ISSN 1110-0419

Annals Of Agric. Sc., Moshtohor.
Vol. 42(2): 699 -710, (2004).

EFFECT OF IRRIGATION INTERVALS, FERTILIZATION LEVELS AND THEIR INTERACTION ON TARO (*Colocasia esculenta* L.) II- YIELD AND ITS COMPONENTS

BY

Abo-Sedera, F.A. *; Amer, S.S.A. **; Badr, L.A.A. * and El-Zohery, S.S.M. **

* Faculty of Agric., Moshtohor Zagazig Univ. Tukh Kalubia, ARE.

** Vegetable Res. Dept., Hort. Res. Inst. Agric. Res. Center

ABSTRACT

Two field experiments were conducted at the Experimental Farm of Faculty of Agriculture, Moshtohor, Zagazig University during the two successive summer seasons of 1997 and 1998 to study the effect of irrigation intervals, fertilization levels and their interactions on yield and its components. The irrigation intervals were (½, 1, 1 ½ and 2) weeks and fertilization levels were zero (NPK), (30 N + 16 P_2O_5 + 48 K_2O) , (60 N + 32 P_2O_5 + 72 K_2O) , (90 N + 48 P_2O_5 + 96 K_2O) and (120 N + 64 P_2O_5 + 120 K_2O) Kg/Fed. Obtained results show that irrigation every half week intervals and/ or fertilization with (120 N + 64 P_2O_5 + 120 K_2O) Kg/Fed each alone or the combination between them significantly affected yield and its components expressed as number and fresh weight of cormels, fresh weight of main corm, height and diameter of main corm, total yield per plant as well as total yield per feddan. In addition, water use efficiency was improved by applying the highest quantity of water connected with the highest used level of NPK.

INTRODUCTION

Taro (*Colocasia esculenta* L.) is belong to the family Araceae. It is considered as one of the most important vegetable crops grown in Egypt due to its high nutritional value. It's corms are rich in starch, proteins, minerals and vitamins, in comparison with potatoes and sweet potatoes (Moursi, 1955). Each 100 (g) fresh weight of corms and cormels contain about 63-85% moisture, 13-29% carbohydrates, 1.4-3% protein, 28 mg calcium and 61 mg phosphorus. It is known that taro plants require ample of moisture and excess amounts of fertilizers due to its long duration in the soil from planting to harvesting. In addition, the irrigation water available in Egypt is the main limiting factor for the extension of agriculture. Therefore, many investigators reported that the yield and its components of different tuber crops were greatly affected with water supply. In this respect, Shoch *et al.* (1992) and Karafy- llidis *et al.* (1996) on potato they reported that water stress decreased number and size of tubers.

Regarding the effect of irrigation on height and diameter of main corm, Khalak and Kumaraswamy (1992) on potatoes revealed that irrigation treatments had no significant effects on tuber diameter.

In addition, Ezumah (1973), Carrilo-Urrutia (1979) and Ravi and Chowdhury (1991) all working on taro plant, they indicated that the tuber yield increased with increasing irrigation regime. Similar results were obtained by Nagy *et al.* (1993), Frank et al. (1994), Abker and Mehta (1995), Glady siak and Borowezak (1996), and Rojek and Chmura (1996) on potato yield.

With regard to the effect of NPK fertilizers on yield and its components, Hossain and Rashid (1982) and Bhuyan and Quasem (1983) reported that the number of cormels were significantly affected by highest rate of N applications. Similar results were obtained by Cremaschi (1982) on tuber of potato.

Regarding the effect of NPK fertilizers on corm characters, Ahita *et al* (1981) on cassava, found that higher rates of NPK application resulted in a significant increase in diameter, length and weight of root. Also, Kasele (1984) found that root weight and diameter were increased when N was combined with K. Similar results were obtained by Bioumy (1991). Moreover, Abd El-Hamed (1993) on taro found that corm diameter and length were significantly increased with highest used K level.

Concerning the effect of NPK on total yield of corms and cormeles, Das and Sethumadhavan (1980) on Cocoyam and Portieles *et al* (1982) on taro they found that the highest yield was obtained by the highest rate of NPK application. Similar results was obtained by Ramaswamy *et al* (1982) on taro. In addition, Barroso et al (1986) on corm yield of Cocoyam found that the highest yield was obtained by application the highest rate of N and K_2O. Also, Abd El-Hamed (1993), and Verma *et al* (1996) on taro they found that the total yield of cormes was significantly increased with increasing the rate of K or N, respectively.

Concerning the water use efficiency (m^3/Kg) many investigators reported that water use efficiency was greatest for plants grown at 80% of field capacity Carrilo-Urrutia (1979) on taro. However, Steyn *et al* (1992) on potato found that water use efficiency was highest with frequent irrigation (50% depletion regime). In this regard, Franke *et al* (1994) on potato, suggested that water use efficiency increased significantly at highest soil moisture content and was highest when the rate of evapotranspirtion was below maximum potential. Khalak and Kumaraswamy (1996) stated that water use efficiency was highest with 20 mm irrigation water. Meanwhile, Costa *et al* (1997) on potato found that water use efficiency was roughtly constant with continous drought stress.

Therefore, this trial was conducted to study the effect of irrigation intervals, Fertilization levels and their interaction on yield and its components.

MATERIALS AND METHODS

This investingation was carried out at the Experimental Farm of Faculty of Agriculture, Moshtohor, Zagazig University during the two successive summer seasons of 1997 and 1998 to study the effect of water regime, levels of NPK fertilization and their interaction on total yield and its components. The soil of the experimental field was clay loam in texture with PH 7.7.

A split plot design with four replicates was adopted. Each experiment included 20 treatments which were the combination of four irrigation treatments within five fertilization levels. The irrigation treatments were arranged in the main plots while the fertilization levels were distributed randomly in the sub plots. Each experimental plot included four ridges 3.5 m in length and 80 cm in width with an area about 11.2 m^2, where three ridges were planted and the fourth one was left without planting as a guard ridge between plots to prevent fertilizers and water movements from any plot to other one. Cormels (seed pieces) were planted in Feb. 11th and 12th in 1997 and 1998, respectively. Cormels were cultivated in the bottom of the ridge at the distance of 30 cm in between and 7-10 cm deep in the soil. All the plots were equally irrigated. After two months from planting, the water regime began for the different irrigation treatments as indicated in Table (1). Soil samples were randomly taken regularly before each irrigation time from 20 plots for every irrigation treatment to determinate the soil moisture at irrigation as % of field capacity. Surface irrigation was used through weir to regulate the rate of water flow and to calculate the quantity of water applied for each plot by using the following equation mentioned by Khurmi (1990).

$$Q = \sqrt{\frac{Ca_1 a_2}{a_1^2 - a_2^2}} + \sqrt{2gh}$$

where :

Q = Quantity of water flowing through the venturiflume
C = Coefficient of discharge = 0.7
$\mathbf{a_1}$ = area of flow in channel = $b_1 h_1$
$\mathbf{a_2}$ = area of flow in throat = $b_2 h_2$
$\mathbf{b_1}$ = width of channal
$\mathbf{b_2}$ = width of throat
$\mathbf{h_1}$ = depth of water in throat
$\mathbf{h_2}$ = different of depths of water
$\mathbf{h} = h_1 - h_2$
g = acceleration equal to 9-8/m/Sec.

The mechanical and chemical analysis of soil were determined according to the method described by Jackson (1965) (Table 2).

Data in Table (3) illustrated average monthly temperature, relative humidity (%) and quantity of rainfall at Kalubia Governorate in the region surrounding the experimental site through the two seasons of study.

Table (1): Water regime for the different irrigation treatments during seasons of 1997 and 1998.

Treatments	Irrigation interval (weeks)	Number of Irrigations/season	Quantity of water (m^3/fed.)		Mean
			1997	1998	
1	½	64	16908.09	17455.04	17181.56
2	1	28	9838.51	11159.79	10499.15
3	1 ½	19	8783.84	8562.82	8673.33
4	2	13	6926.53	7289.96	7108.24

Table (2): Mechanical and chemical analysis of soil.

Mechanical analysis (%) :							
Coarse sand	Fine sand	Silt	Clay	Organic matter	Texture	F.C.	
7.43	15.77	34.88	40.42	1.50	Clay loam	43.54	
Chemical analysis as meq/100gm. Soil :							
Co3	Hco3	Cl	So4	Ca	Mg	Na	Available
							N P K
0.00	1.99	1.42	0.67	1.28	0.70	1.70	82.51 20 0.31

F.C. = field capacity

Experimental treatments :

(I) Irrigation intervals treatments:

(1) half week (2) one week

(3) one and half week (4) two weeks

(II) Fertilization levels treatments:

(1) Zero N + Zero P_2O_5 + Zero K_2O referred as level (1)

(2) 30 N + 16 P_2O_5 + 48 K_2O (Kg/Fed) referred as level (2)

(3) 60 N + 32 P_2O_5 + 72 K_2O (Kg/Fed) referred as level (3)

(4) 90 N + 48 P_2O_5 + 96 K_2O (Kg/Fed) referred as level (4)

(5) 120 N + 64 P_2O_5 + 120 K_2O (Kg/Fed) referred as level (5)

Ammonium sulphate (20.5 % N), calcium super phosphate (16% P_2O_5) and potassium sulphate (48 – 52% K_2O) fertilizers were used as sources of N,P and K, respectively. The first portion was added two months after planting, while the second and third portions of fertilizers were added three and four months after planting, respectively. All agricultural practices were carried out as commonly followed in the district.

Data recorded:

(I) Yield and its components :

At harvesting time (280 days after planting) all corms of each experimental plot harvested after removal of plant foliage above ground surface, then corms were cleaned from the soil and the following data were recorded.

(1) Number of cormels/plant.

(2) Corm length (cm) (it was measured by calipers).

(3) Corm diameter (cm) (it was measured by calipers).

Table (3): Average monthly temperature, relative humidity (%), and quantity of rainfall at Kalubia Governorate in the region surrounding the experimental site through the two seasons of the experimental work.

Seasons	1997					1998				
	Temperature (C°)			Relative humidity %	Quantity of rainfall (m m)	Temperature (C°)			Relative humidity %	Quantity of rainfall (m m)
Month	Min.	Max.	Mean			Min.	Max.	Mean		
February	5.10	18.00	11.00	62.86	0.00	8.3	20.20	14.25	64.23	0.00
March	7.20	19.70	13.43	62.00	0.00	7.96	21.40	14.68	58.91	0.40
April	10.00	23.20	16.56	61.00	0.00	13.40	29.70	21.50	57.00	0.00
May	15.00	31.40	23.26	54.50	0.00	17.40	32.46	24.93	55.33	0.27
June	20.00	33.70	26.79	59.00	0.00	19.53	34.53	27.03	57.66	0.00
July	20.12	33.61	26.86	62.00	0.00	20.73	35.36	28.04	58.66	0.00
August	18.90	32.40	25.60	65.00	0.00	20.58	35.56	28.06	57.62	0.00
September	18.10	31.40	25.60	62.00	0.00	20.43	35.76	28.09	56.58	0.00
October	16.90	29.70	24.06	62.00	0.00	18.46	32.03	25.24	57.16	0.00

(4) Weight of main corm (g) as an average of weight and number of main corms/plot
(5) Weight of corms/plant as an average of weight and number of cormels/plot.
(6) Total plant yield (g) as a result of the weight of main corm and cormels/plant..
(7) Total yield (Ton/Fed). It was calculated from the yield and area/plot.

(II) Water use efficiency :

It was calculated according to the following equation :

$$\text{Efficiency of water utilization} = \frac{\text{Consumptive use (m}^3\text{/Fed)}}{\text{Total yield (Kg/Fed)}}$$

All data were subjected to statistical analysis according to Gomez and Gomez (1983).

RESULTS AND DISCUSSION

I- Yield and its components :

1- Effect of irrigation intervals :

Data presented in Tables (4, 5) indicated that the total produced yield/fed. and its components as number and fresh weight of cormels, fresh weight of main corm and total yield per plant as well as length and diameter for main corm were significantly increased as a result of increasing water supplied for plant either through increasing number of irrigation's frequencies or decreasing the irrigation intervals from 2 to ½ week. Obtained results are true during both seasons of study. These results are in agreement with those reported by Ezumah (1973) and Ravi and Chowdhwy (1991) on taro. In addition, Nagy *et al* (1993), Franke *et al* (1994), Abker and Mehta (1995), Gladysiak and Borowczak (1996), Karafyllidis *et al* (1996) and Rojek and Chmura (1996) on potato, who found that water stress decreased yield and size of tubers. From the aforementioned results, it could be concluded that irrigation is the major and determintal factor for taro production. Since, vegetative growth, photosynthic pigments and plant chemical constituents were increased with increasing irrigation frequencies EL-Zohery (1999).

2- Effect of fertilization levels :

Obtained data in Tables (4, 5) illustrated that the total yield per fed and its components i.e, number and weight of cormels per plant, length, diameter and fresh weight of main corm as well as yield per plant and total yield per feddan were significantly affected as a result of different used levels of fertilization. In this respect, the highest used levels, i.e, 120 Kg N + 64 Kg P_2O_5 + 120 Kg K_2O/Fed reflected the highest values of all characters of yield and its components. In this regard, Das and Sethumadhavan (1980), Portieles *et al* (1990), Abd EL-Hamed (1993) and Verma *et al* (1996) on taro they repoted that appling nitrogen, phosphorus and potassium either in a single form or as a compound fertilizers increased the total produced yield. Obtained results may be attributed to the main role of such macro elements on vegetative growth and consequently such enhancing effect was reflected on the productivity of plant (EL-Zohery, 1999).

Table (4): Effect of irrigation intervals, NPK fertilization levels and their interaction on yield and its components during season of 1997.

1997 Season									
Treatments		Cormels/plant		Main corm			Total yield		Water use efficiency (m^3/Kg)
Irrigation interval (days)	NPK Fertilizer levels	Number	Weight (g)	Length (cm)	Diameter (cm)	Fresh weight	Plant (gm)	Ton/Fed.	
½		3.06	184.84	9.19	12.43	386.97	571.81	9.630	1.87
1		1.60	32.98	7.38	9.25	250.26	283.24	4.720	3.75
1 ½		1.44	14.44	4.97	5.74	57.18	71.62	1.193	14.88
2		1.25	10.69	4.79	4.29	38.49	49.18	0.819	21.64
L.S.D. at 0.05 level		**0.12**	**8.22**	**0.35**	**0.47**	**8.02**	**11.17**	**0.23**	
	1	1.37	34.49	5.45	6.48	114.04	148.53	2.475	15.40
	2	1.63	50.15	6.33	7.48	187.32	237.47	4.082	10.77
	3	1.91	69.26	6.60	8.17	199.40	268.66	4.477	9.36
	4	2.08	72.46	7.14	8.65	201.79	274.25	4.522	8.76
	5	2.18	77.32	7.39	8.85	213.57	290.89	4.847	8.39
L.S.D. at 0.05 level		**0.13**	**7.16**	**0.37**	**0.46**	**9.82**	**14.13**	**0.22**	-
	1	2.43	97.64	7.25	11.17	235.37	333.01	5.550	3.04
	2	2.75	151.27	9.11	12.62	401.95	553.22	9.720	1.73
½	3	3.25	217.52	9.18	12.70	427.50	645.02	10.750	1.57
	4	3.37	223.95	10.20	12.81	431.87	655.82	10.930	1.54
	5	3.50	233.82	10.21	12.83	433.20	672.02	11.200	1.50
	1	1.07	27.62	6.18	6.27	135.76	181.38	3.023	5.59
	2	1.68	30.50	6.81	7.50	256.91	287.41	4.790	3.52
1	3	1.71	32.87	7.25	9.67	265.34	298.21	4.970	3.40
	4	1.72	33.21	8.15	11.28	268.00	301.21	5.020	3.36
	5	1.79	40.70	8.52	11.52	307.31	348.01	5.800	2.91
	1	1.00	7.50	4.37	5.37	40.25	47.75	0.795	21.26
	2	1.10	11.37	4.80	5.56	50.65	62.02	1.032	16.38
1 ½	3	1.58	16.68	5.05	5.70	63.60	80.28	1.337	12.64
	4	1.75	18.07	5.19	5.81	65.60	83.67	1.394	12.12
	5	1.81	18.62	5.47	6.26	65.80	84.42	1.406	12.02
	1	1.0	5.21	4.00	3.12	26.80	32.01	0.533	31.72
	2	1.0	7.47	4.62	4.22	39.80	47.27	0.787	21.48
2	3	1.12	10.00	4.95	4.60	41.17	51.17	0.825	19.84
	4	1.50	14.62	5.02	4.70	41.70	56.32	0.938	18.02
	5	1.62	16.15	5.38	4.80	43.00	59.15	0.985	17.16
L.S.D. at 0.05 level		**0.26**	**10.13**	**0.75**	**0.92**	**19.64**	**28.27**	**0.44**	

Table (5): Effect of irrigation intervals, NPK fertilization levels and their interaction on yield and its components during season of 1998.

1998 Season									
Treatments		Cormels/plant		Main corm			Total yield		Water use efficiency (m^3/Kg)
Irrigation interval (days)	NPK Fertilizer levels	Number	Weight (g)	Length (cm)	Diameter (cm)	Fresh weight	Plant (gm)	Ton/Fed.	
½		3.09	206.27	6.98	8.50	423.19	629.46	10.490	1.73
1		2.08	43.90	6.62	7.57	270.34	314.24	5.091	3.55
1 ½		1.89	17.81	5.54	5.25	59.42	77.23	1.287	14.39
2		1.39	12.33	5.30	4.81	41.30	53.63	0.894	20.42
L.S.D. at 0.05 level		**6.13**	**2.71**	**0.38**	**0.61**	**16.64**	**16.20**	**0.58**	
	1	1.74	41.11	5.23	5.69	137.51	178.62	2.977	14.36
	2	1.96	65.42	5.91	6.26	193.26	258.68	4.311	10.59
	3	2.17	72.54	6.10	6.52	203.61	276.15	4.602	9.20
	4	2.30	78.37	6.53	6.74	213.29	291.66	4.861	8.29
	5	2.38	81.98	6.78	7.45	245.16	327.14	5.452	7.68
L.S.D. at 0.05 level		**0.53**	**2.68**	**0.32**	**0.42**	**23.99**	**23.75**	**0.43**	
	1	2.46	118.00	5.99	7.66	305.13	423.13	7.052	2.47
	2	2.87	207.24	6.66	8.05	401.66	608.96	10.148	1.72
½	3	3.12	225.03	6.99	8.62	428.33	653.36	10.889	1.60
	4	3.43	238.34	7.54	8.69	435.00	673.34	11.222	1.55
	5	3.59	242.78	7.70	9.48	545.83	788.61	13.143	1.32
	1	1.84	30.25	5.75	6.97	175.31	205.56	3.426	5.09
	2	1.93	32.0	6.56	7.36	278.87	310.87	5.181	3.36
1	3	2.05	33.23	6.68	7.48	279.02	312.25	5.204	3.35
	4	2.24	36.50	6.87	7.63	305.45	341.95	5.699	3.06
	5	2.33	43.63	7.25	8.44	313.08	356.71	5.945	2.93
	1	1.68	9.00	4.93	4.58	40.20	49.20	0.820	21.28
	2	1.81	14.50	5.44	5.12	51.68	66.18	1.103	15.82
1 ½	3	1.96	20.51	5.50	5.13	65.29	85.80	1.430	12.20
	4	1.97	22.25	5.87	5.40	66.73	88.98	1.483	11.77
	5	2.02	22.83	6.00	6.40	73.23	96.06	1.601	10.90
	1	1.00	7.20	4.27	3.56	29.40	36.60	0.610	28.61
	2	1.25	7.95	5.00	4.50	40.83	48.78	0.813	21.46
2	3	1.54	11.40	5.25	4.87	41.82	53.22	0.887	19.67
	4	1.54	16.42	5.83	5.25	45.98	62.40	1.040	16.78
	5	1.61	18.70	6.16	5.87	48.50	67.20	1.120	15.58
L.S.D. at 0.05 level		**1.20**	**5.37**	**N.S**	**N.S**	**47.98**	**47.50**	**0.87**	

3- Effect of interaction between irrigation intervals and fertilization levels :

Obtained results from Tables (4,5) cleared that total yield and its components significantly increased with increasing both the amounts of water used and the applied dosage of N,P and K fertilizers. In this regard, the highest yield and its components were obtained in case of irrigation every ½ week by intervals and application of the highest used levels of NPK fertilizers during both seasons of this study. Obtained results were coincided with Abd EL-Rahman (1990) on carrot.

II- Water use efficiency :

1- Effect of irrigation intervals :

It is cleared from data in Tables (4, 5) that the utilized water was increased with either increasing the number of irrigations frequency or shortening the irrigation period up to ½ week by intervals during both seasons of study. It is evident that the highest quantity of water (1870 and 1740 m^3) necessary for producing one ton of corms were used in case of application of 64 irrigation throughout the two growing seasons respectively. Carrilo-Urrutia (1979) on taro, Steyn *et al* (1992) and Franke *et al* (1994) on potato, they found thud water use efficiency was greatest at 80% field capacity or with frequent irrigation (50% depletion regime) as well as at highest moisture content respectively.

2- Effect of fertilization levels :

Data in Tables (4, 5) show clearly that the amount of water required to produce one Kg of corms was decreased with increasing the used level of NPK fertilizers during both seasons of study. The highest used level (120 N + 64 P_2O_5 + 120 K_2O) Kg/Fed resulted in using the lowest quantity of water (4340 – 2940 m^3) needed for production of one ton corms. This means that under such conditions of fertilization, water supply showed the highest efficiency of water utilization.

3- Effect of the interaction between irrigation intervals and fertilization levels:

Data in Tables (4, 5) revealed that the highest quantity of water supplied to the plant, with the highest used level of NPK improved the efficiency of water utilization. It is obvious that water is considered the main facter for taro production under such condition.

REFERENCES

Abd-El-Hamed, Z.A. (1993): Studies on some factors affecting yield and quality of dasheen, M. Sc. Thesis, Faculty of Agric. Ain Shams, Univ. (Cairo. A.R.E).

Abd-El-Rahman, L.A. (1990): Effect of some agricultural practices on yield and quality of carrot. M. Sc. Thesis, Faculty of Agric, Moshtohor, Zagazig Univ. (Benha Branch) (Zagazig – ARE).

Abker, N. and Mehta, A.N. (1995): The effect of shifting dates and irrigation levels on tuber size and yield of potato cv. Kufri Badshah under middle agroclimatic zon of Gujarta, J. of the Indian potato Associafion, 22 (112): 17-22 (C.F. Field Crop Abstr., 49 (5): 3347, 1996).

Ahita, O.P.; Apit, S.E. and Pasas, M.B. (1981): Growth and development of cassava under the traditional and Mukibat system of planting in the phillippenes. Annal, of Tropical Research, 3 (3): 187-198 (C.F. data base of Agricola Internet).

Barroso, R.; Guerra, A.; Mendoza, L. and Valdes, C. (1986): Response of cocoyan (*Colocasia esculenta* L.) cv Rosada Habana to mineral fertilizer in a brown carbonate soil. I. Nitrogen levels, Ciencia, Y. Tecnica, en, la, Agricen. Suelos, Y, Agroquimica, 9 (3): 43-49 (C.F Field Crop Abstr 42 (3), 4:112, 1989).

Bhuyan, M.A.J. and Quasem, M.A. (1983): Effect of nitrogen on the yield of mukhi-kachu (*Colocasia esculenta* L) Bangladesh J. of Agri. Res., 8 (1): 65-67, grek. (C.F data base of Agricola-Internet).

Bioumy, E.G. 1991. Effect of some proper cultural practices on growth and productively of cassava crop. M. Sc. Thesis, Fac. of Agric, Suez Canal Univ. (Ismailia, A.R.E).

Carrilo-Urrutia, R.O. (1979): The effect of soil water content on yield of taro (*Colocasia eseulenta*). Var. Islena Japonesa. 1. First year. Cienica Y Tecnica la Agricultura Riego Y Drenaja. 2 (2): 51-65, (C.F. data base of Agricola, Internet).

Cremaschi, D. (1982): Nitrogen fertilizers for four Semiearly maturing potato cultivars. Terraesole 37 (482): 588-592 (C.F. Field Crop Abstr. 8 (7): 961, 1983).

Das, R.N.M. and Sethumadhavan, P. (1980):Effect of NPK on corm yield, tuber yield and total yield of Colocasia (*Colocasia esculenta* L. *Schott* var. Thamarakkanncn): India Tamil Nadu Agricultural Univ. National seminar on tuber Crops production technology, 21-22 November (1980). Undated. 179-181.

EL-Zohery, S.H.M. (1999): Effect of some agricultural treatments on growth and yield of Taro. M. Sc. Thesis Dept. Hort. Fac, agric. Moshtohor, Zagazig Mniv. (Benha Branch). Zagazig. A.R.E. pp 89.

Ezumah, H.C. (1973): The growth and development of taro (*Colocasia esculen.*ta L. *Schott*). In relation to selected cultural management practices. Dissertation Abstr. International, B. 34 (1) 24. (C.F. data base of Agricola Internet.

Franke, A.E.; Martinl, L.C.P.; Konig, O.; Pozzibon, E. and Liberalesso, R.A. (1994): Effect of irrigation on yield and quality of tubers in potato (*Solanum tuberosum* L.) Revisia ceres, 41 (236): 366-378 (C.F. Field Crop Abstr, 49 (3) 1906, 1996).

Gladysiak, S. and Borowczak, F. (1996): Influence of water sprinkler irrigation and nitrogen fertilizer application on the yield of potatoes in long term experiments under Wielkopolaska conditions, Zeszyty problemowe postepow Nauk Rolniezych, 438: 53-60 (C.F. Field Crop Abstr. 51(3): 1870, 1998).

Gomez, K.A. and Gomez, A.A. (1983): Statistical procedures for Agric.Res. And Ed. Johnwiley and Sons, PUB pp: 139-153.

Hossain, M.M. and M.M. Rashid (1982): Effect of different levels of nitrogen on the yield of mukhi Kachu. Bangladesh Hort. (10) (1) 23-26 (C.F Computer Res. Abstr.).

Jakson, M.L. (1965): Soil chemical analysis-advanced course publ by the author, Dept of soils, Univ. of Wisc., Madison 6, Wisconsin, USA.

Karafyllidis, D.I., N. Stavropoulos and D Geargakls (1990): The effect of water stress on the yielding capacity of potato crops and subsequent performance of seed tubers. Potato Res, 39 (2): 153-163. (C.F. Field Crop Abstr., 50 (4): 2546, 1997).

Kasele, I.N. (1984): Effect of shade, nitrogen and potassium on cassava. JDRC: 52. (C.F. Field Crop Abstr., 38 (7): 1985).

Khalak, A. and Kumaraswamy, A.S. (1992): Dry matter accumulation and growth attributes of potato as influenced by irrigation and fertilizer application. J. of the Indian Potato Association 19 (1-2): 40-44. (C.F. Field Crop Abstr., 47 (1): 417,1994).

Khurmi, R.S. (1990): A text book of hydraulics fluid mechanics and hydroulic machines for the students of U.P.S.C. [Engg. Serviees]; B. Sc. Engg.; Section B., of A.M.I.E (1) and Diploma Courses.

Moursi, M.A. (1955): A comparative study on the effect of seed on rate of emergence, estblishment of plants and yield of different dasheen grown in Egypt. Ind. J. Agric. Sci., 25:265-270.

Nagy, Z.; Luca, E. and Turdean, A. (1993): Irrigation rate and water consumption of the potato crop in the clug area Buletinum Univ. destiinte Cluj Napoca. Seria Agric. Sci. Horticultura, 47 (1): 165-174. (C.F. Field Crop Abstr., 48 (5): 3572: 1995).

Portieles., J.M.; Ruiz, I.; Nuez, A.D.L. and Gutierrez, V. (1982): Up-take and utilization coefficient of fertilizer and soil nutrients in taro (*Colocasia esculenta* L.) Crop Ciencia Y. Tecnica en la Agric, Viandas Tropicales. Suplemento, 33-44. (C.F. data base of Agricola-Internet).

Ramaswamy, N.; Muthukrishnan, C.R. and Surush, M. (1982): Studies on the mineral nutrition of colocasia (*Colocasia esculenta* L. Schort.) Madras. Agric. J., 69(2): 135-138. (C.F. data base of Agricola. Internet).

Ravi, V. and Chowdhury, S.R. (1991): Growth and yield responses of taro to different soil moisture regimes. J. of Root Crops, 17:129-133 (C.F. data base of Agricola Internet).

Rojek, S. and Chmura, K. (1996): Sprinkler irrigation and mineral fertilizer application as factors affecting the yield of potatoes. Zeszyty problem owo postepow Nauk Rolniczych, 438: 383-390. (C.F. Field Crop Abstr. 51(3): 1873, 1998).

Shock, C.C.; Zalewski, J.C.; Stlber, T.D. and Burnett, D.S. (1992): Impact of early season water deficits on Russet Burbank plant development, tuber yield and quality, American potato, J., 69(12): 793-803. (C.F. Field Crop Abstr., 46(8): 5199, 1993).

Steyn, J.M.; Plessis, H.F.D. and Nortje, P.F (1992): The effect of different water regimes on cv. up to date potatoes. I. Vegetative development, photosynthetic rate and stomatal diffusive resistance. South African J. of Plant and Soil (3): 113-117 (C.F Field Crop Abstr., 46(2): 1141, 1993).

Verma, R.B.; Singh, P.K. and Singh, S.B. (1996): Effect of nitrogen and potassium levels on growth, yield and nutrient uptake of Colocasia J. of Root crop, 22 (2): 139-143 (C.F. date base of Agricola Internet.).

دراسة تأثير فترات الرى ومستويات التسميد وكذلك التفاعل بينهما على نبات القلقاس
٢- التأثير على المحصول ومكوناته.

فتحي أبو النصر أبوسديره، عامر سليمان سليمان عامر،
لطفي عبد الفتاح عبد الرحمن بدر، سمير شديد محمد الزهيرى
* قسم البساتين ــ كلية الزراعة بمشتهر ــ جامعة الزقازيق/فرع بنها.
** قسم بحوث الخضر ــ معهد بحوث البساتين ــ مركز البحوث الزراعية ــ مصر.

أجريت هذه الدراسة بمزرعة كلية الزراعة بمشتهر – جامعة الزقازيق خلال موسمى الزراعة الصيفيين ١٩٩٧ ، ١٩٩٨ لدراسة تأثيرفترات الرى المختلفة والتسميد بمستويات مختلفة من كل من الأسمدة النتروجينيه والفوسفاته والبوتاسيه وكذلك التفاعل بينهما على المحصول ومكوناته للقلقاس وتشير النتائج إلى الآتـــى:

١- أدت زيادة المياه المضافة بنقص فترات الرى من أسبوعين إلى نصف أسبوع إلى زيادة معنوية فى المحصول ومكوناته ممثلا فى العدد والوزن الطازج للكورمات والوزن الطازج للكورمة الأساسية والمحصول الكلى للنبات وكذلك زيادة طول وقطر الكورمة الأساسية .

٢- أدى التسميد بأعلى مستوى وهو ١٢٠كجم نتروجين + ٦٤كجم فو٢أه + ١٢٠كجم بو٢أ إلى إرتفاع كبير فى كل قيم المحصول ومكوناته وهى عدد ووزن الكورمات للنبات والوزن الطازج للكورمة الأساسية وكذلك قطرها بالإضافة إلى زيادة محصول النبات وأيضا المحصول الكلى للفدان .

أدى التأثير المشترك لكل من زيادة كميات المياه المضافة بتقليل فترات الرى مع أعلى مستوى تسميدى وهو ١٢٠كجم نتروجين + ٦٤كجم فو٢أه + ١٢٠كجم بو٢أ إلى زيادة معنوية فى المحصول ومكوناته التى تم دراستها .وكذلك كفاءة استخدام المياه.