}$	17.01	16.06	54.02	53.35	38.67	35.67	12.67	12.67	13.00	12.67	847.12	757.15	16.92	16.38
$W_2 \times N_{60}$	18.72	17.87	58.03	57.06	40.00	38.00	13.67	13.33	14.33	13.33	922.35	867.21	17.80	17.28
LSD (5%)	2.05	1.16	2.57	2.01	1.17	2.13	0.63	0.70	1.08	1.04	77.70	32.92	0.41	0.44

Table 6. Changes % in the studied traits as affected by water sources, nitrogen fertilizers rates and their interaction in the clay loam soil Ibshway location at both seasons 2017 and 2018.

Treatments	Characters													
	Dry matter (g)		Plant height (cm)		No of pods		Pod length (cm)		100-seeds Weight (g)		Yield (kg/fed)		Protein (%)	
	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season
Water (W)														
Fish water (W_1)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Nile water (W_2)	121.9	114.3	123.8	117.9	113.5	111.1	119.1	119.4	103.7	104.3	109.7	113.6	108.2	110.0
Nitrogen (N)														
N_{20}	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
N_{40}	133.2	136.9	106.1	105.1	105.5	105.2	110.6	115.6	109.5	106.9	110.4	115.8	105.4	105.3
N_{60}	162.6	161.5	120.3	115.7	110.6	115.0	125.4	128.7	119.6	115.3	126.1	126.0	110.5	111.6
Interaction (W×N)														
$W_2 \times N_{20}$	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
$W_1 \times N_{20}$ %	125.5	117.4	114.7	112.2	109.8	108.8	108.3	102.8	111.1	102.8	104.5	106.3	107.0	108.1
$W_1 \times N_{40}$%	156.7	153.5	107.97	120.4	117.9	114.7	125	125.7	113.9	108.3	116.5	131.5	113.7	115.1
$W_1 \times N_{60}$ %	208.3	190.9	147.96	135.7	125.0	128.4	147.3	157.1	123.2	119.4	138.9	137.1	119.0	122.4
$W_2 \times N_{40}$ %	143.9	143.9	102.8	102.6	103.6	104.9	105.6	108.6	108.3	105.6	109.2	107.3	104.3	104.1
$W_2 \times N_{60}$ %	158.4	160.1	110.4	109.7	107.2	111.8	113.9	114.2	119.4	111.1	118.9	122.9	109.7	109.9

Loam sandy siol of Tamiya(L_2)

Data presented in Tables (7&8) show the effect of water sources and nitrogen rates on dry matter, plant height, no. of pods/plant, Pod length, , 100-seeds weight, Yield/fed and Protein (%). Water sources data clearly indicated that both water sources had significant effect on all studied traits except 100-seeds weight at both 1st and 2nd seasons in loam sandy soil Tamiya location. However, fish culture water (W_1) treatment had higher values than other Nile water (W_2) treatment in all aforementioned traits. W_1 have the significant maximum effects by % (13.2 & 10.2%), (19.3 & 16.6%), (10.9 & 8.8%), (16.0 & 12.7%), (4.7 & 0.9%), (5.9 & 2.2%) and (7.8 & 10.1%) over the corresponding Nile water (W_2) treatments for Dry matter (g), Plant height (cm), No of pods, Pod length, Average 100-seeds weight, Yield and Protein (%) in both 1st and 2nd seasons, respectively.

It is clearly illustrated that all nitrogen applications significantly increased Dry matter (g), Plant height (cm), No of pods, Pod length, Average 100-seeds weight, Yield and Protein (%). However, it was noticed that the 60 kg nitrogen rate (N60) treatment had higher values than other N treatments in all aforementioned characters in both seasons. With regard to loam sandy soil Tamiya location, N60 treatment have the significant maximum effects by (53.3 & 50.1%), (18.7& 15.6%), (11.1&15.3%), (25.2&24.8%), (13.0&12.5%), (24.2&16.5%) and (9.9&11.5%) over the corresponding Nile water (W_2) treatments for Dry matter , Plant height, No of pods, Pod length, Average 100-seeds weight, Yield and Protein content in both 1st and 2nd seasons, respectively. Table (8) show the changes of abovementioned studied traits of Cowpea plants as affected by the interaction between two different water sources, *i.e.*, fish culture water (W_1) and Nile water (W_2) along with 3-nitrogen rates (N_{20}, N_{40} and N_{60}) applications. Irrigation the plants by fish culture water (W_1) with high nitrogen treatment (N_{60}), gave the highest values for dry matter, plant height, no. of pods/plant, Pod length, , 100-seeds weight, Yield/fed and Protein (%) in both seasons [(19.0& 17.2 g/plant), (72.8 & 67.6 cm), (44.7 & 42.0 pods), (17.6 & 16.4 cm), (14.2 & 13.9 g), (959.6 & 770.6 kg/fed.) and (18.7 & 18.6 %) in 1st and 2nd season, respectively] with increment by (74.4 & 63.9%), (42.7 & 34.2%), (21.8 & 26.0%), (43.3 & 39.5%), (17.5 &14.1%), (34.6 & 19.1%) and (17.6& 22.4%) over the corresponding low interaction ($W_2 \times N_{20}$) treatment for dry matter (g), Plant height (cm), no of pods, pod length, average 100-seeds weight, yield and protein (%) in both 1st and 2nd seasons, respectively under the condition of loam sandy soil Tamiya location. On contrast, the lowest values was produced by the interaction between Nile water and low nitrogen (N_{20}) treatment in all studied traits.

The results of irrigation water are in agreement with those mentioned by Castro *et al.* (2006) who found that treatments irrigated with fish effluent had higher fruit number/plant and productivity at 50, 75 and 100 days age. Also, Kamal (2006) found that plant height, market fruit weight(g), marketable ripe fruit yield, mean yield of marketable fruits (kg/m^2) and mean total yield of fruits of bell pepper grown hydroponically in a closed, reticulating fish and bell pepper production system were significantly increased when bell pepper plants/m2were reduced from 15 to 10 plants/m^2. Li and Hu (2009) published that fish plays an important role in food security by providing many nutrients, including high-quality protein, omega-3 polyunsaturated fatty acids, and micronutrients. Regarding nitrogen rates, the present results were in agreement with the findings of Khan *et al*. (1996) who found higher dry matter when extra N fertilizer was applied to the land. Daramy *et al.* (2016) found that cowpea seed N, seed crude protein and cowpea total plant N contents were significantly affected by N rates while the highest values were obtained at 30 kg N/ha. Todorov and Pevicharova (2000) stated that applying 10 kg ammonium nitrate resulted in standard production on average increase of 1.5-18.8%. For study of nitrogen effects on yield of cowpea, Madukwe *et al*., (2008) stated that application of N to cowpea has been reported to increase its yield and the nutritional quality of the seeds. Also, Upadhyay and Anita Singh (2016) used four levels of nitrogen (0, 10, 20 and 30 kg/ha) and found that seeds/pod and grain yield were significantly positive increased with increasing the nitrogen level. Generally, Wesley *et al.* (2001) reported that fish pond effluent applied as irrigation and as a supplemental source of nutrients is beneficial for French bean and kale growth and yield. However, pond effluent should not be used as the primary source of nitrogen and phosphorus for crops owing to its low concentration of these elements. Moreover, the small amount of nitrogen and phosphorus in pond water does not justify adjustment of recommended nitrogen and phosphorus rates for crops.

Table 7. The effect of water sources, nitrogen fertilizers rates and their interaction on cowpea traits in loam sandy soil Tamiya location on both seasons2017 and 2018.

Treatments	Characters													
	Dry matter (g)		Plant height (cm)		No of pods		Pod length (cm)		100-seeds Weight (g)		Yield (kg/fed)		Protein (%)	
	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season
	Water (W)													
Fish culture water (W_1)	14.85	13.87	64.27	60.85	41.67	38.44	15.11	14.15	13.19	12.86	850.58	730.41	17.78	17.54
Nile water (W_2)	13.12	12.59	53.87	52.19	37.56	35.33	13.03	12.56	12.62	12.74	803.14	714.71	16.49	15.93
LSD (5%)	0.16	0.50	2.03	1.84	1.26	1.72	0.88	1.22	ns	ns	8.83	45.71	1.23	0.54
	Nitrogen (N)													
N_{20}	11.23	10.63	54.62	52.69	37.50	34.50	12.58	11.88	12.07	12.00	743.92	660.63	16.33	15.85
N_{40}	13.52	12.80	57.75	55.99	39.67	36.50	13.88	13.36	12.99	12.82	812.69	737.19	17.11	16.68
N_{60}	17.22	15.96	64.84	60.89	41.67	39.77	15.75	14.83	13.64	13.50	923.98	769.86	17.95	17.68
LSD (5%)	0.35	0.56	0.82	0.91	0.74	0.63	0.44	0.48	0.43	0.28	20.13	22.27	0.31	0.29
	Interaction													
$W_1 \times N_{20}$	11.56	10.75	58.18	55.00c	38.30	35.67	12.86	12.05	12.04	12.00	774.72	674.05	16.79	16.46
$W_1 \times N_{40}$	13.99	13.04	61.80	59.95	42.00	37.67	14.83	14.06	13.30	12.71	817.39	746.62	17.86	17.51
$W_1 \times N_{60}$	19.01	17.23	72.83	67.58	44.67	42.00	17.63	16.35	14.22	13.87	959.63	770.57	18.68	18.64
$W_2 \times N_{20}$	10.90	10.51	51.05	50.37	36.67	33.33	12.30	11.72	12.10d	12.16	713.13	647.21	15.88	15.23
$W_2 \times N_{40}$	13.04	12.57	53.70	52.02	37.33d	35.33	12.92	12.67	12.68	12.93	807.98	727.77	16.37	15.84
$W_2 \times N_{60}$	15.42	14.69	56.85	54.19	38.67	37.33	13.87	13.30	13.06	13.13	888.32	769.15	17.22	16.72
LSD (5%)	0.49	0.80	1.16	1.29	1.04	0.89	0.63	0.68	0.61	0.40	28.47	32.21	0.44	0.4

Table 8. Changes % in the studied traits as affected by water sources, nitrogen fertilizers rates and their interaction in the loam sandy soil Tamiya location on both seasons 2017 and 2018.

Treatments	Characters													
	Dry matter (g)		Plant height (cm)		No of pods		Pod length (cm)		100-seeds Weight (g)		Yield (kg/fed)		Protein (%)	
	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season	1st Season	2nd Season
	Water (W)													
Fish culture water (W_1)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Nile water (W_2)	113.2	110.2	119.3	116.6	110.9	108.8	116.0	112.7	104.5	100.9	105.9	102.2	107.8	110.1
	Nitrogen (N)													
N_{20}	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%		100%
N_{40}	120.4	120.4	105.7	106.3	105.8	105.8	110.3	112.5	107.6	106.8	109.2	111.6	104.8	105.2
N_{60}	153.3	150.1	118.7	115.6	111.1	115.3	125.2	124.8	113.0	112.5	124.2	116.5	109.9	111.5
	Interaction (W×N)													
$W_2 \times N_{20}$	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
$W_1 \times N_{20}$	106.1	102.3	114.0	109.2	104.4	107.0	104.6	102.8	99.5	98.7	108.6	104.1	105.7	108.1
$W_1 \times N_{40}$	128.3	124.1	121.1	119.0	114.5	113.0	120.6	120.0	109.9	104.5	114.6	115.4	112.5	115.0
$W_1 \times N_{60}$	174.4	163.9	142.7	134.2	121.8	126.0	143.3	139.5	117.5	114.1	134.6	119.1	117.6	122.4
$W_2 \times N_{40}$	119.6	119.6	105.2	103.3	101.8	106.0	105.0	108.1	104.8	106.3	113.3	112.4	103.1	104.0
$W_2 \times N_{60}$	141.5	139.8	111.4	107.6	105.5	112.0	112.8	113.5	107.9	108.0	124.6	118.8	108.4	109.8

Locality effect:

The combined analysis for both clay loam and loam sandy soil locations (Table 9) indicates significant differences between locations for 100-seeds weight (g), Yield/fed (kg), Dry matter and Protein (%). Also, highly significant differences among both water sources and nitrogen rates were existed for all studied traits except for 100-seed weight which was not significantly affected by water sources. This could be due to that these characters were highly affected by land type in which the main effect was highly significant for these traits. Location × Water sources (L×W) interaction was significant for plant height, yield and dry matter, indicating that cowpea (Teba cv.) produced relatively better with some water sources in some locations (land type) than it did in other. Also, Location × Nitrogen rates (L×N) interaction was significant for dry matter, indicating that cowpea plants produced dry matter relatively better with some Nitrogen rate in some locations (land type) than it did in other.(W×N) and (W× L) interactions in most studied traits revealed definitely that certain water sources fluctuated consistently different in rank performance in the locations of testing at different nitrogen rates. In the meantime, the W×N effect was significantly greater than the interaction of L×W×N for all studied traits except 100-seed weight which exhibited comparable effects. These results revealed that in most traits, the differential response of some water sources with the individual nitrogen rates was sufficiently similar in the different locations to warrant that, these differentials may be permanent features for these nitrogen rates. Furthermore, nitrogen rate had the major effect on these traits, in which the mean square for W×N was greater than that of L×W interaction as all studied traits except 100-seeds weight and yield. Combined means as influenced by location, water sources, nitrogen rates and their interactions in 1st season of study were shown in Table (10). Generally, It could be recommended that cowpea plants cv. Teba fertilized with 60 kg N/fed. and irrigated with fish culture water produced significantly highest values for all studied traits in Ibshway (old land) compared with Tamiya (New land)location with significantly differences between the two land types except pod length and100-seeds weight which exhibited no significant differences. On contrast, no significant differences were observed between the two locations (both clay loam and loam sandy soil types) for plant height, pod length, number of pods and 100 seeds weight when cowpea plants cv. Teba fertilized with 60 kg N/fed. and irrigated with Nile water. Locality effect earlier studied by some Egyptian authors as Zayed*et al.*, 1999 and Zayed*et al.*, 2005 on Pea and Zayed and Asfour 2005 on Faba bean. Therefore, recycling the drainage water of fish farming, rich with organic matter for agriculture use can improve soil quality and crops productivity (Eid et al., 2014) and reduce the total costs of fertilizers by adding A minimum doses from minerals fertilizers.

Table 9. combined analysis of variance for studied traits over two locations of 1st season of study2017

Source of variation	d.f.	plant height (cm)	Pod length (cm)	No. of pods/plant	100-seeds weight (g)	Yield/feddan (kg)	Dry matter	Protein (%)
B	2	10.019	2.0683	0.4444	0.0128	918.1	0.7842	0.49659
Location (L)	1	49.163	0.0427	25	1.8225*	35240*	116.7480**	2.6136*
Ea	2	3.62	0.3399	2.3333	0.0353	1807.8	0.2125	0.03284
Water sources (W)	1	1239.4**	45.96**	196**	2.4859	37835.4**	61.022**	16.080**
L×W	1	16.04*	0.3062	2.7778	0.0178	2724.1*	6.7860*	0.02351
E_b	4	1.143	0.7759	3.0556	0.5715	147.2	0.3146	0.32461
Nitrogen rates (N)	2	371.2**	30.4**	52.11**	11.74**	114031**	154.10**	8.602**
L×N	2	1.248	0.0015	0	0.5328	537.3	5.0935**	0.01905
W×N	2	89.069**	7.250**	10.3333**	0.3587	5421.2*	10.6054**	0.2240*
L×W×N	2	2.376	0.009	0.4444	0.2391	2363	0.7883	0.00737
Error	16	1.121	0.1108	0.3472	0.2172	965.2	0.6245	0.05168

***,** significant and highly significant differences, respectively**

Table 10. combined means as influenced by location, water sources, nitrogen rates and their interactions in 1st season2017 of study.

Character		plant height (cm)			Pod length (cm)			No. of pods/plant			100-seeds weight (g)			Yield/fed (kg)			Dry matter			Protein (%)		
Treatment		W_1	W_2	mean	W_1	W_2	mean	W_1	W_2	mean	W_1	W_2	Mean	W_1	W_2	mean	W_1	W_2	mean	W_1	W_2	Mean
L_1	N_1	60.3	52.6	56.4	13	12	12.5	41	37.3	39.2	12.3	12	12.2	810.5	775.5	793	14.8	11.8	13.3	17.4	16.2	16.8
	N_2	65.8	54.0	59.9	15	12.7	13.8	44	38.7	41.3	13.7	13	13.3	903.8	847.1	875.5	18.5	17.0	17.8	18.5	16.9	17.7
	N_3	77.8	58.0	67.9	17.7	13.7	15.7	46.7	40	43.3	14.8	14.3	14.6	1077.3	922.4	999.8	24.6	18.7	21.7	19.3	17.8	18.6
	mean	67.9	54.9	61.4	15.2	12.8	14	43.9	38.7	41.3	13.6	13.1	13.4	930.6	848.3	889.4	19.3	15.9	17.6	18.4	17.0	17.7
L_2	N_1	58.2	51.1	54.6	12.9	12.3	12.6	38.3	36.7	37.5	12.0	12.1	12.0	774.7	713.1	743.9	11.6	10.9	11.2	16.8	15.9	16.3
	N_2	61.8	53.7	57.8	14.8	12.9	13.9	42	37.3	39.7	13.3	12.7	13.0	817.4	808	812.7	14.0	13.0	13.5	17.9	16.4	17.1
	N_3	72.8	56.9	64.8	17.6	13.9	15.8	44.7	38.7	41.7	14.2	13.0	13.6	959.6	888.3	924	19.0	15.4	17.2	18.7	17.2	18.0
	Mean	64.3	53.9	59.0	15.1	13.0	14.1	41.7	37.6	39.6	13.2	12.6	12.9	850.6	803.1	826.9	14.9	13.1	14	17.8	16.5	17.1
W- mean		66.1	54.4	-	15.2	12.9		42.8	38.1		13.4	12.9		890.6	825.7		17.1	14.5		18.1	16.7	
L.S.D $_{(0.05)}$																						
L×N		-		ns	-		ns	-		ns	-		ns	-		ns	-		0.847	-		ns
L×W		-		2.201	-		ns	-		ns	-		ns	-		55.52	-		0.595	-		ns
L×W×N		ns		-	ns		-	ns		-	ns		-	ns		-	ns		-	ns		-
N_1		59.2	51.8	55.5	12.9	12.2	12.5	39.7	37	38.3	12.2	12.1	12.1	792.6	744.3	768.5	13.2	11.4	12.3	17.1	16.1	16.6
N_2		63.8	53.9	58.8	14.9	12.8	13.9	43	38	40.5	13.5	12.8	13.2	860.6	827.6	844.1	16.3	15.0	15.6	18.2	16.6	17.4
N_3		75.3	57.4	66.4	17.7	13.8	15.7	45.7	39.3	42.5	14.5	13.7	14.1	1018.5	905.3	961.9	21.8	17.1	19.4	19	17.5	18.3
L.S.D $_{0.05}$																						
L		-		ns	-		ns	-		ns	-		0.269	-		60.98	-		0.661	-		0.26
W		-		0.989	-		0.815	-		1.618	-		ns	-		11.23	-		0.519	-		0.527
N		-		0.916	-		0.288	-		0.51	-		0.403	-		26.89	-		0.684	-		0.197
W×N		1.289		-	0.800		-	1.583		-	ns		-	31.91		-	0.869		-	0.519		-

L_1: old soil **L_2: New soil**
W_1: fish water **W_2: Nile water**
N_1: 20 kg N/ fed **N_2: 40 kg N/ fed** **N_3: 60 kg N/ fed**

Seed content of heavy metals:

The result of irrigation by fish culture water (W_1) on two locations study i.e. clay loam(L1) and loam sandy (L2) as affecting on Cowpea seed content of heavy metals are given in Table (11). The data showed that there were differences in seed content of heavy metals with different planting seasons and different locations. Given the(Tables 1c and 1d), which indicate a difference in the content of fish culture water from heavy metals namely lead, aluminum, arsenic, lithium and selenium in both seasons as well as in both locations, the highest data was estimated at the sandy soil location in the first season.

Table 11. Effect fish culture water irrigation on cowpea seed heavy metals content in Ibshway (clay loam soil L1) and Tamiya (loam sandy soil L2) location on 2017 and 2018 seasons.

Heavy metal	L1		L2	
	1st Season	1st Season	2nd Season	2nd Season
Pb	0.04	5.7	5.8	0.04
Al	1.8	5.4	5.6	1.9
As	0.01	0.5	0.3	-
F	0.3	1.4	1.3	0.04
Cr	-	0.2	0.1	-
Ni	-	0.3	0.3	-
Li	0.03	2.7	2.5	-
Se	0.02	0.04	0.04	0.01
Co	-	0.07	0.06	-

REFERENCE

Alloy, B.J. (1995). Heavy metals in soils. John wily and Sons Inc., New York.

AOAC. (1984). Official methods of analysis.14th Edn, Association of Official Analytical Chemists. Washington, DC, USA, Pp. 522-533 Badiane FA, Diouf D, Sane D, Diouf O,Croudiaby

AOAC. (1990). Official methods of analysis. 15thEd. Association of Official Analytical Chemists, Inc., Arlington, Virginia, USA.

Carsky, R.J. and E.N.O. Iwuafor (1999). Contribution of soil fertility research/maintenance to improved maize production and productivity in subSaharan Africa. In Badu-Apraku. B., Fakorede, M.A.B., Ouedraogo, M. and Quin, F.M. (eds.). Strategy for sustainable maize production in West and

Chapman, H. D. and P. F. Pratt (1961). Methods of analysis for soils, plants and water. University of California, Division of Agric. Sci, Berkeley, C,A.

Daramy, M. A., J. Sarkodie-Addo and G. Dumbuya (2016). the effects of nitrogen and phosphorus fertilizer application on crud protein, nutrient concentration and nodulation of cowpea in Ghana. ARPN Journal of Agricultural and Biological Science. 11(12): 470-480

Eid, A.R., E.M. Hoballah and S.E.A. Mosa (2014). Sustainable Mangement of Drainage Water of Fish Farms in Agriculture as a New Source for Irrigation and Bio-Source for Fertilizing. Agricultural Sciences, 5, 730-742.

Fatokum, A.C. (2002). Breeding Cowpea for Resistance to Insects pests; Attemted crosses between Cowpea and *Vignavexillata*. In: Challenges and Opportunities for Enhancing sustainable Cowpea production, Fatokum, C. A., S. A. Tarawali, B. B. Singh, P.M. Kormawa and M. Tamo (EDS.). International Institute for tropical Agriculture (IITA) Ibadan, Nigeria PP; 52:61

Food and Agriculture Organization FAO. (2012). Grassland species index. Vignaunguiculatahttp :// www. fao.org / ag / AGP/AGPC /doc/ Gbase/data/p f000090 .htm (accessed 6 Jun. 2012)

Gomez, K. A. and A. A. Gomez (1984). Statistical Procedures for Agricultural Research, 2nd edition, John Wiley & Sons, New York, USA.

Haruna, I. M. and L. Aliyu (2011).Yield and economic returns of sesame (Sesamumindicum .L.) as influenced by poultry manure, nitrogen and phosphorus at Samaru, Nigeria. Elixir Agric., 39: 4884-4887.

Kamal, S. M. (2006). Aquaponic production of Nile tilapia (oreo chromis niloticus) and bell pepper (capsicum annum L.) in recirculating water system. Egypt . J. Aquat. Biol. And fish, 10 (3):85-97.Klute, A. (1986).Methods of soil analysis part 1-2nd ed., Amer. Soc. of agron.,madieon, Wisconsin, U.S.A.

Kan'ankuk'a, C.N. (1999). Effect of lime, N and P on growth, yield and nutritive value of oat (*Avena sativa*) fodder at different levels of nitrogen fertilizer. Bangladesh J. Anim. Sci., 25(1-2): 109-115

Khan, M. J., M. Shajalal and A. R. Sarkar (1996). Yield, chemical composition and nutritive value of oat (Avena sativa) fodder at different levels of nitrogen fertilizer. Bangladesh J. Anim. Sci., 25(1-2): 109-115

Klute, A. (1986). Methods of soil analysis part 1-2nd ed., Amer. Soc. of agron.,madieon, Wisconsin, U.S.A

Li D, Hu X (2009). Fish and its multiple human health effects in times of threat to sustainability and affordability: are there alternatives? Asia Pac J Clin Nutr 18(4):553–563

Madukwe, D.K., I.E. Christo and M.O. Onuh (2008). Effects of organic manure and cowpea (*Vignaunguiculata* (L.) Walp) varieties on the chemical properties of the soil and root nodulation. Sci., world J. 3: 43-46.

Mahmoud, A.R.; M. M. El – Desuki and M. Abdel - Mouty(2010). Response of snap bean plants to bio – fertilizer and nitrogen level application. Inter. J. Acad. Res. 2(3): 179– 183`

Norton, G., F. A. Bliss and R. Bressari (1985). Biochemical and nutritionalattributes of grain legumes in : Grain Legumes Summerfield. RJ. And Roberts E.H. (Eds.). William Collins and sons Co. Ltd London.Pp: 73 – 144.

Page, A.L., R.H. Miller and D.R. Keeney (1982). Methods of soil analysis. Part. 2, Amer. Soc. of agron., madison, Wisconsin, U.S.A.

Sanginga, N., K. Dashiell, J. Diels, B. Vanlauwe, O. Lyasse, R.J. Carsky, S. Tarawali, B. Asafo-Adjei, A. Menkir, S. Schulz, B. B. Singh, D. Chikoye, D. Keatinge, and O. Rodomiro (2003). Fertilization and plant density on growth, yield and minerals content of pea under sandysoil conditions. J. Agric. Sci., Mansoura Univ., 28 (11) : 6857 – 6873

Santos, B. M. (2009). Combinations of nitrogen rates and irrigation programs for tomato production in spodosoils. Hort. Technology. 19 (4): 781- 785.

Sarg, M. H. S. and M. A. H. Hassan (2003). Effect of Rhizobiuminoculation, nitrogen fertilization and plant density on growth, yield and minerals content of pea under sandysoil conditions. J. Agric. Sci., Mansoura Univ. 28 (11) : 6857 – 6873.

Singh, B.B., D.R. Mohan-Raj, K.E. Dashiel and L.E.N. Jackai (1997). Advances in Cowpea Research-Post Harvest Storage of Cowpea in SubSaharan Africa. I.I.T.A./JIRCA Publication, Ibadan, Nigeria, pp. 302-312

Solieman, T. H. I., H. A. El – Khatib and S. M. El – Araby (2003). Effect of organic manure, mineral nitrogen and bio fertilizer application on vegetative growth and chemical composition of pea *(Pisumsativum, L.)*Zagazig J. Agric. Res., 30 (3): 751 – 767.

Todorov, T. and G. Pevicharova (2000). Technological solution for yield increase and quality improvement of the determinante tomato varieties . Pochvoznanie, Agrokhimiya i Ekologiya. 35 (2): 22 – 25.

Upadhyay, R.G. and Anita Singh (2016). Effect of nitrogen and zinc on nodulation, growth and yield of cowpea (*Vignaunguiculata*). Legume Research, 39 (1) 2016: 149-151

Wesley, W. C., M. M. Bernard, K. L. Veverica and K. Nancy (2001). Use of pond effect for irrigation in an integrated crop/aquaculture system. In: A. Gupta, K. McElwee, D. Burke, J. Burright, X. Cummings, and H. Egna (Editors), Eighteenth Annual

Zayed, G. A., Faris, F. S. and A. H. Amer (1999). Performance of some pea cultivars under the conditions of Upper Egypt. Egypt. J. Agric. Res., 77(4): 1687-1706.

Zayed G. A. and H. E. Asfour (2005). Mean performance and phenotypic stability of some faba bean (*Viciafaba*, L. var. major) genotypes under four different locations. J. Agric. Sci. Mansoura Univ., 30(2),

Zayed G. A., Fawzeya A. Helal and S. T. Farag (2005). The genetic performance of some continuously variable characteristics of pea under different locations. Annals Agric. Sci., Moshtohor, 43(1):337-346.

تأثير الري بمياه المزارع السمكية والتسميد النيتروجيني على نمو و محصول اللوبيا في تربة طينية طميية وتربة طميية رملية.

احمد ابراهيم علي[1] و جيهان زينهم محمد[2]

[1]قسم بحوث الخضر ذاتية التلقيح – معهد بحوث البساتين – مركز البحوث الزراعية

[2]قسم بجوث الخضر خلطية التلقيح – معهد بحوث البساتين – مركز البحوث الزراعية

أجريت التجارب الميدانية في كل من منطقتي إبشواي (تربة الطميية الطينية L1) وطامية (تربة طينية رملية L2) بمحافظة الفيوم ، مصر ، خلال فصلي 2016 و 2017 لدراسة تأثير مصادر المياه (مياه صرف المزارع السمكيه W1، ومياه النيل W2) ، ومستويات التسميد النيتروجيني (20 - 40 - 60) كجم N /للفدان على نمو وإنتاج نباتات اللوبيا في نوعين من التربة. كان لمياه صرف المزارع السمكيه (W1) قيم أعلى من معاملة مياه النيل (W2) في جميع الصفات المدروسه آنفًا. وكان لتركيز النتروجين N60 القيم الاعلي بنسبة (62.6 و 61.5 ٪) ، (20.3 و 15.7 ٪) ، (1 (0.6 و 15.0 ٪) ، (25.4 و 28.7 ٪) ، (19.6 و 15.3 ٪) ، (26.1 و 26.0 ٪) و (10.5 و 11.6 ٪) على المعاملة ذات المعدل المنخفض من النيتروجين (N20) المقابلة للمادة الجافة (جم) ، ارتفاع النبات (سم) ، عدد القرون ، طول القرنة ، متوسط وزن 100 حبة(جم) والنسبة المئوية للبروتين (٪) في كلا الموسمين الأول والثاني على التوالي في التربة الطمييه الطينية (L1) ويشير التحليل المشترك للموقعين أي للتربه الطمييه الطينيه والتربة الرملية الطمييه إلى اختلافات كبيرة بين المواقع لوزن 100 بذرة (جم) و المحصول (كجم) والمادة الجافة (جم) والنسبة المئوية للبروتين (٪). أيضا ، توجد فروق معنويه بين كل من مصادر المياه ومعدلات النيتروجين لجميع الصفات المدروسة باستثناء متوسط وزن 100 بذرة الذي لم يتأثر بشكل كبير بمصادر المياه. نباتات اللوبيا صنف طيبه والمسمده بـ60 كجم N / فدان. ومُرَوَّـه بمياه صرف المزارع السمكيه اعطت أعلى فروق معنويه لكل الصفات المدروسة في موقع إبشواي (التربة الطمييه الطينية) مقارنةً بموقع طامية (تربة رملية طمية) مع وجود اختلافات معنويه كبيرة بين نوعي الأرض باستثناء طول القرنة ومتوسط وزن 100بزره والتي لم تظهر عليها فروق معنويه . على النقيض من ذلك ، لم يلاحظ وجود اي فروق معنويه بين الموقعين (في كلا من ابشواي وطاميه) في صنف اللوبيا طيبه والمسمده بـ60 كجم N / فدان. ومُرَوَّـه بمياه النيل بالنسبة لطول النبات وطول القرن وعدد القرون ووزن 100 بذرة . تحتوي بذور اللوبيا المروية بمياه المزارع السمكية على بعض العناصر الثقيلة ومنها الرصاص والألومنيوم والزرنيخ والليثيوم والسيلينيوم. وتتباين تركيزات كل من هذه العناصر تبعا لموسم النمو وطبيعة التربة.