

Effect of Organic and Bio-Fertilization on the Growth and Chemical Composition on Umbrella Papyrus (*Cyperus alternifolius*, L.) Plants

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ABSTRACT

The present experiment was performed throughout two successive seasons of 2016 and 2017 at the Nursery of Floriculture, Ornamental Horticulture and Landscape Gardening, Faculty of Agriculture, Alexandria University, Egypt to investigate the effects of organic fertilizer and different levels of bio-fertilizers on the vegetative growth, flowering characteristics, rhizomes production and chemical composition of *Cyperus alternifolius*, L. plant. Split-plot was the experiment design in three replicates, and sixteen in each. The main plot represented the organic fertilizers (cattle manure) (0, 10, 20, and 30 % V/V) were mixed with growing media. The sub-plot was bio fertilizer (sub-factor). The two bio-fertilizers used were Nitrobine and Phosphorein. (B₀ = control, B₁ = 5 g Nitrobine / pot , B₂= 5 g Phosphorein/pot, B₃= 5 g Nitrobine +5 g Phosphorein / pot). The results indicated that adding organic fertilizer to growing media by 30% V/V with fourth level of bio-fertilizers B₃ (5 g Nitrobine +5 g Phosphorein / pot) Led to a significant increase of vegetative growth characteristics (plant height, stem length , leaf length , number of leaves / stem, number of stems/ plant and total vegetative fresh weight / plant) and number of days from planting to flowering , rhizomes production, as well as significant increase of chemical composition of leaves and rhizomes, (total chlorophylls contents (SPAD units) in the leaves and carbohydrates contents in rhizomes). It can be recommended that producing high quality umbrella papyrus plants for different decorative purposes in landscaping can be accomplished by addition 30% (V/V)cattle manure to growing media with the addition of bio-fertilizers at rate of 5 g Nitrobine +5 g Phosphorein / pot as the best way to provide the needs the plant of fertilization.

Key words: *Cyperus alternifolius*, L, organic fertilizer, cattle manure, bio-fertilizers, Nitrobine, Phosphorein, semi aquatic plants.

INTRODUCTION

Cyperus alternifolius, L. belongs to the family Cyperaceae. It is native to north and tropical Africa. *Cyperus alternifolius*, L. considered from semi aquatic plants and with the common names of umbrella plant, umbrella papyrus, and umbrella sedge or umbrella palm. (Bailey, 1962).

Umbrella papyrus is now used primarily as graceful accent in water gardens and at the margins of pools or ponds. It has a valuable usage as wonderful unusual cut flower (Hasegawa *et al.*, 1998-b) and in a wide variety of landscaping i.e., tropical looking accent plant, patio and pot plant (Hasegawa *et al.*, 1998-a). Also it used in sewage treatment, as well as the reclamation of contaminated land with heavy metals. (Jones and Humphries 2002).

Energy saving, environment conservation, and pollution control have been the most pronounced issue nowadays all over the world. Minimizing chemical fertilization usage, organic gardens, and bio fertilization are now the new strategies in all agricultural domains around the world. (Samira and El-Tayeb,2008). Organic fertilizers are of paramount importance for their beneficial effects on the physical, chemical and biological properties of soil, cation exchange capacity and available mineral nutrients for plant productivity. However, the opportunities for organic agriculture to affect plant and its occupants in the new century will

increase obviously. (Atowa, 2012). Recent investigations revealed that the application of organic fertilizers and/or bio-fertilizers to the soils can promote nutrients availability and plant uptake, increase crop yield, reduce inputs of chemical fertilizers and minimize environmental risks (Barsom, 1998; Koreish *et al.*, 2004).

It is known that organic fertilization and bio fertilization are of the most important factors affecting umbrella plants. However, no reports are available on production of umbrella papyrus under Egyptian conditions Several investigators studied the effects of organic fertilization and bio fertilization on ornamental plants i.e.,

In a pot experiment, EL-Naggar *et al.* (2004) on *Cyperus papyrus*, L. found that, adding composted leaves to the different growing media were significant effect on the most of vegetative growth, flowering parameters, rhizomes productivity, total chlorophylls contents in leaves and total carbohydrates in rhizome. Sherif and El-Naggar (2005) found that, applying cattle manure and inoculation with bio-fertilizers significantly increased lamina length and width, leaves fresh and dry weights and number of flowers /rhizomes, flower fresh weight, roots dry weight and rhizomes fresh and dry weights compared to the mineral fertilizer (control). They added that cattle or poultry manures application in presence of bio-fertilizers

significantly increased peduncle length of Calla lily (*Zantedeschia aethiops*) plants. Hammam, *et al.* (2014) found that using the fertilization with compost (2 ton/fed.) + chicken manure (2 ton/fed.) + 100kg feldspar + 100 kg rock phosphate mixed inoculation with *Bacillus megatherium* var. *phosphaticum* and *B. circulans* were resulted the highest values of plant height, root length, number of tillers, fresh and dry weights of roots and shoots on Vetiver Plant (*Vetiveria Zizanioides*, L.). Satapathy, *et al.* (2016) Found that INM (Integrated Nutrient Management) practices involving inorganic fertilizer, Vermicompost and Bio fertilizer (*Azospirillum* and *Phosphate solubilising bacteria*) in different combinations had no significant influence on sprouting of gladiolus corms. However, it had significant influence on flowering and corm production in gladiolus.

The main objective of the research is to study the effect of organic fertilization and bio fertilization on the vegetative growth, flowering, rhizomes production and chemical composition of *Cyperus alternifolius*, L. plant.

MATERIALS AND METHODS

The pot experimental study was carried out at Nursery of Floriculture, Ornamental Horticulture, Faculty of Agriculture, Alexandria University, Egypt. throughout the two successive growing seasons of 2016 and 2017. The *Cyperus alternifolius*, L. rootstocks with an Averages weight of 75 g and had at least 8-10 buds were chosen for the present investigation. El-Fawakhry *et al.* (2004) The rootstocks (one rootstock / pot) were cultivated and horizontally laid in pots of 30 cm diameter packed the growing media containing sand + Loam ratio of (1: 1 V/V), in a full sunny place on 25th Feb, 2016 and 20th Feb, 2017 in the first and second season, respectively until reaching the flowering stage.

The chemical analysis of the used medium indicated that it was containing 40.63, 487.5 and 102.11 mg/kg of P, K and N, respectively. The electrical conductivity (EC) was 0.81 d.S m⁻¹ with a pH value of 7.85.

Two Factors were involved in the present study. Four levels of organic fertilizers randomly arranged in the main plots, while the four bio-fertilizers levels occupied the sub-plots. Four levels of organic fertilizers (main-factor) (0, 10, 20, and 30 % / pot V/V were mixed with growing media). The chemical analysis of the used cattle manure in the present study was presented in Table 1.

Bio-fertilizers (sub-factor) used were Nitrobine and Phosphorein (B₀ = control, B₁ = 5 g Nitrobine / pot , B₂= 5 g Phosphorein/pot, B₃= 5 g Nitrobine +5 g Phosphorein / pot). The bio-fertilizers were divided into two equal doses. The first one was added immediately at planting and the second was added 30 days after planting. El-Naggar (2010).

Data were statistically analyzed as a split-plot design with three replications in 2016 and 2017 seasons. Comparisons of the studied treatments were carried-out by least significant difference at 0.05 according to Gomez and Gomez (1984).

Table 1. Chemical analysis of used cattle manure.

Parameter	Results of Analysis
pH	7.73
E.C. ds/m	5.04
Organic C (%)	12.4
Organic matter (%)	21.38
K (%)	0.20
P (%)	0.38
C/N	11.69
Total N (%)	1.06

Data recorded for vegetative growth parameters, included; plant height (cm), stem length (cm), leaf length (cm), number of leaves / stem, number of stems/ plant and total vegetative fresh weight / plant (g). While, flowering data number of days to flowering. In addition, rhizomes fresh weight (g)/pot were recorded. Chemical analysis of total chlorophyll contents (SPAD units) "Special Products Analysis Division." in leaves, and the total carbohydrates content in rhizomes were determined according to Herbert, *et al.* (1971).

RESULTS AND DISCUSSION

I- Vegetative growth characteristics:

Plant height (cm):

Data illustrated in Table (2), showed that there was significantly difference between plant height by using different organic fertilizer treatments. There was a significant increment in plant height with increasing the levels of organic fertilizers in both seasons. The longest plant was obtained by using level of 30% organic fertilizer (66.33 and 66.01 cm, respectively), while the shortest plant was obtained by using organic fertilizer level at 0% organic fertilizer (control) (53.49 and 48.36 cm, respectively) in both seasons.

Furthermore, there was a significant increment in plant height by applications of bio-fertilizers compared to the control treatment in both seasons. However, the longest plant was obtained by using the fourth level of bio-fertilizers B₃ (5 g Nitrobine +5 g Phosphorein / pot) (63.51 and 60.32 cm, respectively), while the shortest plant was produced by untreated plants B₀ (control) (55.47 and 53.50 cm, respectively) in the both seasons.

The interactions among the treatments of organic fertilizer and bio-fertilizers levels were significantly affected. In general the longest plant was produced by using 30% organic fertilizer and the fourth level of bio-fertilizers B₃ (5 g Nitrobine +5 g Phosphorein / pot) (68.52 and 71.98 cm, respectively), while the shortest plant was obtained by using 0% organic fertilizer (control) with B₀ bio-fertilizers (control)

(48.58 and 45.74 cm, respectively) in the both seasons.

Stem length (cm):

The data presented in Table (2) that stem length significantly increased by using different levels of organic fertilizer. The longest stem was obtained by using level 30% of organic fertilizer (57.35 and 62.09 cm, respectively) while the shortest stem was obtained by using level 0% of organic fertilizer (control) (44.39 and 45.10 cm, respectively), in the both seasons.

On the other hand, the application of bio-fertilizers levels was gave a significant effect on stem length. The longest length produced by application B₃ (5 g Nitrobine +5 g Phosphorein /

pot) (53.22 and 56.08 cm, respectively), while the lowest length was obtained by untreated plant B₀ (control), in the both seasons.

The interactions between the using treatments of organic fertilizer and bio-fertilizers levels were significantly affected. The longest stem was produced by using 30% organic fertilizer and fourth level of bio-fertilizers B₃ (5 g Nitrobine +5 g Phosphorein / pot) (63.11 and 66.97 cm, respectively), while the shortest length was obtained by using 0% organic fertilizer (control) with B₀ bio-fertilizers (control) (40.57 and 44.26 cm, respectively) in the both seasons.

Table 2: Averages of plant height (cm), stem length (cm) and Leaf length (cm) of the *Cyperus alternifolius*, L as affected by the organic, bio fertilizer and their interaction throughout of the two seasons 2016 and 2017.

Plant height (cm)										
Organic fertilizer (A)	First season					Second season				
	Bio-fertilizers (B)				Mean	Bio-fertilizers (B)				Mean
	B ₀	B ₁	B ₂	B ₃		B ₀	B ₁	B ₂	B ₃	
0%	48.58	53.19	54.89	60.28	53.49	45.74	47.37	49.35	50.98	48.36
10%	53.21	54.38	54.38	57.96	55.40	50.67	53.25	54.10	56.43	53.61
20%	58.95	54.34	61.93	67.28	60.29	56.64	59.00	60.55	61.88	59.52
30%	61.15	67.50	68.16	68.52	66.33	60.96	63.90	67.20	71.98	66.01
Mean	55.47	57.35	59.84	63.51		53.50	55.88	57.80	60.32	
LSD0.05	A= 7.09 B= 2.65 A*B= 5.30					A=2.25 B= 1.02 A*B= 2.04				
Stem length (cm)										
Organic fertilizer (A)	First season					Second season				
	Bio-fertilizers (B)				Mean	Bio-fertilizers (B)				Mean
	B ₀	B ₁	B ₂	B ₃		B ₀	B ₁	B ₂	B ₃	
0%	40.57	45.33	46.31	45.36	44.39	44.26	43.83	45.47	46.87	45.10
10%	41.85	43.73	46.74	47.20	44.88	46.36	49.31	50.67	52.58	49.73
20%	47.01	46.90	50.99	57.22	50.53	52.50	55.18	56.75	57.88	55.58
30%	52.92	55.23	58.16	63.11	57.35	58.04	59.91	63.42	66.97	62.09
Mean	45.59	47.80	50.55	53.22		50.29	52.06	54.08	56.08	
LSD0.05	A= 3.95 B= 2.09 A* B= 4.19					A= 1.58 B= 1.02 A* B= 2.04				
Leaf length (cm)										
Organic fertilizer (A)	First season					Second season				
	Bio-fertilizers (B)				Mean	Bio-fertilizers (B)				Mean
	B ₀	B ₁	B ₂	B ₃		B ₀	B ₁	B ₂	B ₃	
0%	16.63	16.95	17.77	18.28	17.40	15.70	16.80	17.76	18.56	17.20
10%	16.09	17.17	18.79	18.49	17.63	16.78	17.30	18.77	18.36	17.80
20%	17.35	17.81	18.34	18.78	18.07	17.75	18.24	22.10	23.66	20.44
30%	16.42	17.75	18.57	20.39	18.28	18.86	21.16	22.04	25.16	21.80
Mean	16.62	17.42	18.36	18.98		17.27	18.38	20.17	21.43	
LSD0.05	A= 0.52 B= 0.52 A*B= 1.05					A= 2.38 B= 0.78 A*B= 1.56				

L.S.D. _{0.05} = least significant differences at 0.05 of probability.

Leaf length (cm):

Data given in Table (2), proved that the leaf length significantly increased by using different levels of organic fertilizers. The longest leaf length was obtained by using 30% and 20% organic fertilizer (18.28 and 18.07 cm) in the first season. For the second season longest leaf length was obtained by using 30% organic fertilizer (21.80 cm). While the lowest length was obtained by using 0% organic fertilizer (control) (17.40 and 17.20 cm, respectively), in the both season.

Moreover, the application of bio-fertilizers levels was observed a significant effect on leaf length. The longest length produced when an application B₃ (18.98 and 21.43 cm, respectively), while the lowest length was obtained by untreated plant B₀ (control) (16.62 and 17.27 cm, respectively), in two seasons.

Concerning to the interaction among the treatments of organic fertilizers and bio-fertilizers was significant effect on leaf length. The longest leaf was produced by using 30% organic fertilizer with fourth level of bio-fertilizers B₃ (5 g Nitrobine +5 g Phosphorein / pot) (20.39 and 25.16 cm, respectively), while the shortest length was obtained by using 10% organic fertilizer and 0% organic fertilizer (control) with B₀ bio-fertilizers (control) (16.09 and 15.70 cm, respectively) in the both seasons.

Number of leaves per stem:

From the data in Table (3) it is clear that there was significant increment in number of leaves per stem of umbrella papyrus. The maximum numbers of leaves per stem were obtained by using levels 30% and 20% of organic fertilizer. The minimum number of leaves was obtained by using 0% (control) (16.24 and 17.23 leaf/stem, respectively) in the both seasons.

Moreover, there was significant effect of bio-fertilizers treatment on number of umbrella papyrus leaves in the two seasons. The best result was recorded when treated plants with B₃ (5 g Nitrobine +5 g Phosphorein / pot) (18.16 and 19.45 leaf/ stem, respectively).

Concerning to the interaction among the treatments of organic fertilizer and levels of bio-fertilizers in the both seasons. The most effective treatment was organic fertilizer at the level of 30% with B₃ (5 g Nitrobine +5 g Phosphorein / pot) (18.27 and 20.00 leaf/ stem). The Less effective treatment was organic fertilizer at the level of 0% (control) with B₀ (control) (14.38 and 15.61 leaf/ stem).

Number of stems per plant:

Data given in table (3), prove that the main effect different levels of organic fertilizer was significant in the both seasons. The maximum numbers of stems were obtained by using level 30% of organic fertilizer (37.94 and 35.13 stems/plant, respectively). The minimum number of stems were

obtained by using 0% (control) (30.08 and 29.41 stems/ plant, respectively) in the both seasons.

For bio-fertilizers levels, any of bio-fertilizers applications led to significant increases in the number of stems per plant. The largest number obtained when B₃ (5 g Nitrobine +5 g Phosphorein / pot) (37.16 and 34.91 stems/ plant, respectively) was used, while the lowest number was produced by untreated B₀ (control) (33.19 and 29.30 stems/ plant, respectively), in the two seasons.

The interactions between using the levels of organic fertilizer and bio-fertilizers levels were not significant in the number of stems per plant in the first season, but there were significant difference in number of stems in the second season. The maximum numbers of stems were obtained by using 30% organic fertilizer with B₃ (5 g Nitrobine +5 g Phosphorein / pot) (39.44 stem/ plant), while the minimum number of stems were obtained by using 0% organic fertilizer (control) with B₀ bio-fertilizers (control) (28.00 stems/ plant).

Total vegetative fresh weight / plant (g):

Data given in Table (3) proved that total fresh weight of vegetative growth were significant increased by using the organic fertilizer levels. The heaviest total fresh weight was obtained by using 30% organic fertilizer (149.12 and 146.05 g/ plant, respectively), while the lowest total fresh weight was produced by using 0% organic fertilizer (control) (101.35 and 96.27 g/ plant, respectively), in the both seasons.

Moreover, the application of bio-fertilizers levels was observed a significant effect on total fresh weight of vegetative growth. The heaviest in total fresh weight was produced by application B₃ (5 g Nitrobine +5 g Phosphorein / pot) (139.45 and 132.29 g/ plant, respectively), while the lowest in total fresh weight was produced by untreated (control) (108.13 and 112.87 g/ plant, respectively), in the both seasons.

Generally, the interactions between the using organic fertilizer and different levels bio-fertilizers, there were significant increased in fresh weight. The maximum in fresh weight was obtained by using 30% organic fertilizer with B₃ (174.83 and 165.41 g/ plant, respectively), while the lowest in fresh weight was obtained by using 0% organic fertilizer (control) with B₀ (control) (92.65 and 91.93 g/ plant, respectively), in the both seasons.

In general, from the previous results show that using 30% of organic fertilizer with fourth level of bio-fertilizers B₃ (5 g Nitrobine +5 g Phosphorein / pot) led to significantly increased of vegetative growth characteristics (plant height, stem length, leaf length, number of leaves / stem, number of stems/ plant and total vegetative fresh weight / plant) compared to other treatments.

Table 3: Averages of number of leaves / stem, number of stem / plant and total vegetative fresh weight per plant (g) of the *Cyperus alternifolius*, L as affected by the organic, bio fertilizer and their interaction throughout of the two seasons 2016 and 2017.

Number of leaves / stem										
Organic fertilizer (A)	First season					Second season				
	Bio-fertilizers (B)				Mean	Bio-fertilizers (B)				Mean
	B ₀	B ₁	B ₂	B ₃		B ₀	B ₁	B ₂	B ₃	
0%	14.38	15.94	16.83	17.83	16.24	15.61	16.83	18.05	18.44	17.23
10%	15.55	17.16	18.72	18.16	17.39	17.00	18.77	19.05	19.50	18.58
20%	16.88	17.99	18.05	18.38	17.83	18.61	18.72	19.05	19.88	19.06
30%	17.66	17.44	18.02	18.27	17.84	18.72	19.16	19.66	20.00	19.38
Mean	16.12	17.13	17.90	18.16		17.48	18.37	18.95	19.45	
LSD0.05	A = 0.780 B = 0.574 A*B = 1.148					A = 1.70 B = 0.37 A*B = 0.75				
Number of stem / plant										
Organic fertilizer (A)	First season					Second season				
	Bio-fertilizers (B)				Mean	Bio-fertilizers (B)				Mean
	B ₀	B ₁	B ₂	B ₃		B ₀	B ₁	B ₂	B ₃	
0%	28.99	29.33	29.33	32.66	30.08	28.00	28.33	30.66	30.66	29.41
10%	34.77	30.22	35.88	36.44	34.32	30.11	30.44	30.88	32.11	30.88
20%	34.33	37.33	39.10	39.33	37.52	28.22	30.88	30.88	37.44	31.86
30%	34.66	37.22	39.66	40.21	37.94	30.88	34.11	36.11	39.44	35.13
Mean	33.19	33.52	35.996	37.16		29.30	30.94	32.13	34.91	
LSD0.05	A = 4.339 B = 3.171 A*B = N.S					A = 3.71 B = 1.33 A*B = 2.66				
Total vegetative fresh weight per plant (g)										
Organic fertilizer (A)	First season					Second season				
	Bio-fertilizers (B)				Mean	Bio-fertilizers (B)				Mean
	B ₀	B ₁	B ₂	B ₃		B ₀	B ₁	B ₂	B ₃	
0%	92.65	100.63	101.12	110.98	101.35	91.93	93.75	97.93	101.46	96.27
10%	97.69	107.34	112.15	127.55	111.18	103.22	106.67	112.87	123.86	111.66
20%	119.41	132.99	138.45	144.43	133.82	121.75	127.58	133.73	138.43	130.37
30%	122.75	143.40	155.48	174.83	149.12	134.58	133.06	151.14	165.41	146.05
Mean	108.13	121.09	126.80	139.45		112.87	115.27	123.92	132.29	
LSD0.05	A = 15.43 B = 5.75 A*B = 11.51					A = 9.43 B = 3.76 A*B = 7.51				

L.S.D. _{0.05} = least significant differences at 0.05 of probability.

N.S = Non- significant differences at 0.05 of probability.

The increment of the previous characteristics of vegetative growth due the role organic fertilization and bio fertilization could be explained by enhancing the cell division rate and cell enlargement. (Shalaby and El-Nady, 2008). Additionally, organic fertilization and bio fertilization is a very important for supplying the plants with their nutritional requirement without having an undesirable impact on the environment (Sherif and El-Naggar 2005). Furthermore, this increasing in vegetative growth might be attributed to the effect of organic fertilizer that improves physical, chemical, and biological properties of soil; that is, increasing soil organic matter, cation exchange capacity, water holding capacity and availability of mineral nutrients, this in turn, increases vegetative growth (Al-Fraihat *et al.*,

2011). These results may be attributed due to the physiological roles of vitamins and amino acids produced by microorganism which led increased the metabolic processes role and levels of endogenous hormones in treated plants, (Chaliakhyan, 1957). As finding could be related to the important role of microorganism such as nitrogen fixing bacteria, (NFB) *Azotobacter* or phosphate solubilizing bacteria (PSB) on improving the microbiological activity in the *rhizosphere* (Ridvan, 2009).

The previous results of vegetative growth were in harmony with those obtained by EL-Naggar *et al.* (2004) on *Cyperus papyrus*. L, Sherif and El-Naggar (2005) on *Calla lily* plants., Godse *et al.* (2006) on *gladiolus*, Kiran, *et al.* (2007) on *Dahlia pinnata*., Kengne, *et al.* (2008) on *Cyperus papyrus*. L., Abdou, *et al.* (2013) on *Gladiolus grandiflorus*

cv. Eurovision plant., Chaudhary *et al.* (2013) on gladiolus, Hammam, *et al.* (2014) on (*Vetiveria zizanioides*, L. Nash), El- Deeb (2016) on gladiolus *Gladiolus grandiflorus* L. cv. "White Prosperity"., and Yathindra, *et al.* (2016) on *Strelitzia reginae* L.

II- Flowering characteristics:

Number of days to flowering:

Data in Table (4), showed that, the main effect of organic fertilizer was highly significant on the number of days to flowering. The shortest period between planting and flowering (137.88 and 131.33 days, respectively) was recorded with 0% organic fertilizer (control). The treatment of 30% organic fertilizer led to delay of flowering (172.10 and 159.66 days, in the both seasons, respectively). Fourth level of bio-fertilizers B₃ (5 g Nitrobin + 5 g Phosphorein / pot) led to increasing the time required from planting to flowering (165.10 and 154.69 days, respectively). While the shortest period from planting to flowering (153.08 and 142.52 days, respectively) was recorded by control treatment, in both seasons.

The interactions between organic fertilizer and bio-fertilizers were significant leading to an increase in number of days to flowering. Generally, the longest period between planting and flowering (176.32 and 171.11 days, respectively) were recorded with 30% organic fertilizer with fourth level of bio-fertilizers (B₃). While the shortest period were recorded with control (124.88 and 126.88 days, respectively), in the both seasons.

Increasing in period of transplanting to flowering might be attributed to the important role of microorganism such as nitrogen fixing bacteria, (NFB) *Azotobacter* or phosphate solubilizing bacteria (PSB) *Bacillus megaterium* and potassium solubilizing bacteria (KSB) *B. circulans*, on improving the microbiological activity in the rhizosphere or contributed and solubilize essential minerals, making scarce nutrients more available to the plant. Moreover, production of growth promoting substances or organic acids, that could lead to a stimulate several physiological changes giving a better growth plant more tolerance to stresses (El-Haddad *et al.*, 1993). Moreover, organic materials can reduce the P-sorption capacity of the soil, enhance P availability, improve P recovery or result in better utilization by plants. Organic materials add Carbon into the soil provides substrate for microbial growth, and subsequent microbial activity. The turnover resulting from the decomposition of organic materials improves the nutrient cycling and availability to the plants especially, N and P, which improved root development and subsequently vegetative growth (Iyamuremye and Dick, 1997). These results are in agreement with that reported by EL-Naggar *et al.* (2004) on *Cyperus papyrus*, L. and Kengne, *et al.*

(2008) on *Echinochloa pyramidalis* and *Cyperus papyrus*.

III- Rhizomes and roots characteristics:

Rhizomes fresh weight per pot (g):

Data illustrated in Table (4), showed that there were significant difference between the rhizomes fresh weight by using different organic fertilizer levels. The heavy rhizomes fresh weight was obtained by using 30% organic fertilizer (165.29 and 169.14 g/pot, respectively). The lowest rhizomes fresh weight produced by untreated (control)(135.77 and 134.70 g/pot, respectively), in the both seasons.

For bio-fertilizers levels, any of bio-fertilizers applications led to significant increases in rhizomes fresh weight as compared with the control treatment (N₀). In generally, the maximum fresh weight was obtained when using B₃ (166.54 and 169.43 g/pot, respectively), while the lowest fresh weight was obtained by using untreated B₀ (control) (136.97 and 135.77 g/pot, respectively), in the both seasons.

General, the interactions between the using levels organic fertilizer and bio-fertilizers levels, there were significant differences in rhizomes fresh weight. The maximum fresh weight was obtained by using level 30% organic fertilizer with B₃ (189.27 and 193.13 g/pot, respectively), while the lowest fresh weight was obtained by using 0% organic fertilizer with B₀ untreated (control)(121.00 and 117.14 g/pot, respectively), in the both seasons.

These results can be attributed to the role of organic fertilizers and bio-fertilizers in the provision of nutrients. In addition, these results may be due to the physiological roles of vitamins and amino acids produced by microorganism which led increased the metabolic processes role and levels of endogenous hormones, i.e., IAA and GA₃ (Chaliakhyan, 1957).

These results were in harmony with those obtained by Jena, *et al.* (1999) on *Curcuma longa* cv., Koura, (2001) on *Canna indica*, L., EL-Naggar *et al.* (2004) on *Cyperus papyrus*, L., Sherif and El-Naggar (2005) on Calla lily (*Zantedeschia aethiopicum*) plants. Kengne, *et al.* (2008) on *Echinochloa pyramidalis* and *Cyperus papyrus*. L., and Torkashvand, *et al.* (2015) on *Strelitzia reginae*.

IV- Chemical analysis:

Total chlorophylls contents (SPAD units) in the leaves:

Data given in Table (5), proved that the leaf total chlorophyll contents significant increased by using different organic fertilizer levels. The increases in the leaf total chlorophyll contents was obtained by using level 30% organic fertilizer (40.76 and 41.74 SPAD, respectively), while the lowest leaf total chlorophyll contents was obtained by untreated plants (control) (30.57 and 33.90 SPAD, respectively) in the both seasons 2016 and 2017.

Table 4: Averages of number of days to flowering and rhizomes fresh weight (g) of the *Cyperus alternifolius*, L as affected by the organic, bio fertilizer and their interaction throughout of the two seasons 2016 and 2017.

Number of days to flowering										
Organic fertilizer (A)	First season					Second season				
	Bio-fertilizers (B)				Mean	Bio-fertilizers (B)				Mean
	B ₀	B ₁	B ₂	B ₃		B ₀	B ₁	B ₂	B ₃	
0%	124.88	137.88	143.88	144.88	137.88	126.88	129.11	130.22	139.11	131.33
10%	154.22	163.33	167.33	168.77	163.41	131.88	136.66	144.22	145.11	139.47
20%	166.21	168.55	169.33	170.44	168.63	160.77	149.00	159.22	163.44	158.11
30%	166.99	170.88	174.21	176.32	172.10	150.55	156.11	160.88	171.11	159.66
Mean	153.08	160.16	163.69	165.10		142.52	142.72	148.63	154.69	
LSD0.05	A = 8.44 B = 5.27 A*B = 10.55					A = 11.87 B = 6.75 A*B = 13.51				

Rhizomes fresh weight (g)										
Organic fertilizer (A)	First season					Second season				
	Bio-fertilizers (B)				Mean	Bio-fertilizers (B)				Mean
	B ₀	B ₁	B ₂	B ₃		B ₀	B ₁	B ₂	B ₃	
0%	121.00	140.44	137.12	144.53	135.77	117.14	136.50	139.64	145.50	134.70
10%	145.27	145.88	150.06	155.52	149.18	140.50	148.25	156.94	167.52	153.30
20%	146.54	152.38	171.06	176.83	161.70	146.09	154.60	170.05	171.58	160.58
30%	135.08	163.21	173.61	189.27	165.29	139.36	165.95	178.14	193.13	169.14
Mean	136.97	150.48	157.96	166.54		135.77	151.32	161.19	169.43	
LSD0.05	A = 11.03 B = 8.393 A*B = 16.786					A = 6.34 B = 6.01 A*B = 12.01				

L.S.D. _{0.05} = least significant differences at 0.05 of probability.

Table 5: Averages of Total chlorophylls contents (SPAD units) in the leaves and total carbohydrates contents in rhizomes (mg/ g D.W.) of the *Cyperus alternifolius*, L as affected by the organic, bio fertilizer and their interaction throughout of the two seasons 2016 and 2017.

Total chlorophylls contents (SPAD units) in the leaves										
Organic fertilizer (A)	First season					Second season				
	Bio-fertilizers (B)				Mean	Bio-fertilizers (B)				Mean
	B ₀	B ₁	B ₂	B ₃		B ₀	B ₁	B ₂	B ₃	
0%	29.82	29.96	30.85	31.64	30.57	30.33	34.45	35.70	35.14	33.90
10%	32.44	34.42	34.40	36.41	34.41	37.07	36.85	37.53	39.63	37.77
20%	36.33	37.22	38.53	39.48	37.89	36.05	39.15	40.94	40.12	39.06
30%	39.92	39.93	40.57	42.64	40.76	40.90	39.52	43.34	43.22	41.74
Mean	34.63	35.38	36.09	37.54		36.09	37.49	39.38	39.53	
LSD0.05	A = 3.31 B = 3.91 A*B = N.S					A = 3.97 B = 3.11 A*B = N.S				

Total carbohydrates contents in rhizomes (mg/ g D.W.)										
Organic fertilizer (A)	First season					Second season				
	Bio-fertilizers (B)				Mean	Bio-fertilizers (B)				Mean
	B ₀	B ₁	B ₂	B ₃		B ₀	B ₁	B ₂	B ₃	
0%	28.98	31.28	29.99	31.89	30.53	29.13	30.69	30.89	32.83	30.88
10%	32.09	33.53	32.95	35.99	33.64	31.89	33.95	34.15	36.19	34.04
20%	35.89	37.45	36.65	38.99	37.24	33.65	35.81	36.93	38.45	36.21
30%	35.91	39.30	37.24	39.79	38.06	35.12	37.18	38.14	40.20	37.66
Mean	33.21	35.39	34.20	36.66		32.44	34.40	35.02	36.91	
LSD0.05	A = 0.03 B = 0.027 A*B = 0.05					A = 0.45 B = 0.57 A*B = N.S				

L.S.D. _{0.05} = least significant differences at 0.05 of probability.

N.S = Non- significant differences at 0.05 of probability.

For bio-fertilizers levels, any of bio-fertilizers application led to significant increases in the total leaf chlorophyll contents as comparing to control treatment (B₀). The increase in the total leaf chlorophyll contents was obtained by using application of (5 g Nitrobine +5 g Phosphorein / pot) (37.54 and 39.53 SPAD, respectively), while the lowest total leaf chlorophyll contents was produced by untreated (control) (34.63 and 36.09 SPAD, respectively), in the both seasons.

The interactions between the using different organic fertilizers levels and bio-fertilizers levels, there were not significant differences in the leaf total chlorophyll content, in the both seasons.

The significant increase in total chlorophylls content may be due to the effect of mixture of biofertilizers and organic, which acted mainly in increasing the availability of nitrogen, consequently increasing its absorption by plant. It is well known that nitrogen is present in chlorophyll molecule. (Ridvan, 2009). Additionally, such increase in photosynthetic pigments formation could be attributed to the role of bio-fertilizers in producing certain phyto hormones consequent from microbiological activity Which delaying the aging of leaves by reducing the degradation of chlorophyll and enhancing the protein and RNA synthesis (Castelfranco and Beale, 1983).

These results were in agreement with Hussien (2004) on Iris plants, Sherif and El-Naggar (2005) on Calla lily plants, Atowa (2012) on *Freesia refracta*, Qasim, *et al.* (2014) on gladiolus cultivar, and Suseela, *et al.* (2016) on tuberose.

Total carbohydrates contents in rhizomes (mg/ g D.W.):

Data presented in Table (5), showed that there was significant effect of levels organic fertilizer on carbohydrate contents compared with control treatment. The highest contents was obtained by application organic fertilizer level 30% (38.06 and 37.66 mg/ g D.W, respectively), while the lowest contents was obtained by untreated (control) (30.53 and 30.88 mg/ g D.W, respectively) in the both seasons.

Moreover, bio-fertilizers treatments had a significant effect on carbohydrate contents of *Cyperus alternifolius*, L. plants compared with control treatment and the best result was recorded by B₃ (5 g Nitrobine +5 g Phosphorein / pot) (36.66 and 36.91 mg/ g D.W, respectively), in the both seasons.

Concerning to the interaction between the using different organic fertilizers levels and bio-fertilizers levels, there were significant effect on carbohydrate contents of *Cyperus alternifolius*, L. plants in the first season, but there were not significant in the second season. The highest percentage was obtained by application organic fertilizer level 30% with (5 g Nitrobine +5 g Phosphorein / pot) (39.79 mg/ g

D.W), while the lowest percentage was obtained by 0% organic fertilizer (control) with untreated (control) of bio-fertilizers (28.98 mg/ g D.W), in the first season.

These results might be attributed to both the activation of enzymes of carbohydrate formation or regulation of the consumption of sugars and contents of water and carbon dioxide absorption which could be led to increase the capacity of *Cyperus alternifolius*, L. plant in building metabolites, consequently the contents of total carbohydrates in the produced rhizomes could be increased. (Ridvan, 2009).

These results were in agreement with Hussien (2004) on Iris plants, EL-Naggar *et al.* (2004) on *Cyperus papyrus*, L., Atowa (2012) on *Freesia refracta* cv. Red Lion, Kuo (2015) on Bermuda grass, and Suseela, *et al.* (2016) on tuberose cv. Suvasini.

CONCLUSION

The obtained results from this study revealed that addition of 30% / pot V/V from organic fertilizer with using bio-fertilizers level (5 g Nitrobine +5 g Phosphorein / pot) to growing media were produced a considerable increase in both vegetative growth and flowering as well as rhizomes productivity, total chlorophylls contents in leaves and total carbohydrates in rhizome on Umbrella Papyrus (*Cyperus alternifolius*, L.) plants.

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