IV- RESULTS AND DISCUSSION

IV-1-Effect of irrigation intervals, fertilization levels and their interaction, on growth characteristics of taro plants :

Data illustrated in Table (4 & 5) and Figs (1 & 2) show the effect of irrigation intervals , fertilization levels and their interaction on morphological characteristics of taro plants at 260 days from planting .

IV- 1-1 Effect of irrigation intervals :

Data in Table (4) and Fig. (1) reveal that, increasing water supply ,i.e. irrigation every ½ week by intervals throughout the growing season increased all the studied vegetative growth parameters of taro plants, expressed as plant height , number of leaves per plant, leaf area, lamina and petiole fresh weight, and fresh weight of corms as well as fresh weight of whole plant during both seasons of study. In this respect, the highest increments in the aforementioned growth parameters were obtained as a result of the highest used quantity of water supply (16908 and 17455 m^3) in both seasons, respectively.

Regarding the effect of irrigation on dry matter content, the same data show that the dry matter content of plant was increased with increasing soil moisture content ,i.e. irrigation at short intervals (½ week) during the growing period. Such imbroving effect of irrigation on vegetative growth may be due to the main role of water in increasing the cell size of plant, accelerating the physiological process of plant and also increasing the available nutrients in root zoon which led to increasing the uptake of macronutrients by plant

Table (4): Effect of irrigation intervals and NPK fertilization levels on vegetative growth characters of taro plants .

Treatments		Plant height (cm)	No. of leaves/ plant	L. A. /Plant (cm^2)	Fresh weight (g)			Dry matter %				D. M. Content/plant(g)
Irrigation interval (weeks)	NPK Fertilizer levels				Lamina	Petiole	Total plant	Lamina	Petiole	Corm	Whole plant	
1997 Season												
1/2		112.82	9.49	5572.48	227.74	650.32	1449.06	13.23	5.12	15.24	11.19	124.51
1		83.05	4.17	3636.81	134.70	169.85	587.82	13.82	6.95	15.73	12.16	70.30
11/2		59.94	3.55	893.26	33.83	16.05	121.53	14.83	7.18	15.87	12.62	15.47
2		46.36	1.96	242.71	8.68	10.50	68.40	17.97	7.56	17.10	14.21	9.06
L. S. D. at 0.05 level		1.22	0.32	272.87	9.31	4.83	9.26	0.51	0.24	0.09	0.14	1.30
	1	68.71	2.98	1904.72	74.20	175.08	1397.83	12.32	5.21	14.35	10.62	32.97
	2	74.24	4.42	2328.99	88.64	204.24	530.38	14.10	6.82	14.84	11.91	50.67
	3	77.18	5.32	2801.58	109.60	223.67	602.05	15.30	7.18	16.48	12.98	61.25
	4	78.17	5.46	2904.76	115.83	226.27	615.32	16.68	7.40	17.22	13.76	64.28
	5	79.41	5.78	2991.53	117.92	229.13	637.94	16.41	6.89	17.04	13.44	65.0
L. S. D. at 0.05 level		1.0	0.28	299.75	7.90	3.67	11.69	0.52	0.24	0.15	0.19	1.33
1998 Season												
1/2		159.09	7.78	8922.48	197.37	1137.37	1962.98	18.19	6.05	16.33	13.52	175.28
1		111.18	6.55	4810.64	110.78	489.15	905.39	18.80	7.29	17.71	14.58	105.45
11/2		60.28	5.07	1233.10	26.45	85.09	190.13	19.80	7.63	17.91	15.11	22.79
2		53.55	3.53	504.09	11.47	33.73	98.86	20.07	7.71	18.17	15.11	12.48
L. S. D. at 0.05 level		3.14	0.38	215.34	4.42	21.92	25.01	0.58	0.48	2.02	0.74	5.40
	1	85.80	3.36	3161.82	71.82	384.26	631.17	15.07	6.23	16.24	12.51	52.66
	2	92.80	4.45	3646.20	82.16	411.81	752.65	17.66	6.66	17.48	13.92	70.80
	3	97.38	5.58	3862.18	87.11	449.91	813.18	18.79	7.60	17.90	14.74	82.91
	4	100.76	7.20	4228.54	93.20	457.04	843.62	22.13	7.81	18.18	15.78	90.93
	5	103.37	7.57	4439.18	98.30	478.65	906.08	22.42	7.55	17.86	15.94	97.72
L. S. D. at 0.05 level		3.73	0.50	231.54	4.99	19.44	31.15	0.69	0.40	0.53	0.60	5.54

L. A. = leaf area D. M. dry matter

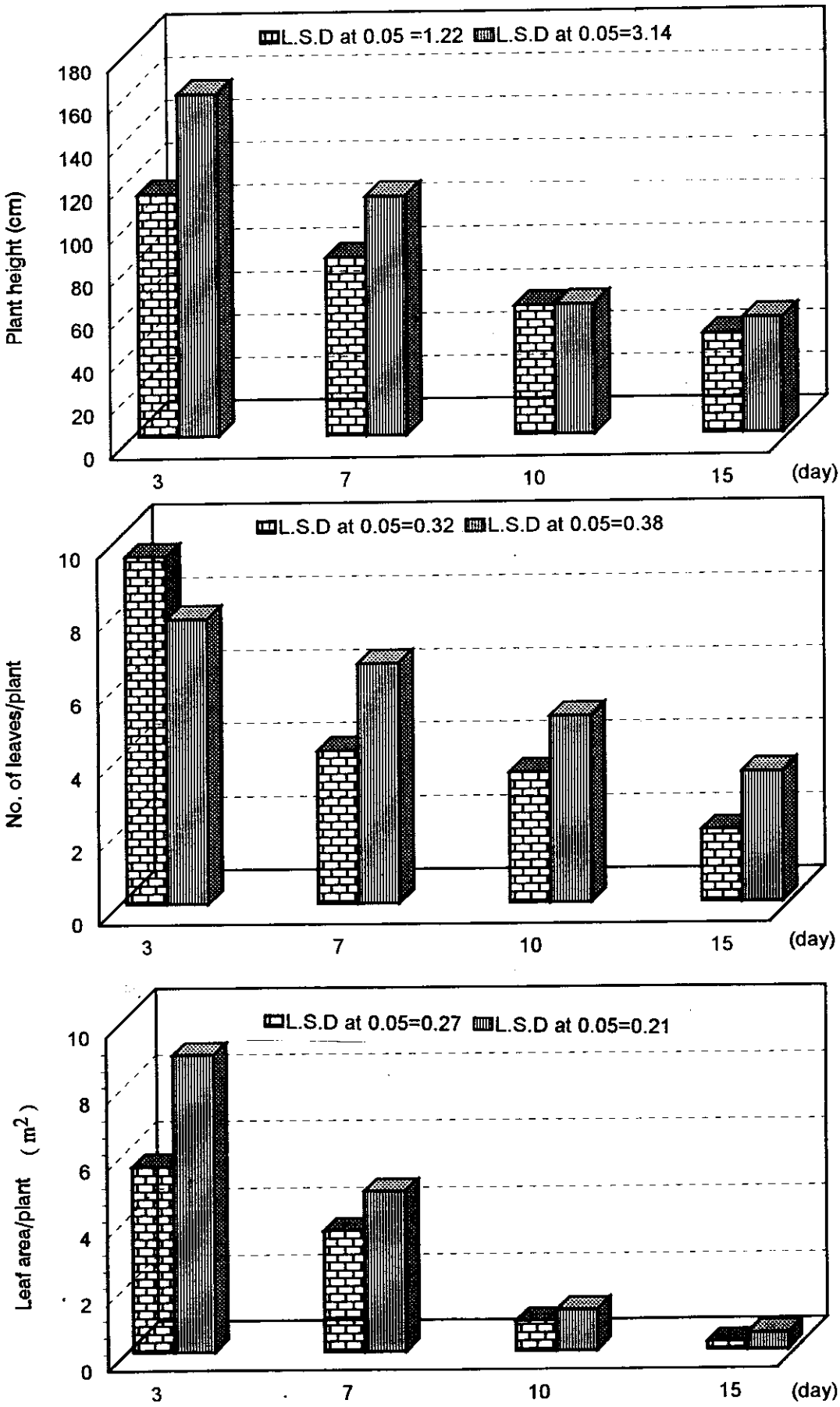


Fig. (1) : Effect of irrigation intervals on vegetative growth characters of taro plants during 1997 (▭) and 1998 (▥) seasons.

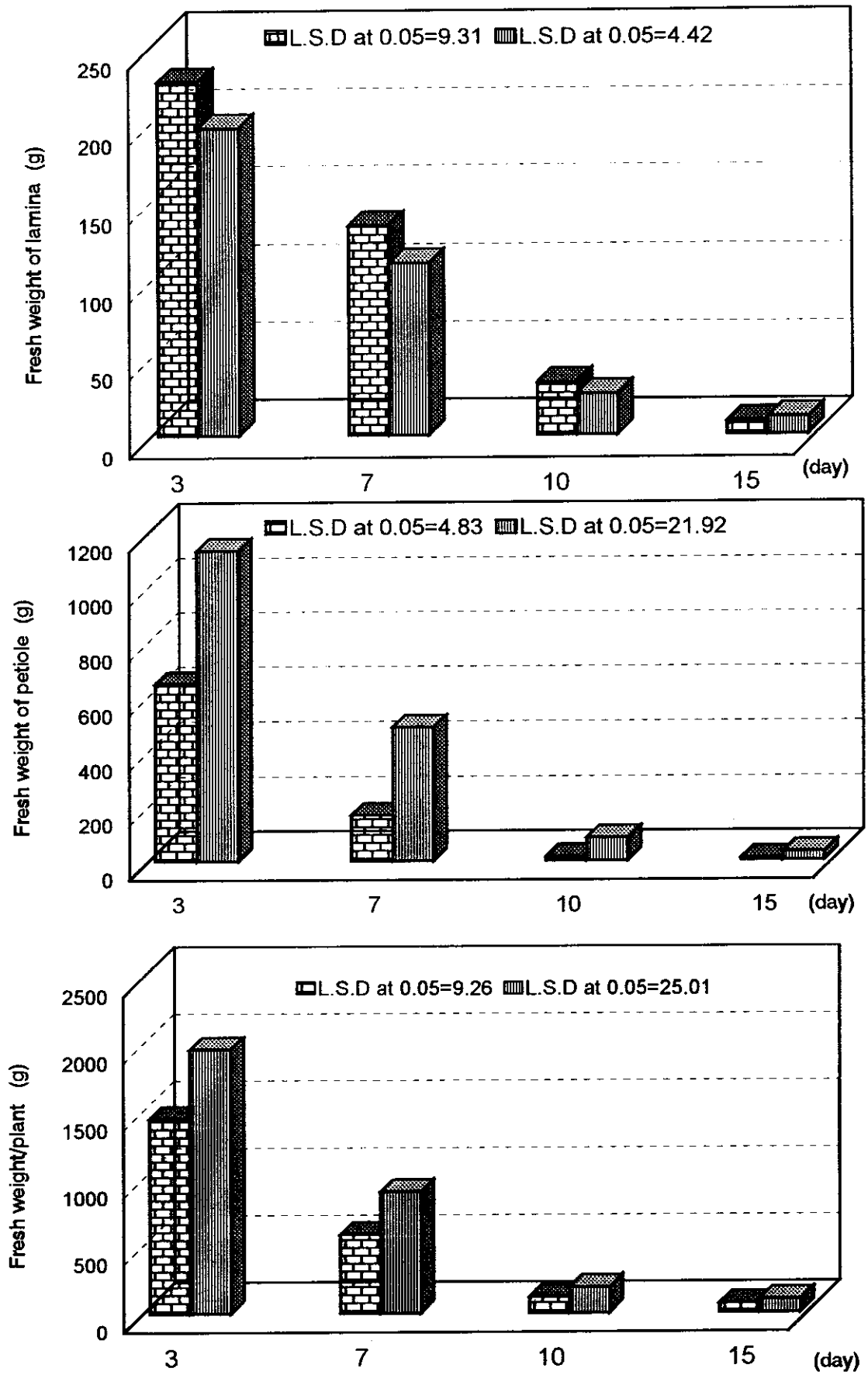

L.S.D at 0.05=9.31
L.S.D at 0.05=4.42
Fresh weight of lamina (g)
250
200
150
100
50
0
3
7
10
15
(day)
L.S.D at 0.05=4.83
L.S.D at 0.05=21.92
Fresh weight of petiole (g)
1200
1000
800
600
400
200
0
3
7
10
15
(day)
L.S.D at 0.05=9.26
L.S.D at 0.05=25.01
Fresh weight/plant (g)
2500
2000
1500
1000
500
0
3
7
10
15
(day)

Fig.(1 Cont.).

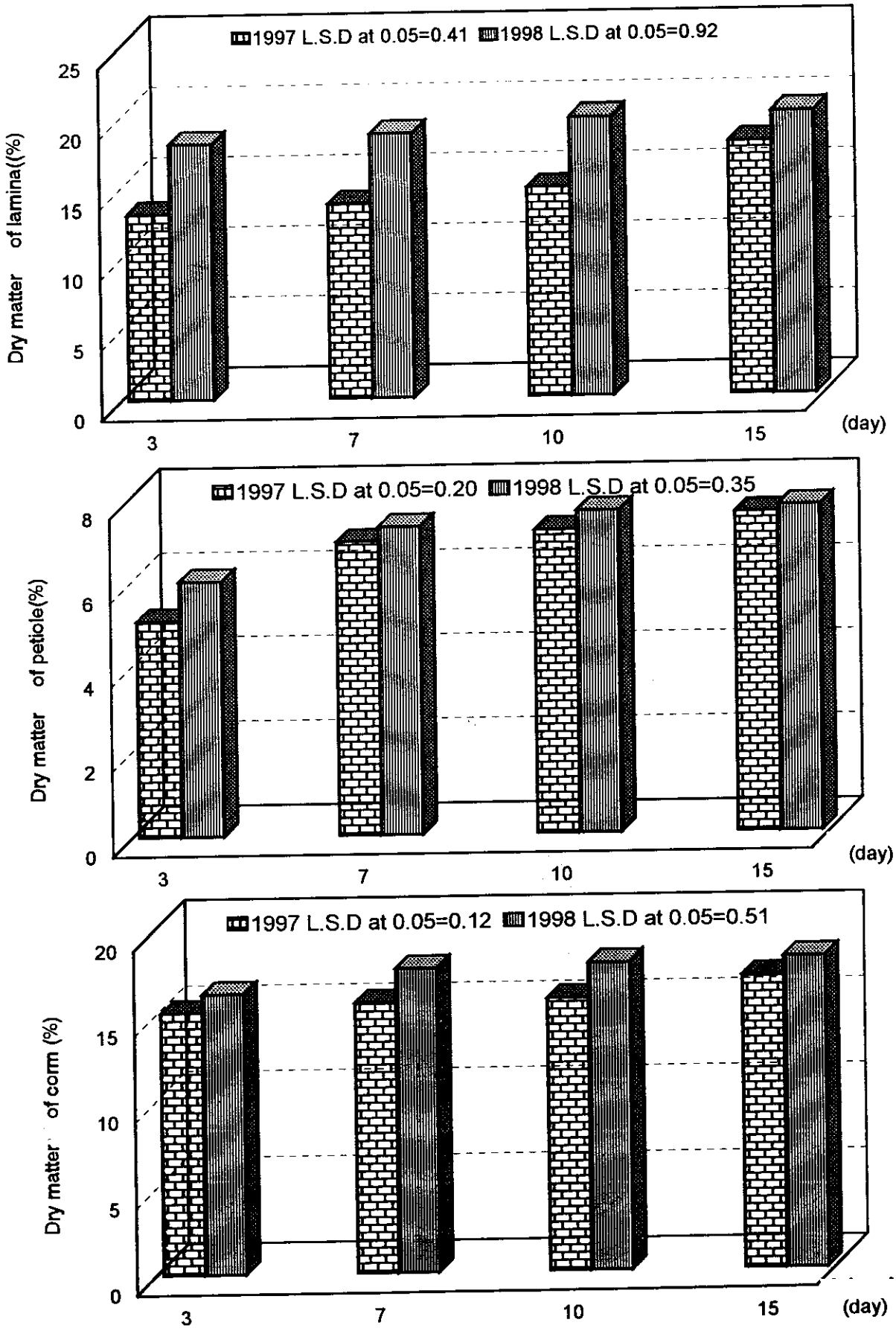
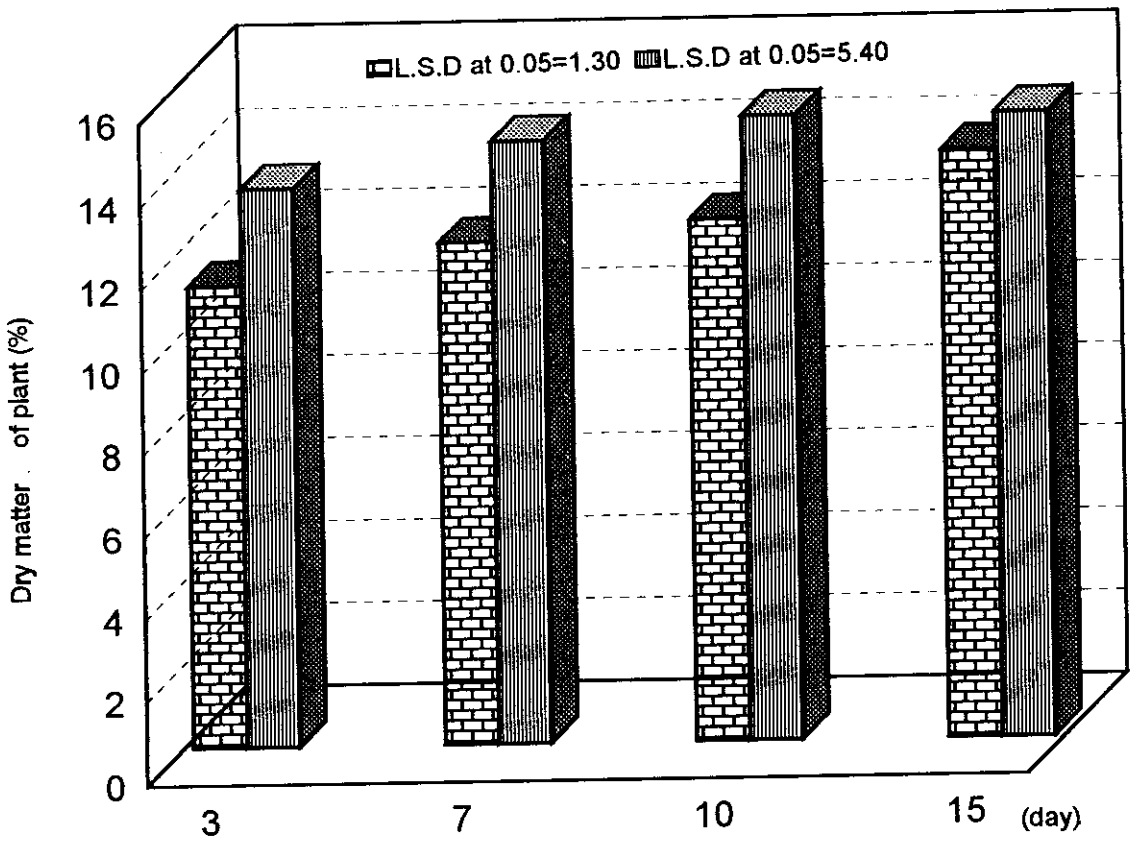

1997 L.S.D at 0.05=0.41
1998 L.S.D at 0.05=0.92
Dry matter of lamina((%)
25
20
15
10
5
0
3
7
10
15
(day)
1997 L.S.D at 0.05=0.20
1998 L.S.D at 0.05=0.35
Dry matter of petiole(%)
8
6
4
2
0
3
7
10
15
(day)
1997 L.S.D at 0.05=0.12
1998 L.S.D at 0.05=0.51
Dry matter of corm (%)
20
15
10
5
0
3
7
10
15
(day)

Fig.1 (Cont.) .


L.S.D at 0.05=1.30
L.S.D at 0.05=5.40
Dry matter of plant (%)
16
14
12
10
8
6
4
2
0
3
7
10
15
(day)

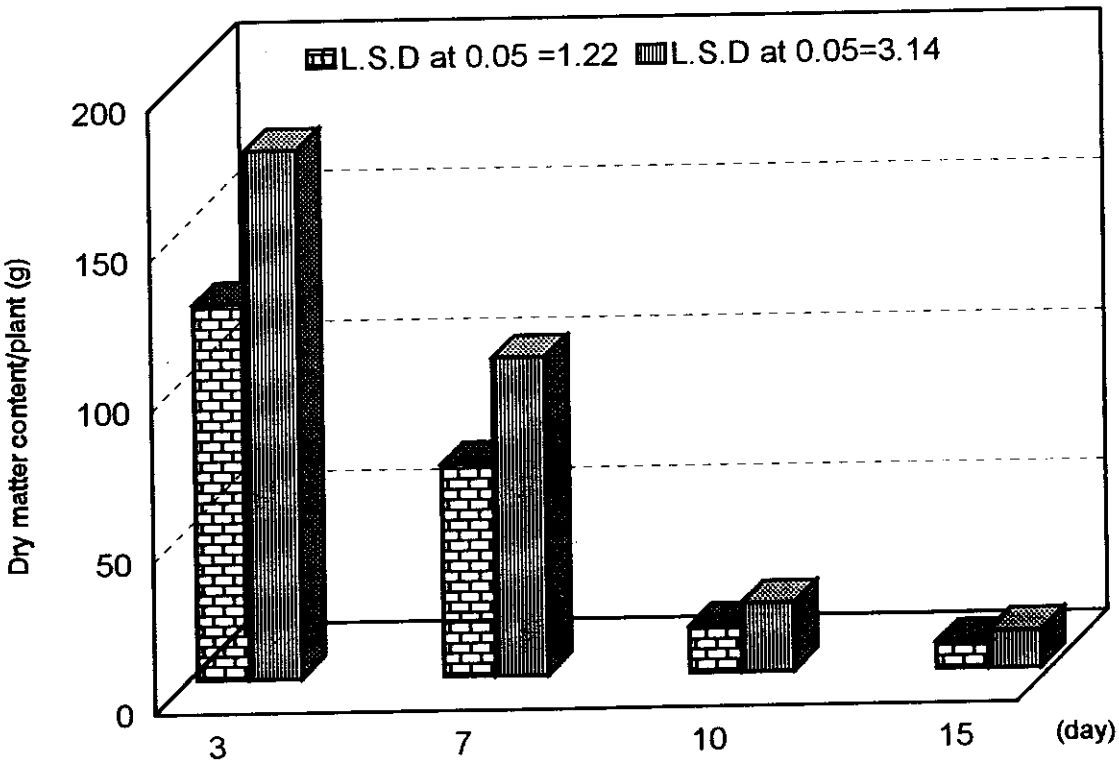

L.S.D at 0.05 =1.22
L.S.D at 0.05=3.14
Dry matter content/plant (g)
200
150
100
50
0
3
7
10
15
(day)

Fig. (1 Cont.) .

Table (8 & 9) that increased the growth rate. On the other hand, the dry matter percentage of different plant parts (leaf and corms) was significantly decreased with increasing the amounts of water applied or decreasing the irrigation intervals up to ½ week by in both seasons of study . Obtained results are in agreement with those obtained by **Abou-Hadid (1978)** , and **Carrilo** and **Urrutia (1979)** and **Ravi** and **Chowdhury (1991)** on taro who reported that increasing soil water content increased plant height, number of leaves and total leaves area /plant . In addition, **Khalak** and **Kumaraswamy (1992), Shock *et al.* (1992) , Steyn *et al.* (1992) , Kumar** and **Minhas (1993)** and **Foti *et al.* (1995)** on potato and **El-Mansi *et al.* (1975), El-Beheidi *et al* (1976),** and **Hartman *et al.* (1986)** and **Abd-El-Rahman (1990)** on carrot added that fresh and dry weight of different plant parts were increased as a result of increasing soil moisture content .

Contra results were obtained by **El-Mansi *et al.* (1975)**on carrot and **Carrilo** and **Urrutia (1979)** on taro and **Foti *et al.* (1995)** on potato regarding the dry matter percentage of different plant parts.

IV- 1-2 Effect of fertilization levels :

Data in Table (4) and Fig. (2) show clearly that all the studied growth parameters ,i.e. plant height , number of leaves per plant , leaf area and fresh weight of lamina and petiole as well as fresh weight of hole plant were significantly increased with increasing fertilization levels up to the highest used one (120 kg N + 64 kg P_2O_5 + 120 kg K_2O/fed.). Similar trend was obtained in case of dry matter content for different plant parts ,i.e. lamina, petiole and corms.

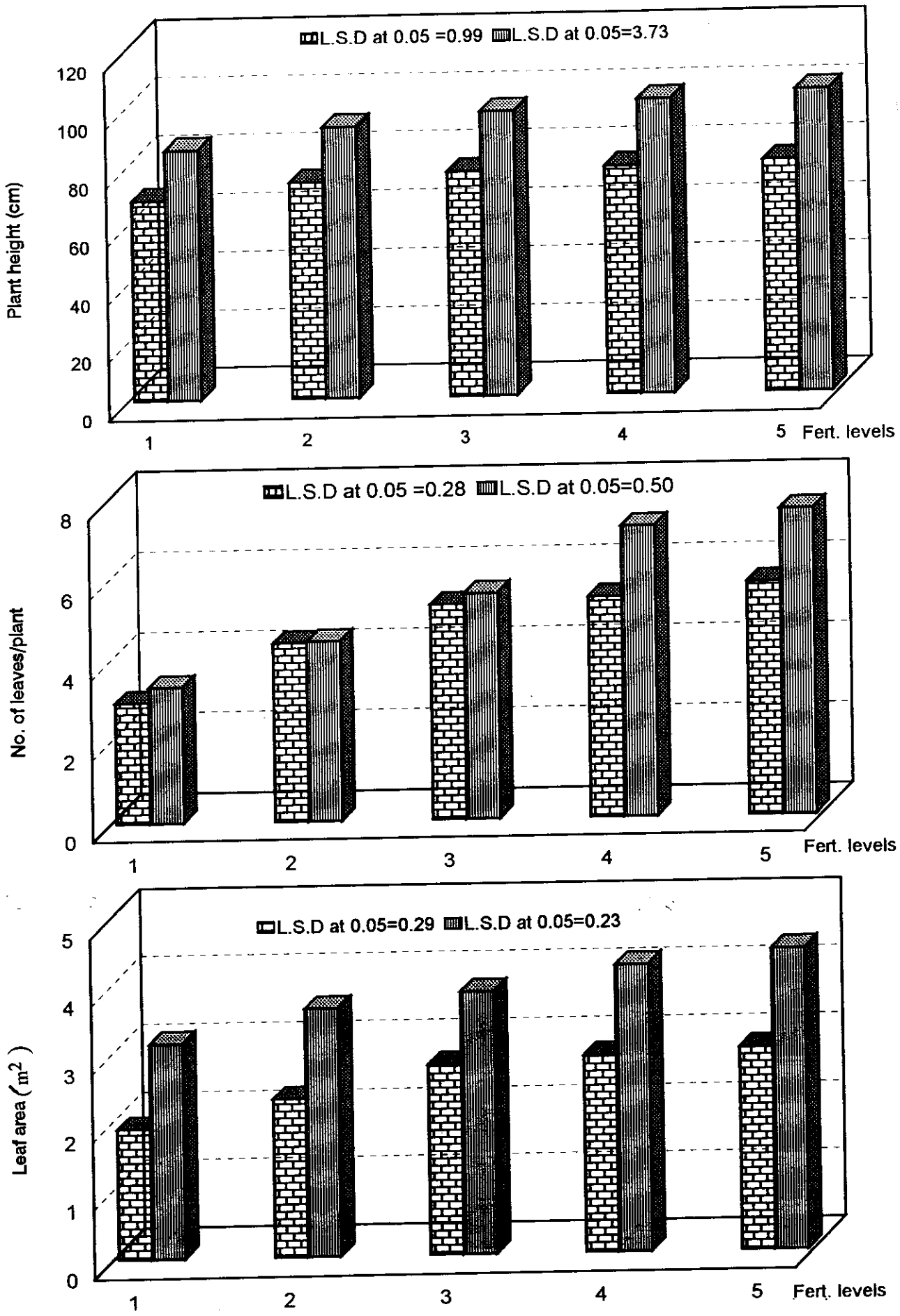


Fig.(2):Effect of NPK fertilization levels on vegetative growth characters of taro plants during 1997 (▭) and 1998 (▭) seasons .

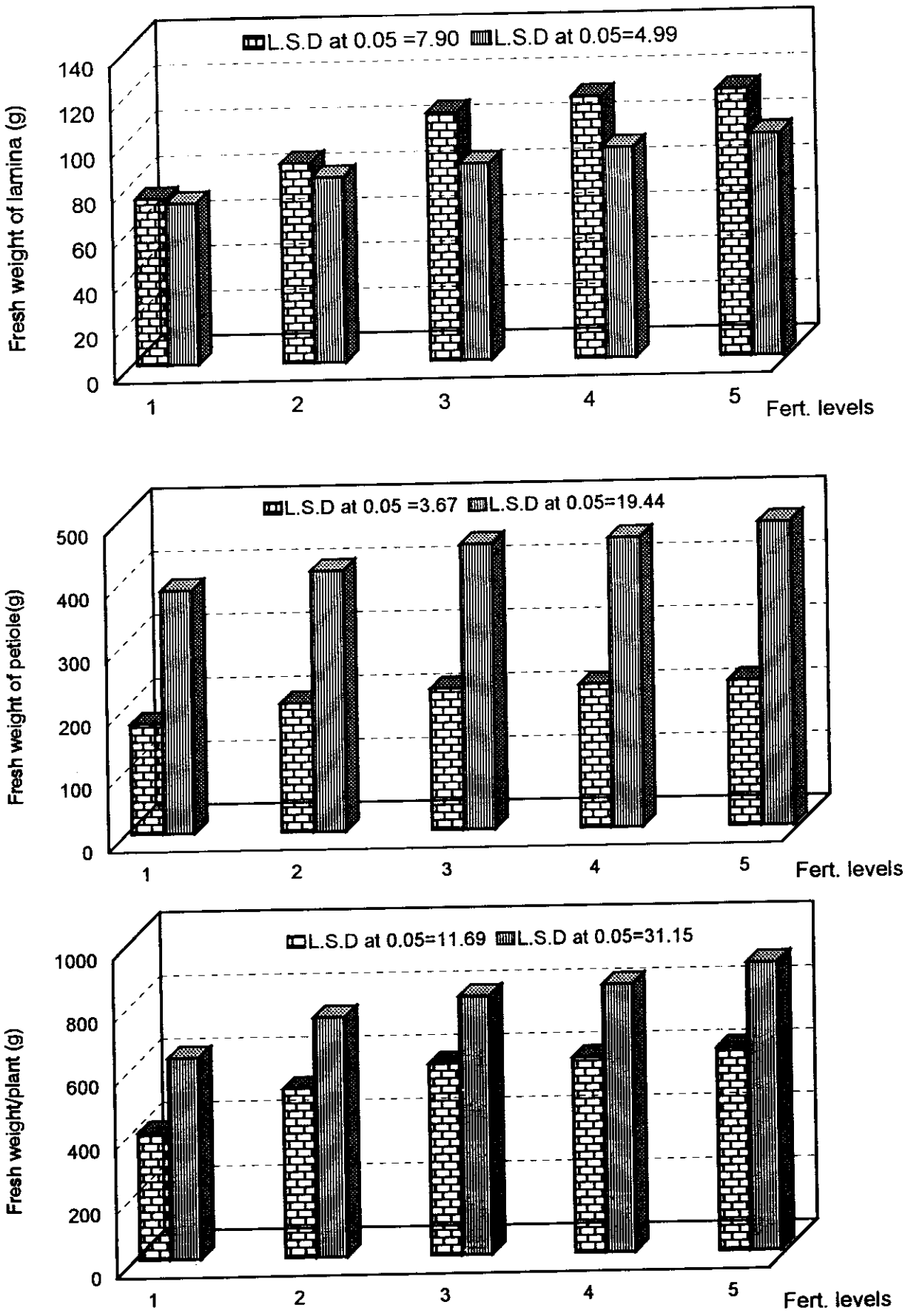
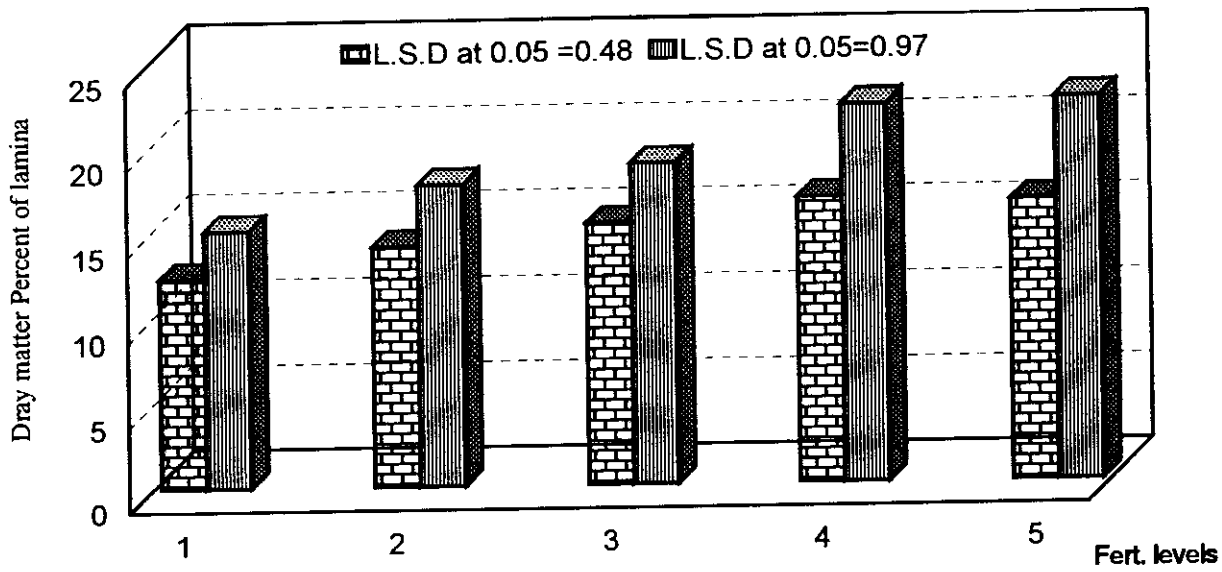
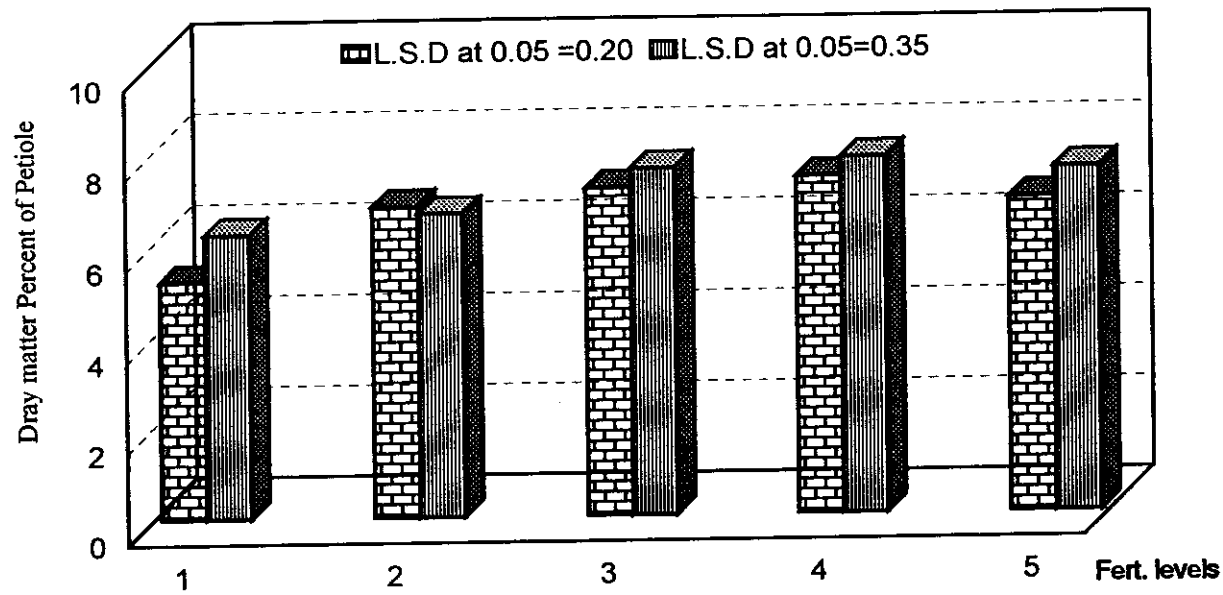

L.S.D at 0.05 =7.90
L.S.D at 0.05=4.99
Fresh weight of lamina (g)
0
20
40
60
80
100
120
140
1
2
3
4
5
Fert. levels
L.S.D at 0.05 =3.67
L.S.D at 0.05=19.44
Fresh weight of petiole(g)
0
100
200
300
400
500
1
2
3
4
5
Fert. levels
L.S.D at 0.05=11.69
L.S.D at 0.05=31.15
Fresh weight/plant (g)
0
200
400
600
800
1000
1
2
3
4
5
Fert. levels

Fig. (2 Cont.) .


L.S.D at 0.05 =0.48
L.S.D at 0.05=0.97
Dray matter Percent of lamina
25
20
15
10
5
0
1
2
3
4
5
Fert. levels


L.S.D at 0.05 =0.20
L.S.D at 0.05=0.35
Dray matter Percent of Petiole
10
8
6
4
2
0
1
2
3
4
5
Fert. levels

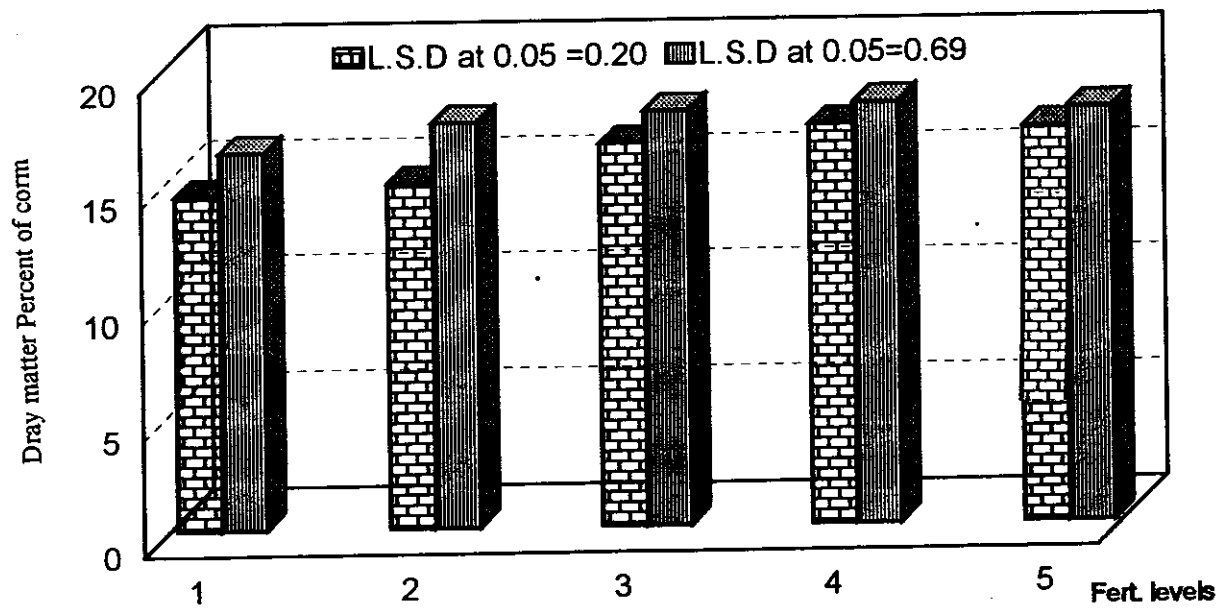
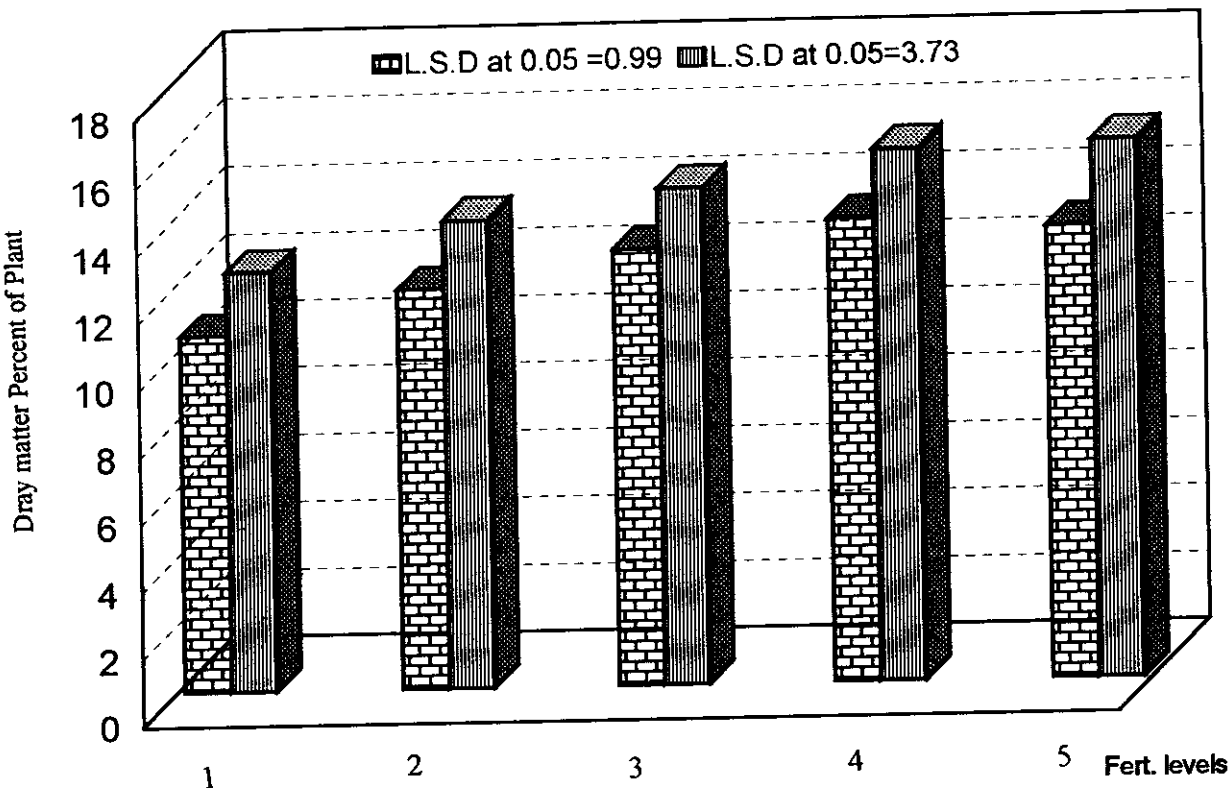

L.S.D at 0.05 =0.20
L.S.D at 0.05=0.69
Dray matter Percent of corm
20
15
10
5
0
1
2
3
4
5
Fert. levels

Fig.(2 Cont.) .


L.S.D at 0.05 =0.99
L.S.D at 0.05=3.73
Dray matter Percent of Plant
18
16
14
12
10
8
6
4
2
0
1
2
3
4
5
Fert. levels

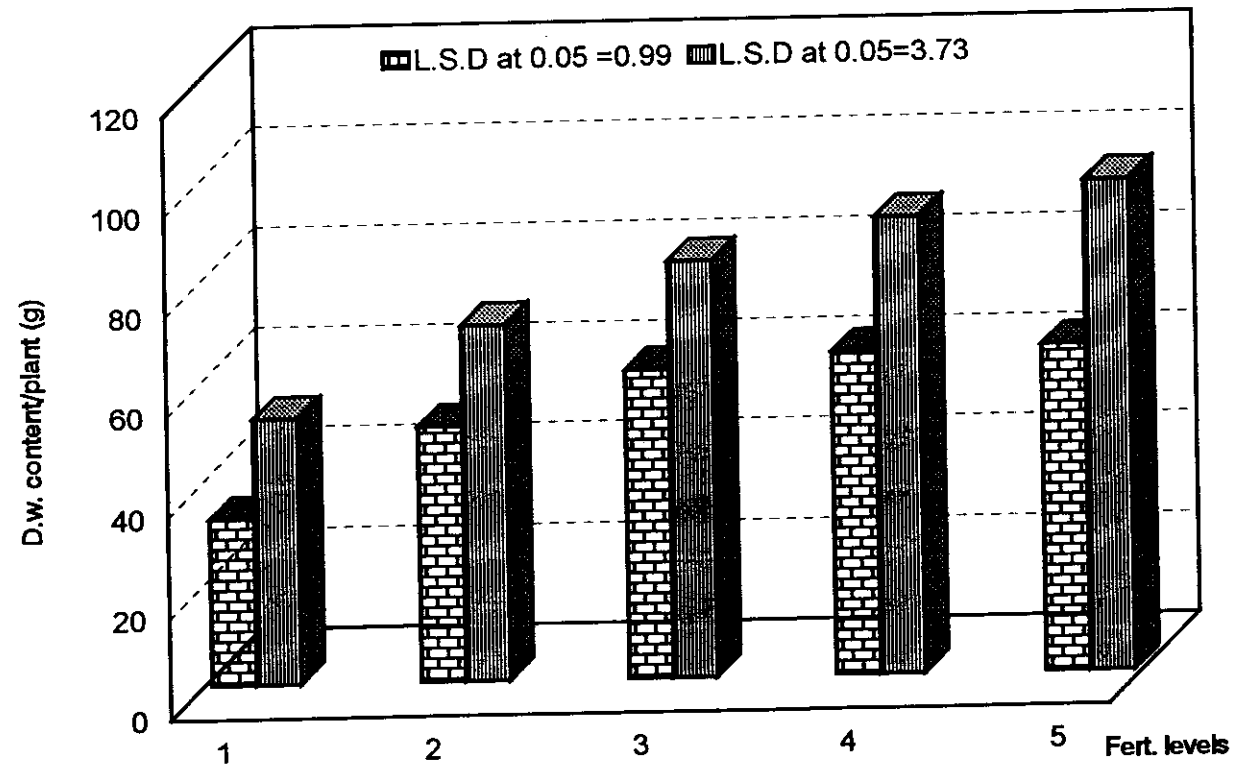

L.S.D at 0.05 =0.99
L.S.D at 0.05=3.73
D.w. content/plant (g)
120
100
80
60
40
20
0
1
2
3
4
5
Fert. levels

Fig. (2 Cont.).

In this respect, the forth used levels of fertilization (90 kg N + 48 kg P_2O_5 + 96 kg K_2O/fed.) resulted in the highest dry matter percentage during both seasons of study. Moreover, increasing the fertilizer levels more than this rare tended to be of decreasing effect in this respect. Obtained results are true during both seasons of study. Obtained results are attributed to the role of such macro-nutrients in increasing the cell division and cell size and concentently increased plant growth. Also, the main role of such nutrients in increasing the photosynthetic pigments Table (6) and Figs. (3 & 4) which increased the photosynthetic assimilation which is necessary for cell formation and division as well as consequently plant growth. Such results are in harmony with those reported by **Makram(1958), Hossain** and **Rashid (1982), Mandal *et al.* (1982), Pardales *et al.* (1982), Bhuyan** and **Quasem (1983), Barroso *et al.* (1986), Mohankamar** and **Sadanadan (1989), Ruiz *et al.* (1989), Abdel-Hamed (1993), Jacobs** and **Clark (1993)** and **Verma *et al.* (1996)** all working on taro, **Santeliz** and **Eweng (1981),** and **Galeev** and **Simonov (1987)** on potato , **Bioumy (1991)** on cassava and **Midan *et al.* (1987)** on sweet potato. They reported that application of N , P and K either in a single or compound form had a positive effect on the growth of different plant parts.

IV-1-3 Effect of interaction between irrigation and fertilization :

Different parameters of vegetative growth, data in Table (5) indicate that all the studied growth aspects were significantly affected as a result of increasing both the amounts of water and

Table (5): Effect of interaction between irrigation intervals and NPK fertilization levels on vegetative growth characters of taro plants .

1997 season												
Treatments		Plant height (cm)	No. of leaves/ plant	L. A. /Plant (cm^2)	Fresh weight (g)			Dry matter %				D. M. Content/plant(g)
Irrigation interval (weeks)	NPK Fertilizer level				Lamina	Petiole	Total plant	Lamina	Petiole	Corm	Whole plant	
½	1	100.35	7.06	4272.57	157.25	548.25	1038.25	11.65	4.45	13.92	10.00	75.52
	2	113.68	9.02	5209.64	203.05	620.12	1376.39	12.63	5.31	14.46	10.80	116.73
	3	115.05	10.20	5996.07	253.33	690.75	1589.22	13.62	5.53	16.20	11.53	142.45
	4	116.89	10.31	6124.45	261.44	696.00	1609.01	14.43	5.56	16.40	12.13	145.79
	5	118.12	10.87	6259.69	263.62	696.50	1632.19	13.81	4.27	15.98	11.51	142.05
1	1	79.10	2.04	2546.17	109.25	134.50	425.13	11.89	5.11	14.33	10.44	41.86
	2	82.62	4.31	3239.18	118.31	174.50	580.22	13.46	7.11	14.61	11.72	66.00
	3	83.93	4.52	3974.08	140.00	175.05	613.46	13.73	7.56	16.31	12.53	75.75
	4	84.20	4.81	4151.51	150.76	177.25	629.22	14.68	7.67	16.77	13.04	80.70
	5	85.41	5.18	4273.12	155.20	188.00	691.09	15.33	7.31	16.77	13.10	87.20
1½	1	51.92	1.84	654.60	24.75	11.50	84.00	12.33	5.22	14.5	10.63	9.47
	2	54.75	2.63	710.43	27.08	14.87	103.97	13.81	7.38	14.64	11.94	12.17
	3	62.63	4.33	967.31	35.01	16.09	131.44	14.80	7.75	16.51	13.01	16.78
	4	64.30	4.37	1025.31	40.41	18.27	142.40	17.00	8.05	16.80	13.95	19.37
	5	66.10	4.58	1108.65	41.90	19.53	145.88	16.25	7.50	16.91	13.55	19.54
2	1	43.50	1.00	145.53	5.55	6.07	43.67	13.43	6.08	14.67	11.39	5.04
	2	45.91	1.72	156.70	6.12	7.50	60.97	16.51	7.48	15.65	13.21	7.79
	3	47.12	2.25	268.88	10.06	12.87	74.11	19.06	7.90	17.68	14.88	10.02
	4	47.27	2.37	317.78	10.73	13.56	80.67	20.62	8.33	18.90	15.95	11.27
	5	48..00	2.50	324.67	10.95	12.50	82.61	20.25	8.00	18.62	15.62	11.21
L. S. D. at 0.05		2.00	0.56	599.50	15.81	7.35	23.39	N.S	0.48	0.31	0.39	4.63

*D.M=dry matter

Table (5 Cont.) .

1998 season													
Treatments		Plant height (cm)	No. of leaves/ plant	L. A. / Plant (cm^2)	Fresh weight (g)			Dry mater %				D. M. Content/plant (g)
Irrigation interval (weeks)	NPK Fertilizer levels				Lamina	Petiole	Total plant	Lamina	Petiole	Corms	whole plant	
½	1	144.52	5.00	7886.32	171.20	1036.62	1616.95	13.46	5.05	15.0	11.17	121.31
	2	156.10	5.68	8215.50	189.30	1117.46	1915.66	16.7	5.32	15.84	12.61	155.51
	3	161.12	7.25	8926.97	194.16	1170.00	2017.52	17.81	6.57	16.75	13.71	183.20
	4	165.40	10.41	9399.50	208.14	1180.37	2061.85	21.54	6.75	16.93	15.07	198.14
	5	168.30	10.59	10184.25	224.15	1182.42	2202.92	21.46	6.55	17.16	15.05	218.25
1	1	101.82	4.91	3426.20	84.80	426.35	716.71	14.17	6.13	16.47	12.25	67.49
	2	104.62	5.19	4741.7	103.33	430.47	844.67	17.75	6.86	17.68	14.09	97.27
	3	112.50	6.45	4843.4	116.64	497.45	926.34	18.62	7.86	18.0	14.76	110.96
	4	117.47	8.08	5516.2	122.50	504.5	968.95	21.8	7.89	18.31	15.99	112.35
	5	119.50	8.14	5525.7	126.63	586.97	1070.31	21.65	7.72	18.12	15.82	129.17
1½	1	51.95	3.50	946.45	22.28	44.44	115.79	16.23	6.86	16.57	13.22	13.36
	2	58.65	4.12	1121.87	25.15	69.32	160.65	18.0	7.06	17.92	14.32	18.67
	3	60.60	5.40	1148.35	25.88	97.63	209.32	19.24	7.94	18.28	15.15	24.65
	4	63.40	5.93	1453.0	29.41	106.49	231.74	22.5	8.29	18.60	16.46	28.58
	5	66.80	6.42	1495.88	29.52	107.58	233.17	23.05	8.00	18.16	16.40	28.71
2	1	44.90	2.06	388.42	9.0	29.65	75.25	16.43	6.88	16.91	13.40	8.47
	2	51.85	2.81	505.75	10.87	30.0	89.65	18.21	7.4	18.48	14.69	11.75
	3	55.30	3.25	530.0	11.75	34.57	99.54	19.48	8.03	18.57	15.36	12.81
	4	56.80	4.37	545.41	12.75	36.81	111.96	22.68	8.33	18.90	15.61	14.65
	5	58.90	5.15	550.87	13.0	37.61	117.93	23.54	7.92	18.02	16.49	14.74
L. S. D. at 0.05		N.S	1.01	463.09	9.99	38.88	62.31	N.S	N.S	N.S	N.S	11.09

N, P and K fertilizers applied during both seasons of study. In this respect the maximum increments in all the studied growth parameters were obtained in case of irrigation every ½ weeks by intervals combined with the highest used levels of NPK fertilizers (120kg N + 64 kg P_2O_5 + 120 kg K_2O /fed.).

On the contrary, increasing the irrigation period up to 2 weeks by intervals without application of fertilization reflected the lowest values of all measured growth aspects. Obtained results are in agreement with those of **Abd-El-Rahman (1990)** on carrot, who reported that, the highest irrigation treatment (2280 m^3/fed) combined with 40 kg N + 32 kg P_2O_5 + 100 kg K_2O /fed. resulted in the highest plant growth rate.

From the above mentioned results and discussion, it could be concluded that under such conditions of this experiment, irrigation every ½ week by intervals during the growing season combined with application of 120kg N + 64 kg P_2O_5 + 120 kg K_2O /fed. resulted in the highest plant growth rate .

IV- 2- Effect of irrigation intervals and fertilization levels and their interaction on chemical composition of taro plant parts:

IV-2- Photosynthetic pigments :

Data presented in Tables (6& 7) and Figs. (3 & 4) show the effect of irrigation intervals and different fertilization levels as well as their interaction on photosynthetic pigments content of taro leaves.

IV-2-1-1 Effect of irrigation intervals :

In this connection, it is obvious from data in Table (6) and Fig. (3) that increasing the irrigation intervals from ½ up to 2 weeks led to a significant decrease in chlorophyll a , b and total chlorophyll as well as the carotenoids content of plant leaves. These results are true during both seasons of study. In this respect, the maximum values of assayed photosynthetic pigments were connected with the highest used amounts of water ,i.e. irrigation every ½ week by intervals. Obtained results may be attributed to the increase of macro-nutrients uptake which are considered the major constituents of photosynthetic pigments .

Contra results were obtained by **El-Mansi *et al.* (1975), El-Beheidi *et al.* (1976)** and **Abd-El-Rahman (1990)** on carrot, who stated that increasing quantity of supplied water up to the highest used levels(2280 m^3/fed.) reflected a depressive effect on all determined photosynthetic pigments, i.e. chlorophyll a , b and carotenoides .

IV-2-1-2 Effect of fertilization levels :

Data in Table (6) and Fig. (4) indicate that increasing the fertilization levels up to the highest used one (120 kg N + 64 kg P_2O_5 + 120 kg K_2O /fed.) increased gradually chlorophyll a , b and total chlorophyll as well as carotenoides content of plant leaves during both seasons of growth. Such results were expected due to the main role of such macro-nutrients in constitution of Photosynthetic ingredients. Obtained results are in agreement with those found by **Afifi *et al.*(1989)**on cow pea and **Abd-El-Rahman (1990)** on carrot.

Table (6) :Effect of irrigation interval and NPK fertilization levels on photosynthetic pigments of taro plants (mg/100gm fresh weight.

Treatments		Chlorophyll			Carotenoides
Irrigation interval (weeks)	NPK Fertilizer levels	a	b	Total (a + b)	
1997 season					
½		208.90	118.40	227.30	200.15
1		146.85	83.90	230.75	168.25
1½		98.75	65.95	164.70	112.35
2		56.65	47.50	104.15	104.95
L. S. D. at 0.05 level		4.39	2.31	4.59	4.47
	1	92.43	51.87	144.31	111.62
	2	111.93	65.12	177.06	131.50
	3	132.87	79.87	212.75	153.06
	4	147.50	97.81	245.31	165.25
	5	154.18	100.0	254.18	170.68
L. S. D. at 0.05 level		6.14	2.85	6.49	3.52
1998 season					
½		227.40	129.15	356.55	197.55
1		161.75	86.90	248.65	175.95
1½		107.40	70.85	178.25	154.40
2		70.45	57.20	127.65	144.10
L. S. D. at 0.05 level		7.44	2.66	7.20	4.72
	1	102.68	62.75	165.12	137.87
	2	126.12	73.93	200.06	161.81
	3	148.56	89.81	238.37	167.62
	4	163.81	100.87	264.68	183.50
	5	167.56	103.06	270.62	189.18
L. S. D. at 0.05 level		6.40	3.14	7.61	5.07

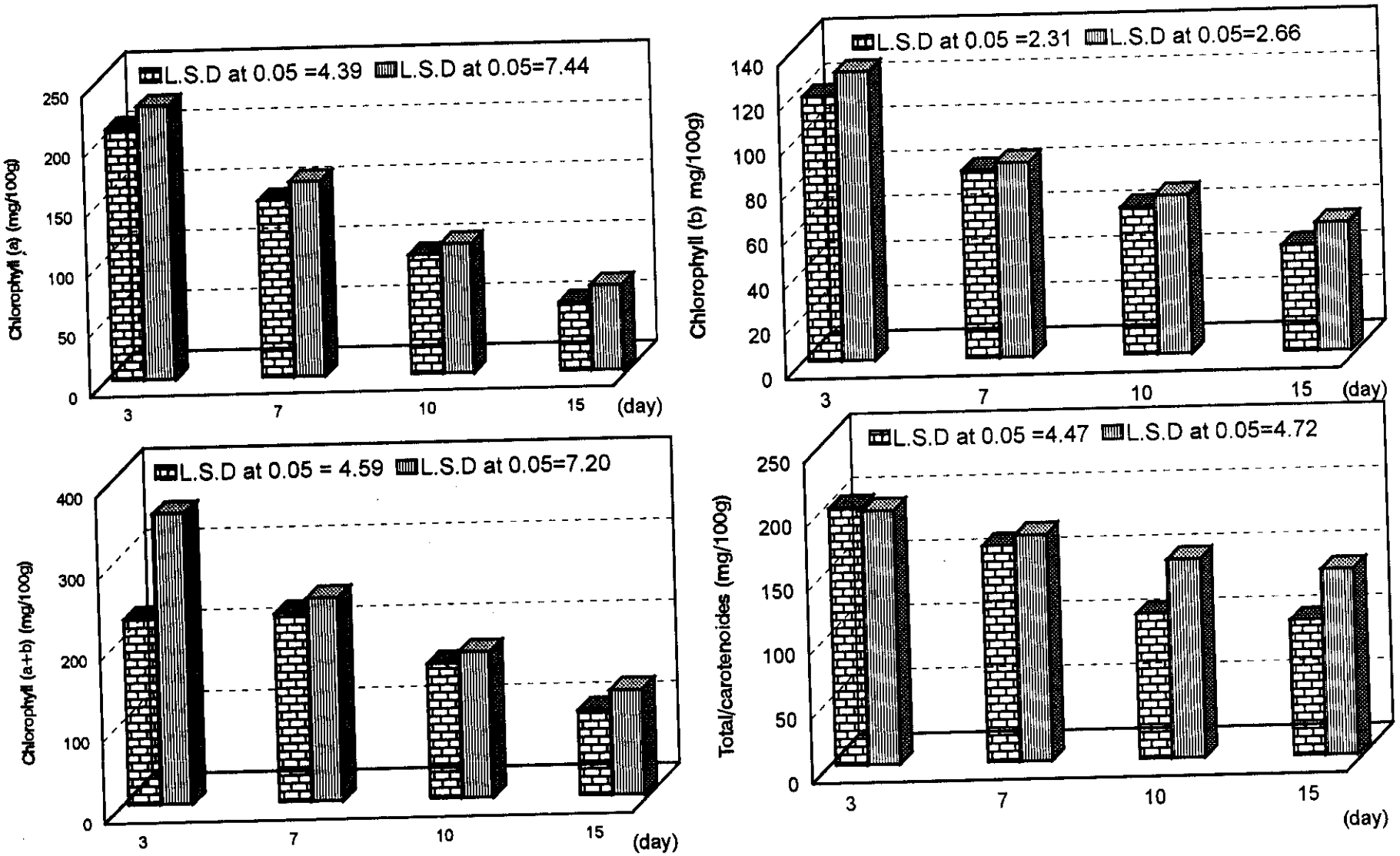


Fig. (3) : Effect of irrigation interval on photosynthetic pigments of taro plants during 1997 (▭) and 1998 (▭) seasons.

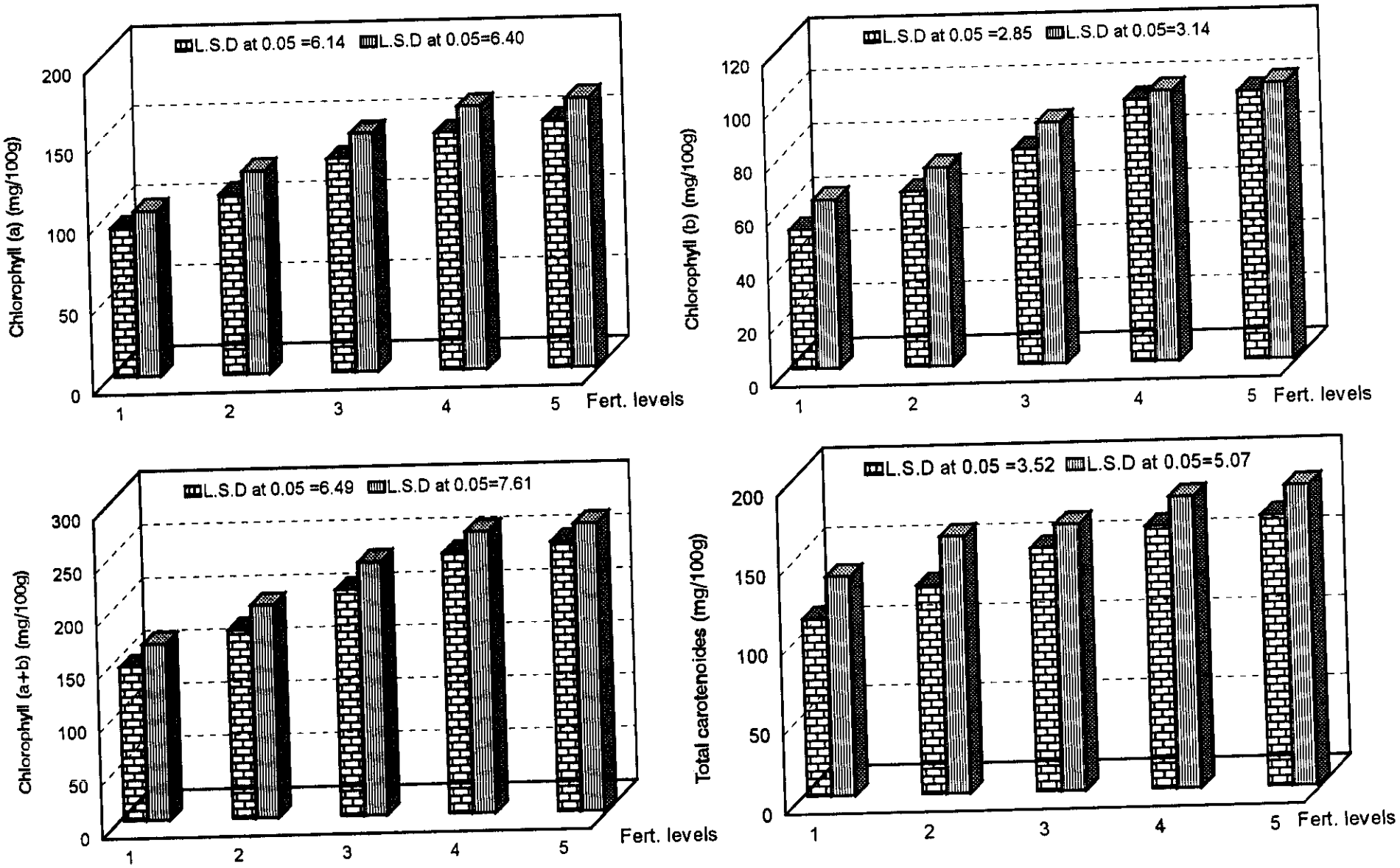


Fig. (4): Effect of NPK fertilization level on photosynthetic pigments of taro plants during 1997 (▣) and 1998 (▤) seasons.

IV-2-1-3-Effect of interaction between irrigation and fertilization :

Data in Table (7) reveal that, the maximum values of all measured photosynthetic pigments ,i.e. chlorophyll a , b and total chlorophyll as well as carotenoides were obtained as a result of the combination between irrigation every ½ week by intervals and application of the highest used levels of fertilization (120 kg N + 64 kg P_2O_5 + 120 kg K_2O /fed.) . In this regard , such increment did not reach the levels of significancy in case of carotenoides substances during the second season only.

IV-2-2-Plant nutritional status :

IV-2-2-1- Effect of irrigation intervals :

Data illustrated in Table (8 & 9) and Figs. (5 & 6) show the effect of irrigation intervals, fertilization levels and their interaction on total nitrogen, phosphorus and potassium content of taro plant.

Such data reveal that, increasing the amounts of water supplied to the plants either through increasing the number of irrigations or shortening the irrigation intervals ,i.e. from 2 to ½ week during the growing season led to a significant increase in the uptake of nitrogen, phosphorus and potassium by plant. In this respect, the highest content of such assayed macroelements in different plant parts (lamina , petiole and corms) were obtained by irrigation every ½ week by intervals in the two growing seasons . These results may be attributed to the role of water in decreasing the viscosity of soil solution and increasing the movement of such macroelements in the soil which leads to the increase in the uptake of such nutrients by plants. Similar results on increasing the plant content of N , P and K

Table (7) : Effect of interaction between irrigation intervals and NPK fertilization levels on photosynthetic pigments of taro plants .

Treatments		1997 season				1998 season			
		Chlorophyll (mg/100 g fresh weight)			Carotenoides (mg/100 g F. W.)	Chlorophyll (mg/100 g fresh weight)			Caratenoides (mg/100 g F. W.)
Irrigation interval (weeks)	NPK Fertilizer levels	a	b	Total (a + b)		a	b	Total(a+b)	
½	1	155	88	244	152.25	168	96	264	162
	2	178	102	281	179.25	194	110	304	192
	3	225	129	354	206.25	246	140	387	199
	4	240	134	374	229.00	261	147	409	211
	5	246	137	383	234.00	266	150	416	223
1	1	118	54	172	137.25	129	71	200	148
	2	138	77	216	167.50	153	80	233	173
	3	139	83	222	173.75	155	85	240	178
	4	164	101	266	181.00	183	97	280	188
	5	174	103	277	182.00	187	101	288	193
1½	1	58	34	92	80.25	63	42	105	130
	2	81	42	123	90.25	88	53	142	142
	3	108	63	171	120.25	119	74	193	147
	4	119	94	213	130.00	132	91	223	175
	5	127	97	224	141.00	133	93	226	177
2	1	38	30	68	77	49	39	89	110
	2	50	38	89	89	68	52	120	141
	3	58	44	102	112	73	59	132	146
	4	66	61	127	121	78	67	145	160
	5	70	63	133	126	83	68	151	164
L. S. D. at 0.05		12.29	5.71	12.98	7.05	12.80	6.28	15.22	N.S

Table (8): Effect of irrigation intervals and NPK fertilization levels on NP and K contentof taro plants .

Treatments		Minerals uptake /plant parts (mg)											
		N				P				K			
Irrigation intervals (weeks)	NPK Fertilizer levels	Lamina	Petiole	Corm	Total	Lamina	Petiole	Corm	Total	Lamina	Petiole	Corm	Total
1997 Season													
1/2		1070	1006	2159	4264	126	122	249	496	1129	968	1413	3528
1		678	428	1319	2453	69	47	145	262	693	465	892	2050
1 1/2		222	47	354	623	21	5	45	70	193	47	274	516
2		63	24	223	310	6	3	29	38	56	26	238	321
L. S. D. at 0.05 level		70.06	157.39	127.25	233.22	9.20	7.15	13.95	36.50	74.08	48.66	95.66	140.05
	1	236	208	528	972	27	21	67	115	268	176	385	855
	2	358	342	868	1615	43	42	104	190	410	349	576	1335
	3	557	427	1069	2077	57	50	123	229	510	413	727	1690
	4	683	449	1237	2367	71	52	141	265	673	466	857	1997
	5	709	455	1368	2534	78	56	149	283	689	480	976	2142
L. S. D. at 0.05 level		53.13	61.47	153.57	180.75	4.51	4.86	11.35	44.24	55.88	54.29	110.81	138.20
1998 Season													
1/2		1180	1504	1676	4361	164	301	279	744	1180	3010	2538	6729
1		776	965	1647	3389	111	154	275	542	787	1751	2397	4943
1 1/2		162	214	892	1269	28	34	112	175	172	350	1201	1724
2		45	77	358	481	10	11	61	83	70	140	871	1082
L. S. D. at 0.05 level		51.04	118.91	228.61	294.72	17.87	14.50	27.20	22.07	91.14	152.24	199.04	342.67
	1	239	392	496	1128	41	71	100	213	268	862	641	1771
	2	413	516	814	1744	66	95	145	305	436	1046	1521	3003
	3	516	674	1048	2240	77	127	176	381	554	1277	1831	3673
	4	750	868	1434	3054	101	161	223	486	734	1620	2226	4580
	5	786	1000	1924	3710	108	172	264	545	769	1761	2540	5071
L. S. D. at 0.05 level		63.67	135.32	317.69	378	10.81	25.89	30.70	12.21	68.91	173.22	212.13	295.23

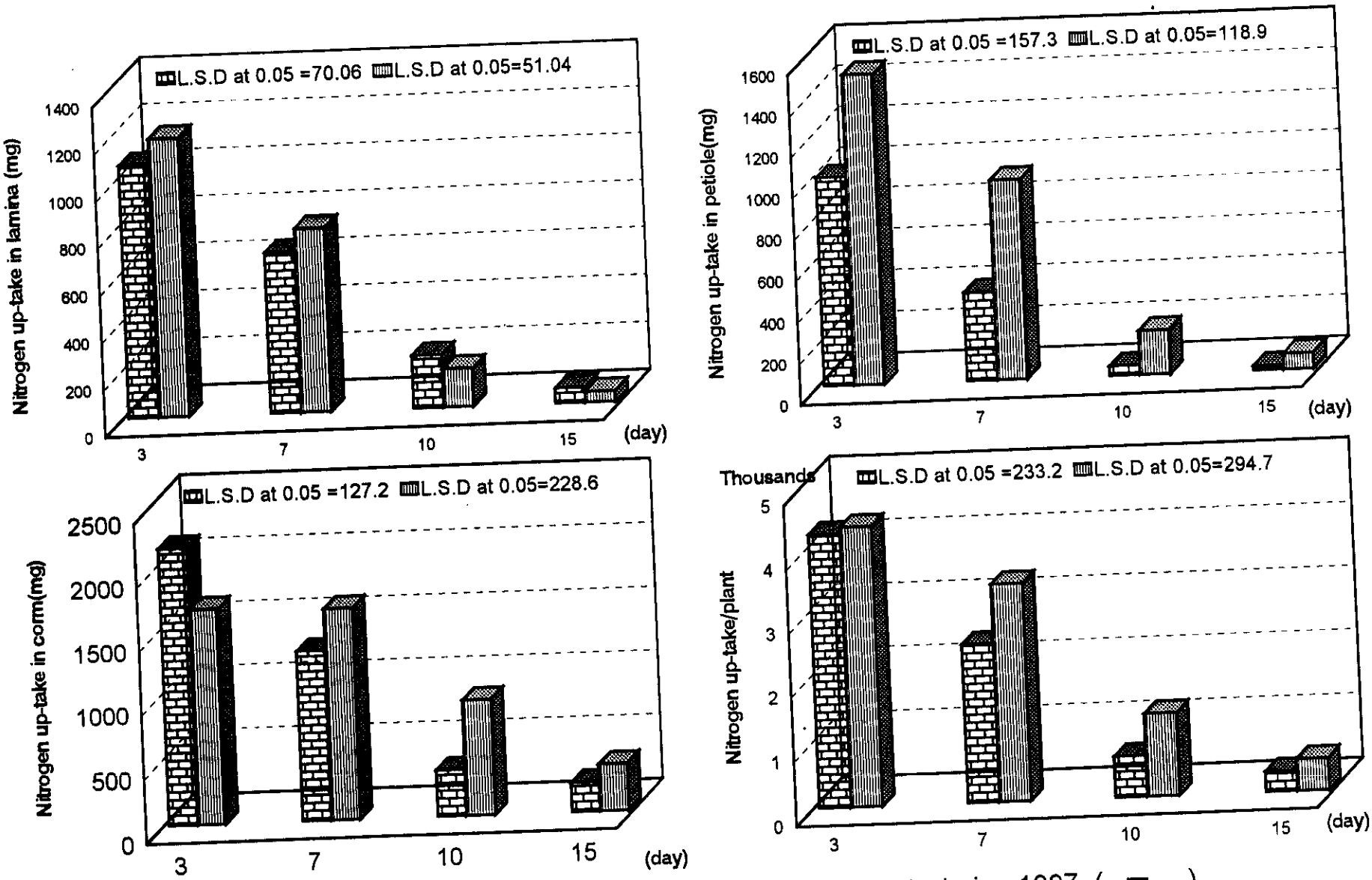
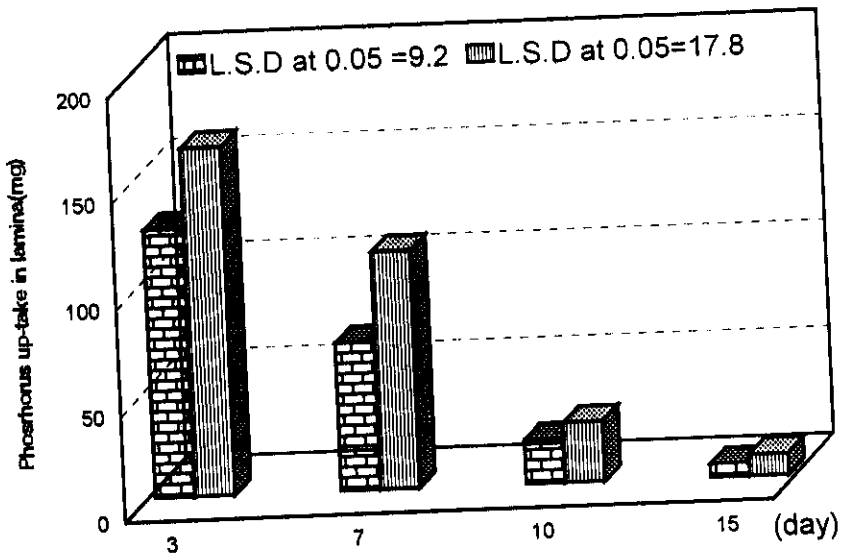
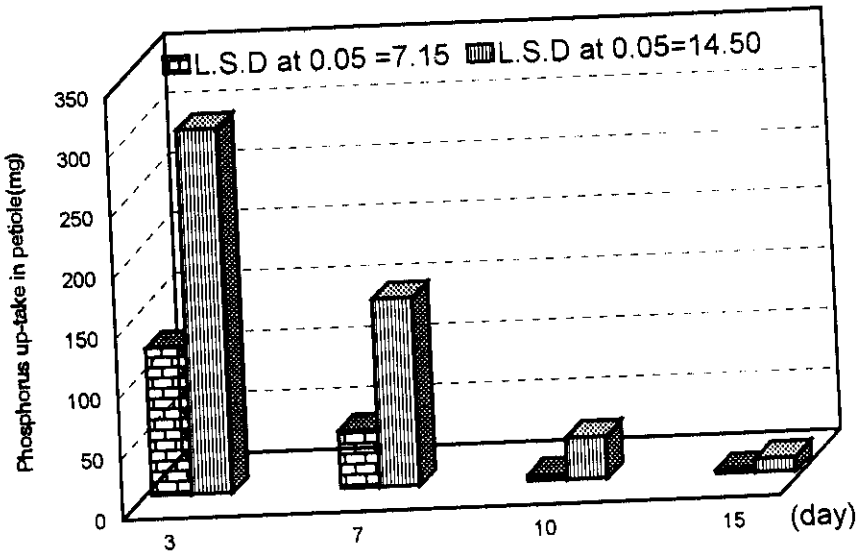
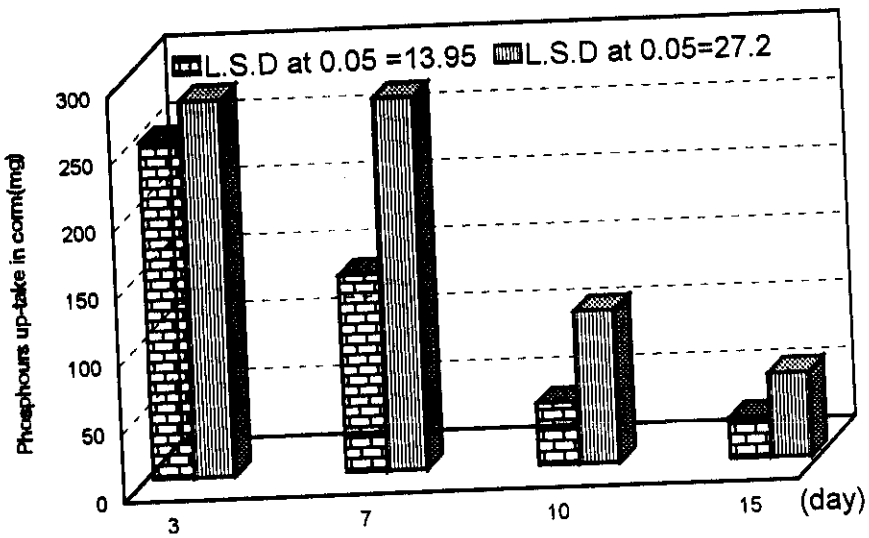


Fig. ((5) : Effect of irrigation interval on macro-elements of taro plants during 1997 ( ) and 1998 ( ) seasons.


L.S.D at 0.05 =9.2
L.S.D at 0.05=17.8
Phosphorus up-take in lamina(mg)
200
150
100
50
0
3
7
10
15
(day)


L.S.D at 0.05 =7.15
L.S.D at 0.05=14.50
Phosphorus up-take in petiole(mg)
350
300
250
200
150
100
50
0
3
7
10
15
(day)


L.S.D at 0.05 =13.95
L.S.D at 0.05=27.2
Phosphorus up-take in corm(mg)
300
250
200
150
100
50
0
3
7
10
15
(day)

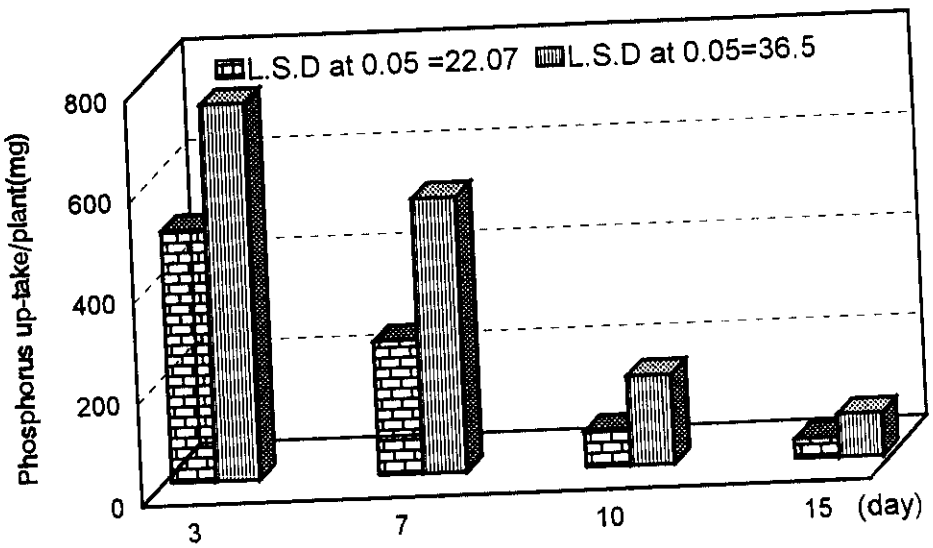
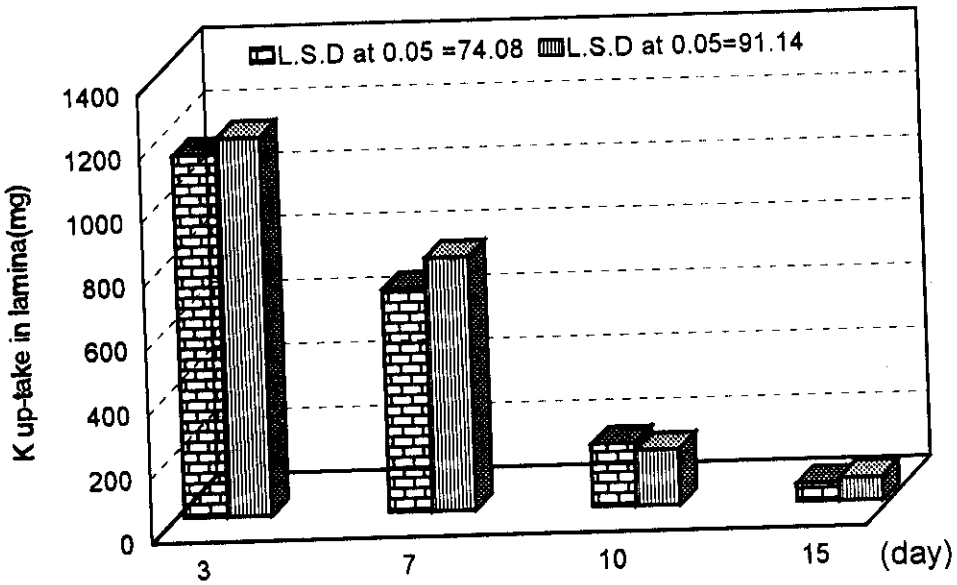
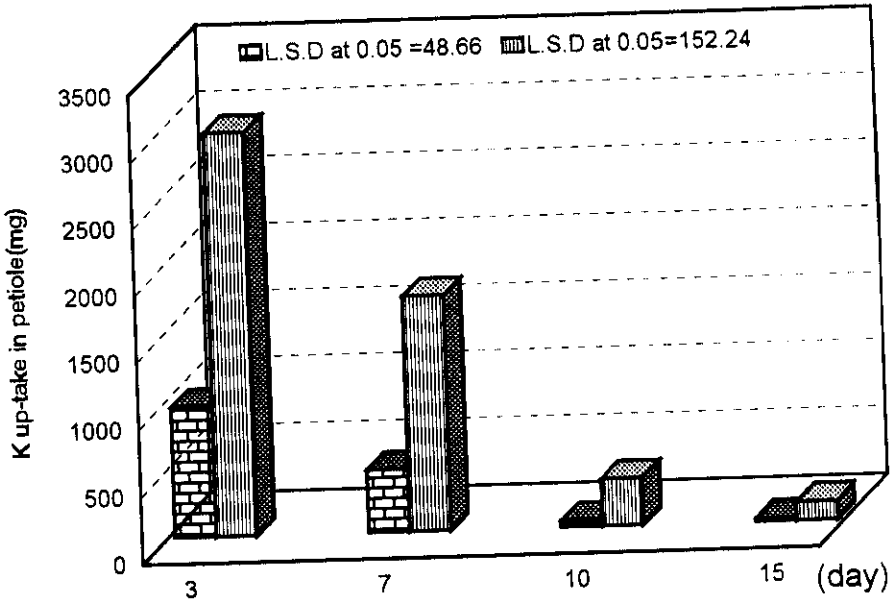
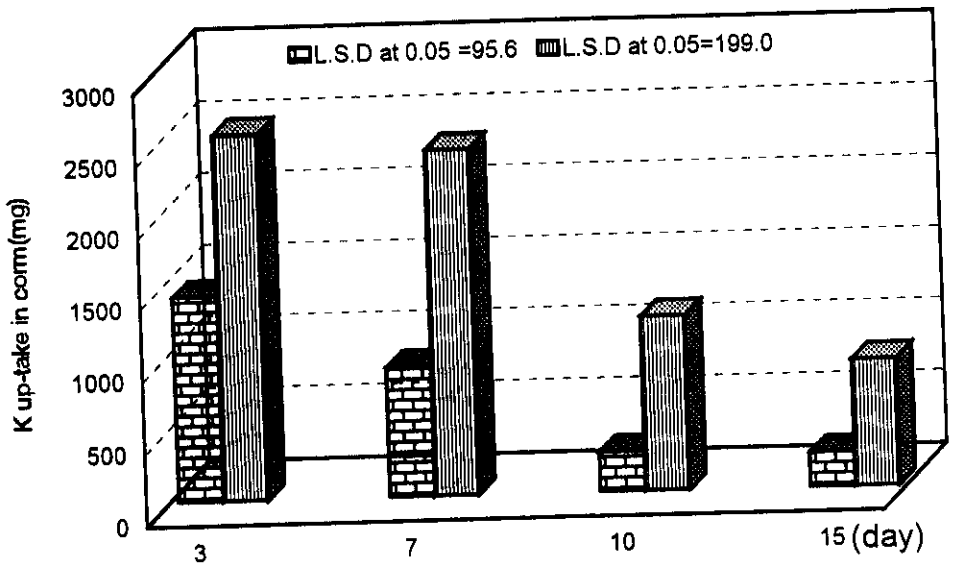

L.S.D at 0.05 =22.07
L.S.D at 0.05=36.5
Phosphorus up-take/plant(mg)
800
600
400
200
0
3
7
10
15
(day)

Fig. (5 Cont.) .


L.S.D at 0.05 =74.08
L.S.D at 0.05=91.14
K up-take in lamina(mg)
1400
1200
1000
800
600
400
200
0
3
7
10
15
(day)


L.S.D at 0.05 =48.66
L.S.D at 0.05=152.24
K up-take in petiole(mg)
3500
3000
2500
2000
1500
1000
500
0
3
7
10
15
(day)


L.S.D at 0.05 =95.6
L.S.D at 0.05=199.0
K up-take in corm(mg)
3000
2500
2000
1500
1000
500
0
3
7
10
15 (day)

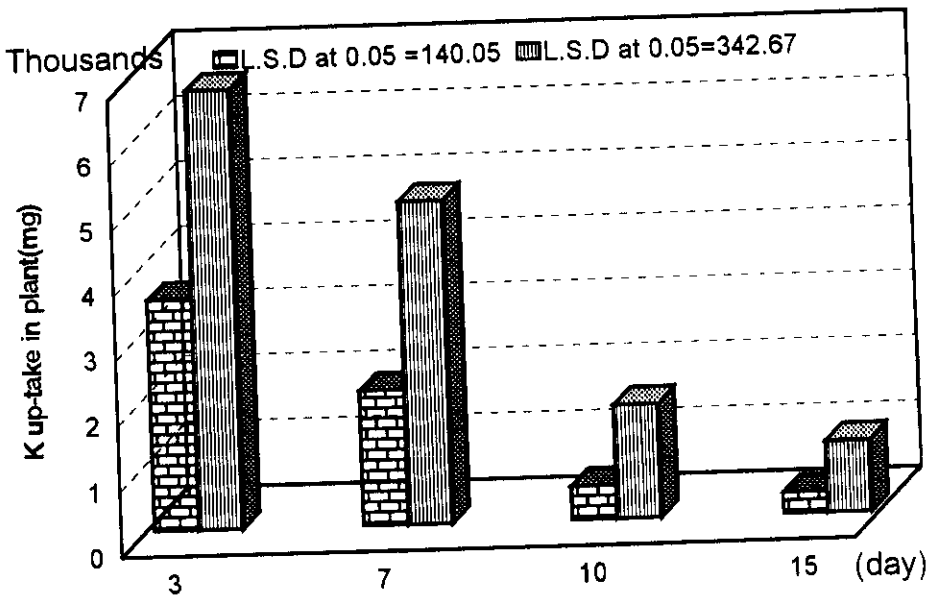

Thousands
L.S.D at 0.05 =140.05
L.S.D at 0.05=342.67
K up-take in plant(mg)
7
6
5
4
3
2
1
0
3
7
10
15
(day)

Fig.(5 Cont.)

with increasing the quantity of water supplied to the plant were reported by **Khalak** and **Kumaraswamy (1992 & 1996), Pis (1994)** and **Costa *et al.* (1997)** on potato and **El-Mansi *et al.* (1975), Geissler** and **Hinkle (1985)** and **Abd-El-Rahman (1990)** on carrot .

IV-2-2-2- Effect of fertilization levels :

Data in Table (8) and Fig. (6) investigate that total nitrogen , phosphorus and potassium contents of different plant parts ,i. e. foliage and corms were significantly affected with application of NPK fertilizers whereas, the maximum increments of all aforementioned macroelements in different plant parts were connected with the highest used level of N , P and K fertilizers (120 kg N + 64 kg P_2O_5 + 120 kg K_2O /fed.). The same trend was obtained during both seasons of growth. Such increments in the uptake of nitrogen , phosphorus and potassium in different plant parts may be attributed to the increase in soil concentration of such macronutrients as a result of fertilization in the roots zoon which led to increasing the amounts absorbed by plants. Similar results were obtained by **Ruiz *et al.* (1989), Mohankumar** and **Sadanadan (1990), Jacobs** and **Clarke (1993)** and **Verma *et al.* (1996)** all working on taro. They reported that increasing nitrogen , phosphorus and potassium fertilizers either in a single or in a compound form increased these macro-nutrients in different plant parts.

IV-2-2-3- Effect of interaction between irrigation intervals and NPK fertilizer levels :

As for the interaction effect, it is obvious from data in Table (9) that increasing the amount of water supplied to the plant either

Table (9) : Effect of interaction between irrigation intervals and NPK fertilization levels on N, P and K content of taro plants .

1997 season												
Treatments		Minerals uptake /plant parts (mg)											
		N				P				K			
Irrigation interval (weeks)	NPK Fertilizer levels	Lamina	Petiole	Corm	Total	Lamina	Petiole	Corm	Total	Lamina	Petiole	Corm	Total
½	1	468	623	1120	2211	57	60	149	266	550	511	801	1963
	2	726	282	1933	3592	92	116	230	439	901	858	1238	3000
	3	1167	1140	2320	4718	133	139	270	542	1242	1023	1510	3776
	4	1480	1183	2650	5314	165	143	292	601	1448	1206	1718	4373
	5	1509	1203	2773	5486	180	150	304	634	1500	1240	1798	4530
1	1	371	188	725	1284	41	22	85	148	405	163	518	1087
	2	545	427	1089	2199	64	47	126	238	564	474	699	1739
	3	747	496	1317	2561	68	53	140	260	698	549	844	2092
	4	854	514	1555	2923	85	56	178	318	896	561	1021	2478
	5	873	515	1911	3300	89	59	195	343	903	576	1373	2850
1½	1	85	14	166	265	9	2	22	32	96	18	129	244
	2	131	42	259	433	14	4	34	51	137	42	185	365
	3	244	48	402	694	20	5	51	75	191	51	306	549
	4	302	63	463	829	29	6	58	91	263	61	367	697
	5	349	66	480	896	32	8	59	98	275	65	382	722
2	1	18	7	100	126	2	1	13	16	21	10	92	125
	2	29	16	192	237	3	2	25	30	34	20	179	234
	3	71	24	239	334	6	3	32	41	66	28	246	341
	4	94	34	276	402	8	4	37	49	79	34	323	436
	5	105	37	309	452	12	5	40	57	81	37	349	466
L. S. D. at 0.05		106.26	122.95	307.14	361.51	9.02	9.72	22.71	88.49	111.77	108.58	221.63	276.41

Table : (9 Cont.) .

Treatments		1998 season											
		Minerals uptake /plant parts (mg)											
		N				P				K			
Irrigation interval (weeks)	NPK Fertilizer levels	Lamina	Petiole	Corm	Total	Lamina	Petiole	Corm	Total	Lamina	Petiole	Corm	Total
½	1	563	919	771	2253	80	184	173	439	547	2068	1041	3657
	2	925	1186	1113	3225	143	223	229	595	869	2418	2197	5484
	3	1100	1465	1393	3962	158	303	262	723	1180	2873	2661	6715
	4	1620	1903	2063	5587	207	391	331	930	1590	3741	3098	8430
	5	1690	2048	3041	6779	231	405	397	1033	1713	3950	3695	9359
1	1	303	548	628	1540	63	85	145	293	382	1140	830	2353
	2	582	686	1198	2466	87	112	212	410	680	1408	2145	4233
	3	775	907	1562	3245	112	161	272	546	813	1683	2478	5015
	4	1081	1161	2098	4342	146	196	347	689	1027	2093	3111	6231
	5	1139	1525	2688	5353	149	220	402	772	1032	2431	3421	6884
1½	1	72	64	401	538	15	11	63	90	103	142	418	663
	2	108	133	754	996	24	36	102	162	136	246	1210	1564
	3	136	241	926	1304	25	34	114	173	154	403	1317	1875
	4	244	306	1051	1603	38	44	125	208	231	476	1435	2143
	5	251	324	1330	1906	39	47	155	241	238	490	1623	2352
2	1	20	36	125	182	5	6	18	30	41	97	273	412
	2	38	60	192	290	7	9	37	53	59	115	533	707
	3	51	83	313	447	11	12	58	81	70	147	869	1086
	4	56	103	523	683	13	14	90	117	89	170	1258	1516
	5	62	104	636	802	15	16	103	135	93	173	1420	1689
L. S. D. at 0.05		127.35	270.65	635.39	756.48	21.63	51.78	61.41	24.42	137.83	346.44	424.26	590.47

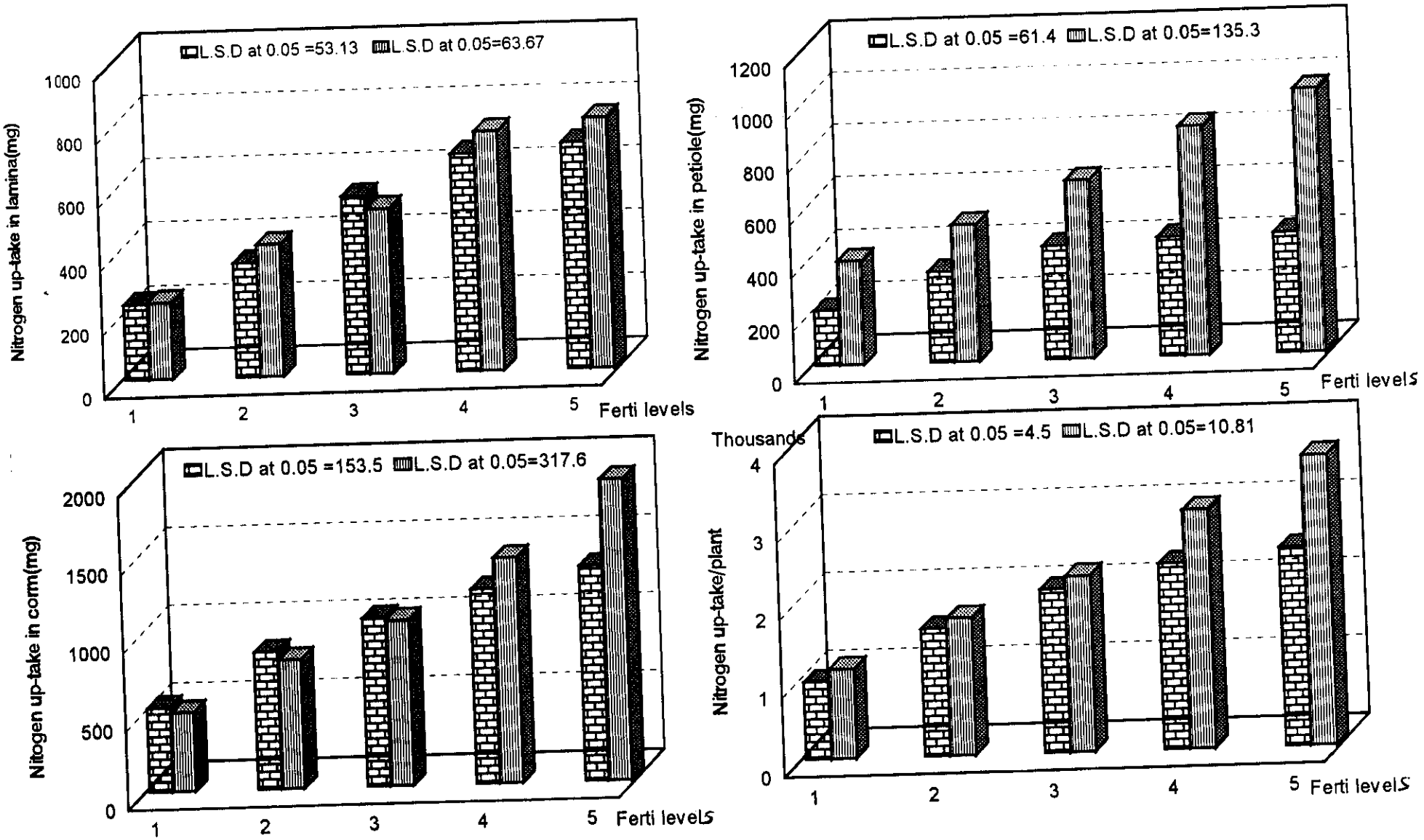
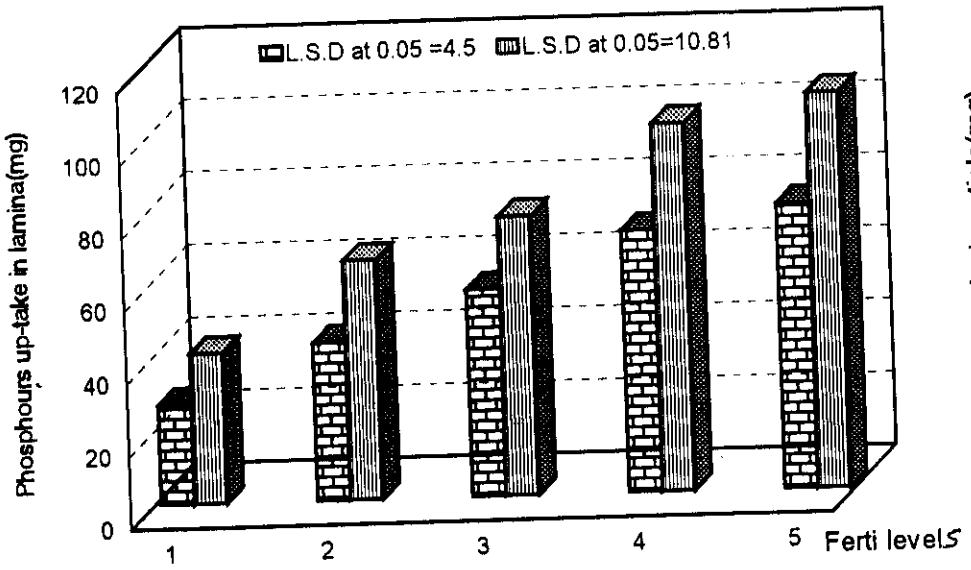
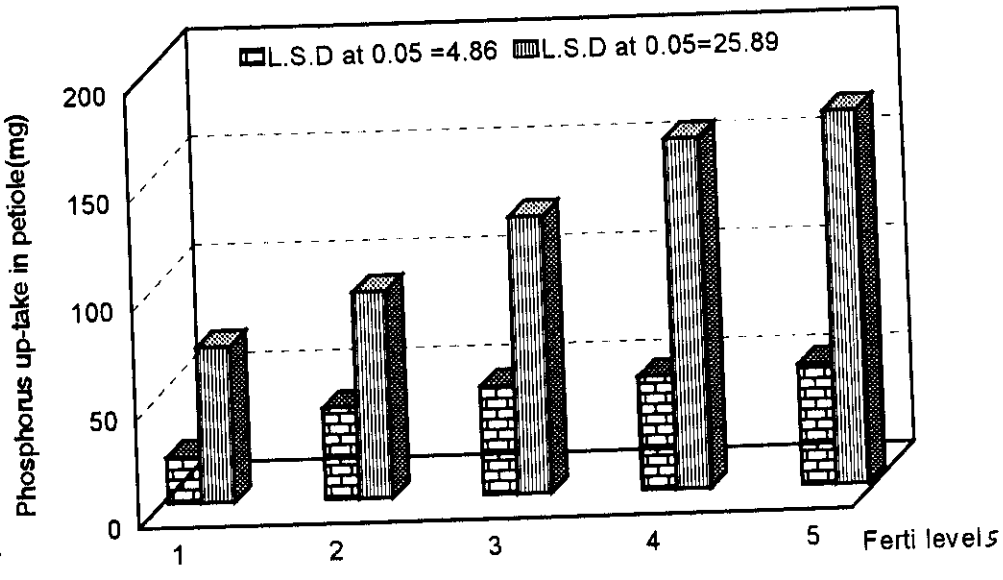
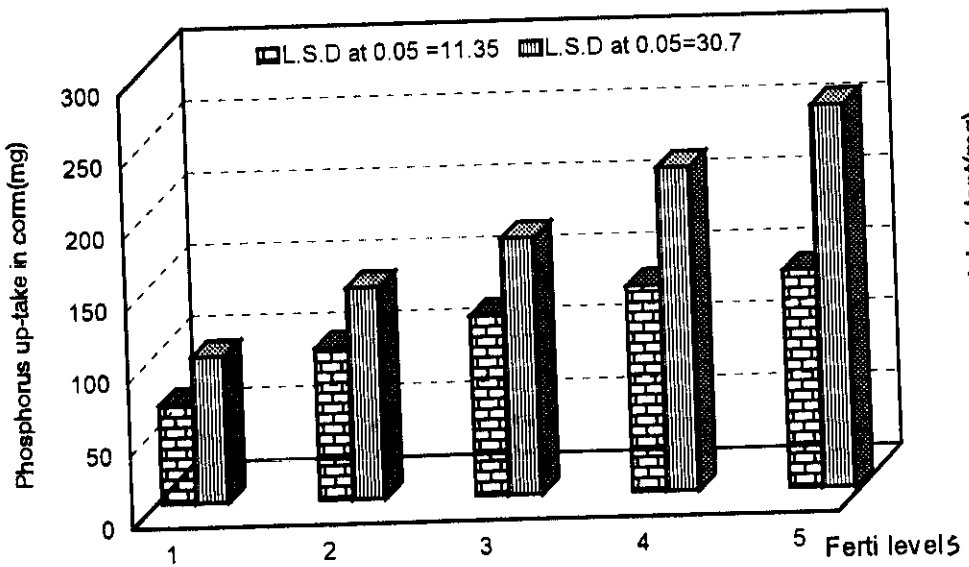


Fig. (6) : Effect of fertilization level on macro-element of taro plants during 1997 (▭) and 1998 (▥) seasons.


L.S.D at 0.05 =4.5
L.S.D at 0.05=10.81
Phosphours up-take in lamina(mg)
120
100
80
60
40
20
0
1
2
3
4
5
Ferti levels


L.S.D at 0.05 =4.86
L.S.D at 0.05=25.89
Phosphorus up-take in petiole(mg)
200
150
100
50
0
1
2
3
4
5
Ferti levels


L.S.D at 0.05 =11.35
L.S.D at 0.05=30.7
Phosphorus up-take in corn(mg)
300
250
200
150
100
50
0
1
2
3
4
5
Ferti levels

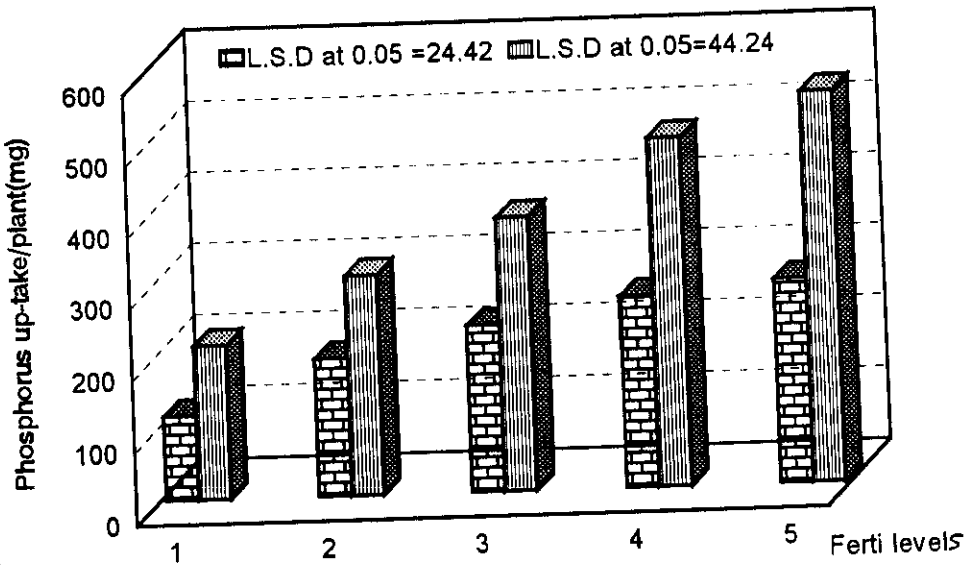

L.S.D at 0.05 =24.42
L.S.D at 0.05=44.24
Phosphorus up-take/plant(mg)
600
500
400
300
200
100
0
1
2
3
4
5
Ferti levels

Fig.(6 Cont.),

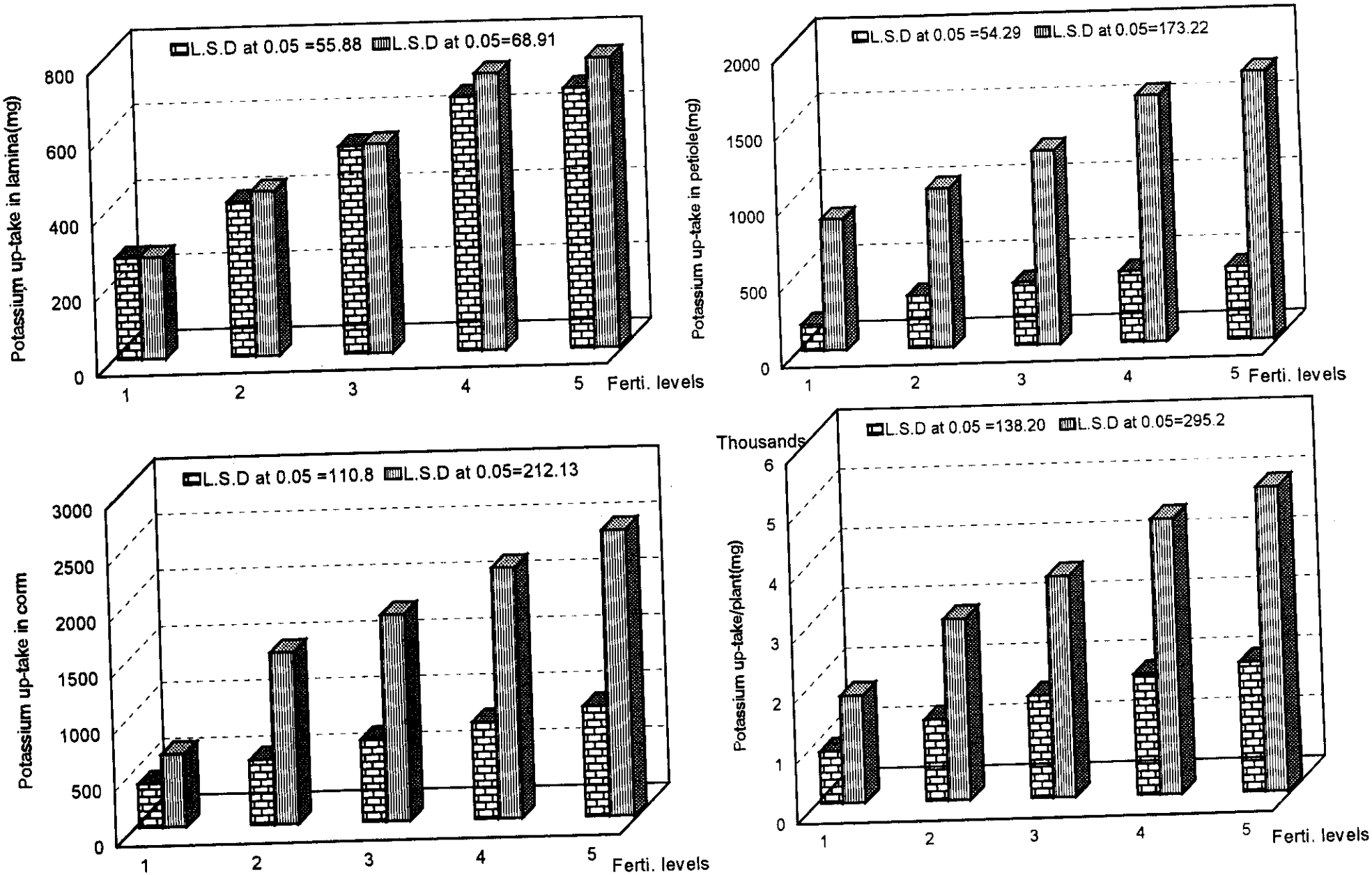

L.S.D at 0.05 =55.88
L.S.D at 0.05=68.91
Potassium up-take in lamina(mg)
800
600
400
200
0
1
2
3
4
5
Ferti. levels
L.S.D at 0.05 =54.29
L.S.D at 0.05=173.22
Potassium up-take in petiole(mg)
2000
1500
1000
500
0
1
2
3
4
5
Ferti. levels
L.S.D at 0.05 =110.8
L.S.D at 0.05=212.13
Potassium up-take in corm
3000
2500
2000
1500
1000
500
0
1
2
3
4
5
Ferti. levels
L.S.D at 0.05 =138.20
L.S.D at 0.05=295.2
Thousands
Potassium up-take/plant(mg)
6
5
4
3
2
1
0
1
2
3
4
5
Ferti. levels

Fig. (6 Cont.).

through shortening the irrigation intervals ,i.e. (irrigation every ½ week) or increasing the irrigation frequencies throughout the growing season and increasing the fertilization levels up to the highest used one (120 kg N + 64 kg P_2O_5 + 120 kg K_2O /fed.) resulted in the highest N , P and K content in different plant parts. In this respect, **Abd-El-Rahman (1990)** found that irrigation of carrot plants with the highest used amount of water combined with (40 kg N + 32 kg P_2O_5 + 100 kg K_2O /fed.) resulted in the highest values of N, P and K content of plant.

IV-2-3- Total hydrolizable carbohydrates :

Data in Table (10 & 11) and Figs. (7 & 8) show the effect of irrigation intervals, fertilization levels and their interaction on total carbohydrates content of different plant parts ,i.e. leaf blade and petiole as well as corms.

IV-2-3-1- Effect of irrigation intervals :

Such data reveal generally, that the total carbohydrates percentage of different plant parts were increased with decreasing the irrigation intervals from 2 to 1 week . In addition, decreasing the irrigation intervals less than 1 week tended to decrease the total carbohydrates content of different plant parts. Obtained results are connected with the dry matter content of different plant parts. Such results are in conformity with those reported by **Vaquez *et al.* (1978)** on taro, **El-Mansi *et al.* (1975) , El-Beheidi *et al.* (1976)** and **Abd-El-Rahman (1990)** on carrot, **El-Dredge *et al.*(1996)** on potato and **Biswas *et al.* (1997)** on sweet potato.

Table (10):Effect of irrigation interval and NPK fertilization level on carbohydrates percentage in taro plants .

Treatments		Carbohydrates %			
Irrigation interval (days)	NPK Fertilizer level	Lamina	Petiole	Corm	Total plant
1997 season					
½		17.63	21.76	40.21	26.54
1		19.56	26.63	48.00	31.43
1½		24.63	23.54	41.39	29.67
2		21.41	21.77	35.14	26.11
L. S. D. at 0.05 level		1.38	1.53	1.35	0.77
	1	16.83	18.46	23.25	19.42
	2	19.45	21.87	36.98	26.10
	3	21.68	24.22	45.54	30.29
	4	22.69	25.72	48.87	32.44
	5	23.41	26.86	51.54	33.93
L. S. D. at 0.05 level		1.76	1.73	3.18	3.25
1998 season					
½		29.28	33.68	41.60	34.85
1		31.64	34.96	49.92	38.84
1½		32.65	29.34	41.72	34.57
2		29.78	26.07	36.44	30.76
L. S. D. at 0.05 level		1.48	2.10	5.57	0.97
	1	22.16	24.80	31.00	25.99
	2	28.88	28.90	39.99	32.60
	3	32.36	31.19	43.50	35.68
	4	34.92	34.34	46.86	38.79
	5	35.86	35.82	50.77	39.90
L. S. D. at 0.05 level		1.28	2.29	1.88	1.36

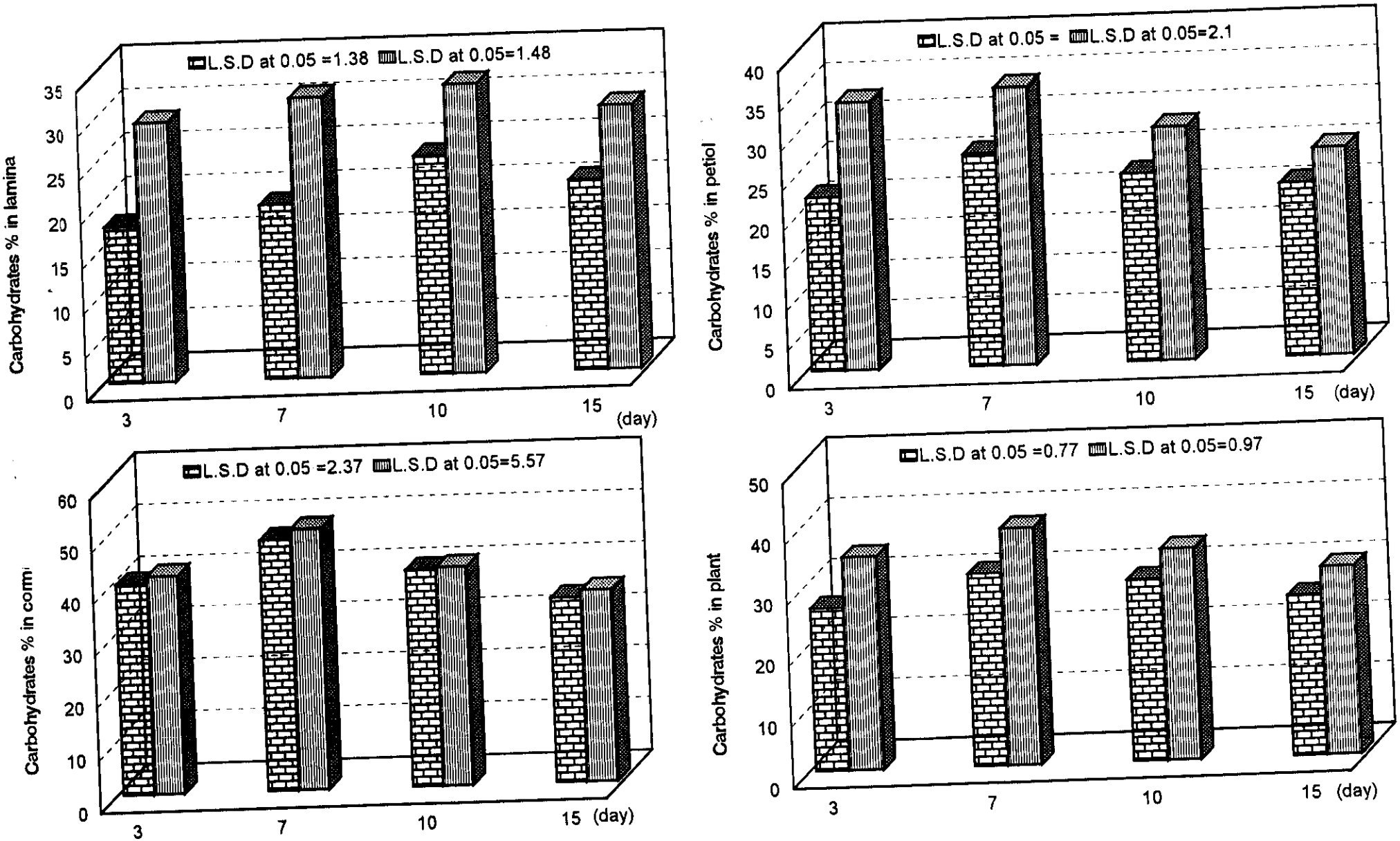


Fig.(7): Effect of irrigation interval on carbohydrates percentage in taro plants during 1997 (▭) and 1998 (▥) seasons.

IV-2-3-2- Effect of fertilization levels :

Data in Table (10) and Fig. (8) show that total carbohydrates of both plant foliage and corms were significantly increased with increasing fertilizers rate during both seasons of study. In this respect, application of 120 kg N + 64 kg P_2O_5 + 120 kg K_2O /fed. reflected the maximum increments in carbohydrates content of plant foliage and corms. Such results may be due to the role of macroelements in increasing photosynthetic molecules content and consequently the photosynthetic assimilation of carbohydrates. Obtained results are in agreement with those of **Mandal *et al.* (1982)** and **Abd El-Hamed (1993)** on taro, **Al'-Shevskü (1990)** and **Sing** and **Sing (1996)** on potato. **Djazuli and Ismunaji (1983)** and **Sharfuddin** and **Voican (1984)** on sweet potato and **Abd-El-Rahman (1990)** on carrot, who reported that application of N , P and K fertilizers either in a single form or as a compound fertilizer increased the total carbohydrates content of different plant parts. However, contra results were obtained by **El-Sayed (1987)** on sweet potato and **Westerman *et al.* (1994)** on potato were they reported that fertilization decreased the total carbohydrates content of sweet potato and starch concentration of potato tubers .

IV-2-3-3- Effect of interaction between irrigation intervals and NPK fertilizer levels :

With respect to the effect of the interaction between the two studied factors the same data in Table (11) reveal that decreasing the irrigation intervals from 2 to 1 week and increasing the applied levels of N, P and K fertilizers up to the fifth used one (120 kg N + 64 kg P_2O_5 + 120 kg K_2O /fed.) reflected the highest carbohydrates

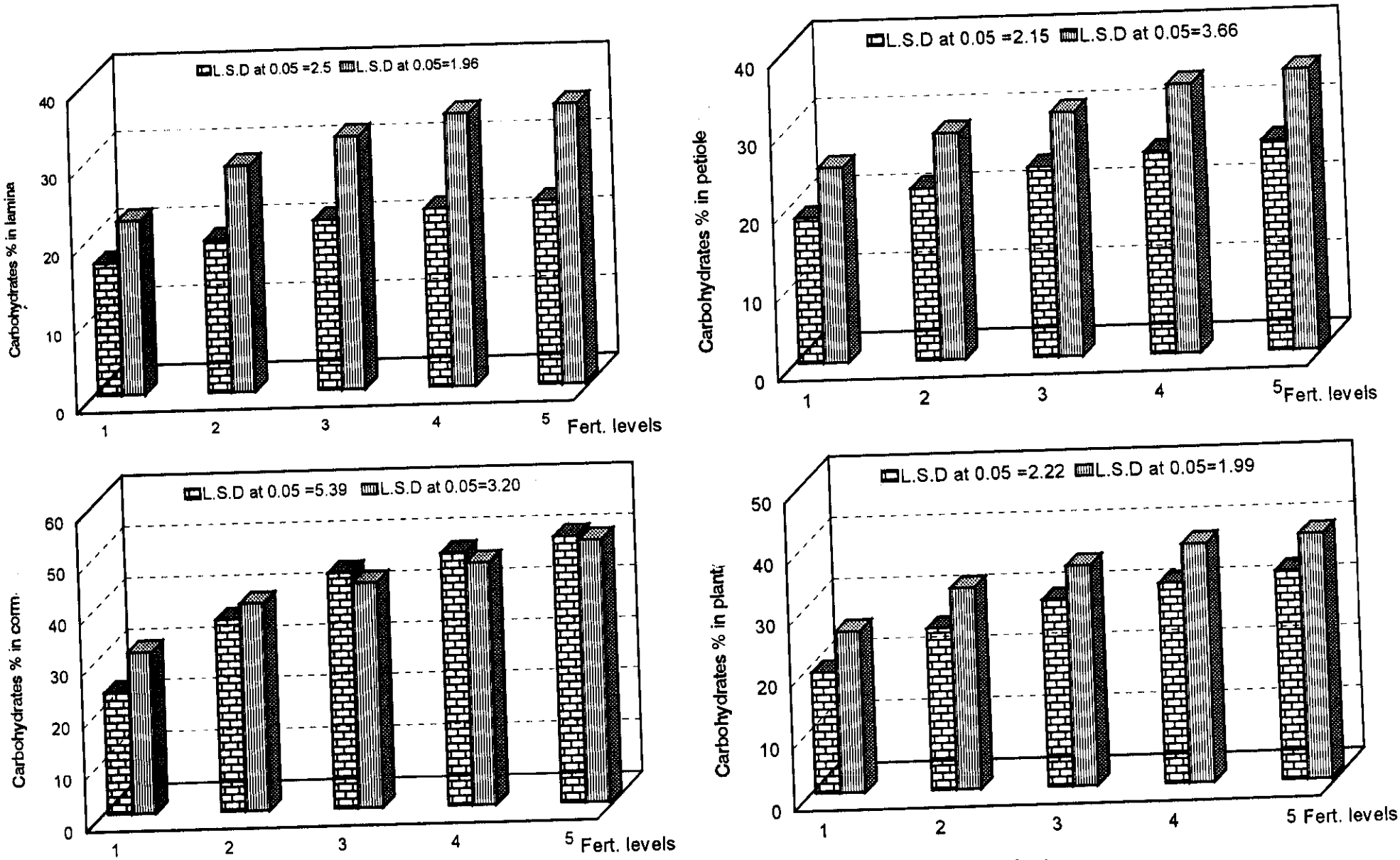


Fig (8) Effect of NPK fertilization levels on carbohydrates percentage of taro plant .during 1997 (▭) and 1998 (▭) seasons.

Table (10) : **Effect of interaction between irrigation intervals and NPK fertilization levels on carbohydrates percentage in different plant parts of taro .**

1997 season						1998 season			
Treatments		Carbohydrates %				Carbohydrates %			
Irrigation interval (weeks)	NPK Fertilizer levels	Lamina	Petiole	Corm	Mean	Lamina	Petiole	Corm	Mean
½	1	14.08	17.16	24.20	18.47	20.64	26.13	33.95	26.90
	2	15.25	18.24	35.52	23.0	25.98	30.46	35.50	30.64
	3	16.96	23.12	45.48	28.57	30.13	33.38	42.44	35.31
	4	20.80	24.16	46.68	30.54	34.13	38.40	47.37	39.97
	5	21.10	26.14	49.21	32.15	35.55	40.06	48.78	41.46
1	1	16.88	20.32	26.27	21.15	23.71	27.27	38.09	29.69
	2	17.84	26.03	43.58	29.23	29.95	32.10	48.97	37.01
	3	20.80	27.94	52.64	33.82	33.06	35.32	49.79	39.39
	4	20.90	28.60	56.32	35.33	35.41	39.56	53.37	42.78
	5	21.42	30.28	61.21	37.63	36.10	40.55	59.42	45.35
1½	1	18.98	18.90	21.95	19.94	24.32	25.55	26.85	25.57
	2	23.14	22.82	38.63	28.12	30.56	28.26	40.70	33.17
	3	26.40	23.88	47.34	31.78	35.87	29.07	44.07	36.33
	4	26.42	25.44	48.97	33.73	36.04	31.06	45.0	37.70
	5	28.24	26.38	50.06	34.89	36.47	32.80	52.01	40.42
2	1	17.38	17.46	19.58	18.14	20.0	20.28	25.12	21.80
	2	21.60	20.42	30.19	24.07	29.06	24.81	34.82	29.57
	3	22.56	21.97	36.72	27.08	30.4	27.0	37.71	31.70
	4	22.67	24.40	43.53	30.19	34.12	28.36	41.70	34.72
	5	22.88	24.64	45.70	31.07	35.35	29.90	42.87	36.04
L. S. D. at 0.05		N.S	3.46	N.S	N.S	2.56	N.S	N.S	N.S

content of different plant parts (plant foliage and corms) exept for lamina which showed height values. In this respect with the third used water irrigation intervals (every 1 ½ week) . On the other hand increasing the amounts of water supplied to the plant ,i. e. irrigation every ½ week combined with no fertilizers addition resulted in the lowest values of total carbohydrates during both seasons of study. However ,the differences between deferent used treatments combination were not statistically significant. Such insignificancy may be due to that the two studied factors of this work did not affect in the same way.

IV-3- Effect of irrigation intervals, fertilization levels and their interaction on yield and its components of taro plants :

Data presented in Tables (12 & 13) and Figs. (9 & 10) show the effect of irrigation intervals, fertilization levels and their interaction on yield and its components of taro plant.

IV-4-3-1- Effect of irrigation intervals :

Such data in Table (12) and Fig.(9) indicate that the yield and its components, expressed 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 growing seasons.

Table (12): Effect of irrigation intervals and NPK fertilization levels on vegetative growth characters of taro plants .

Treatments		Cormels/plant		Main corm			Total yield		Water use efficiency (m^3/kg)
Irrigation interval (weeks)	NPK Fertilizer level	Number	Weight (g)	Length (cm)	Diameter (cm)	Fresh weight	Plant (gm)	Ton/fed.	
1997 Season									
1/2		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 1/2		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	-
1998 Season									
1/2		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 1/2		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	

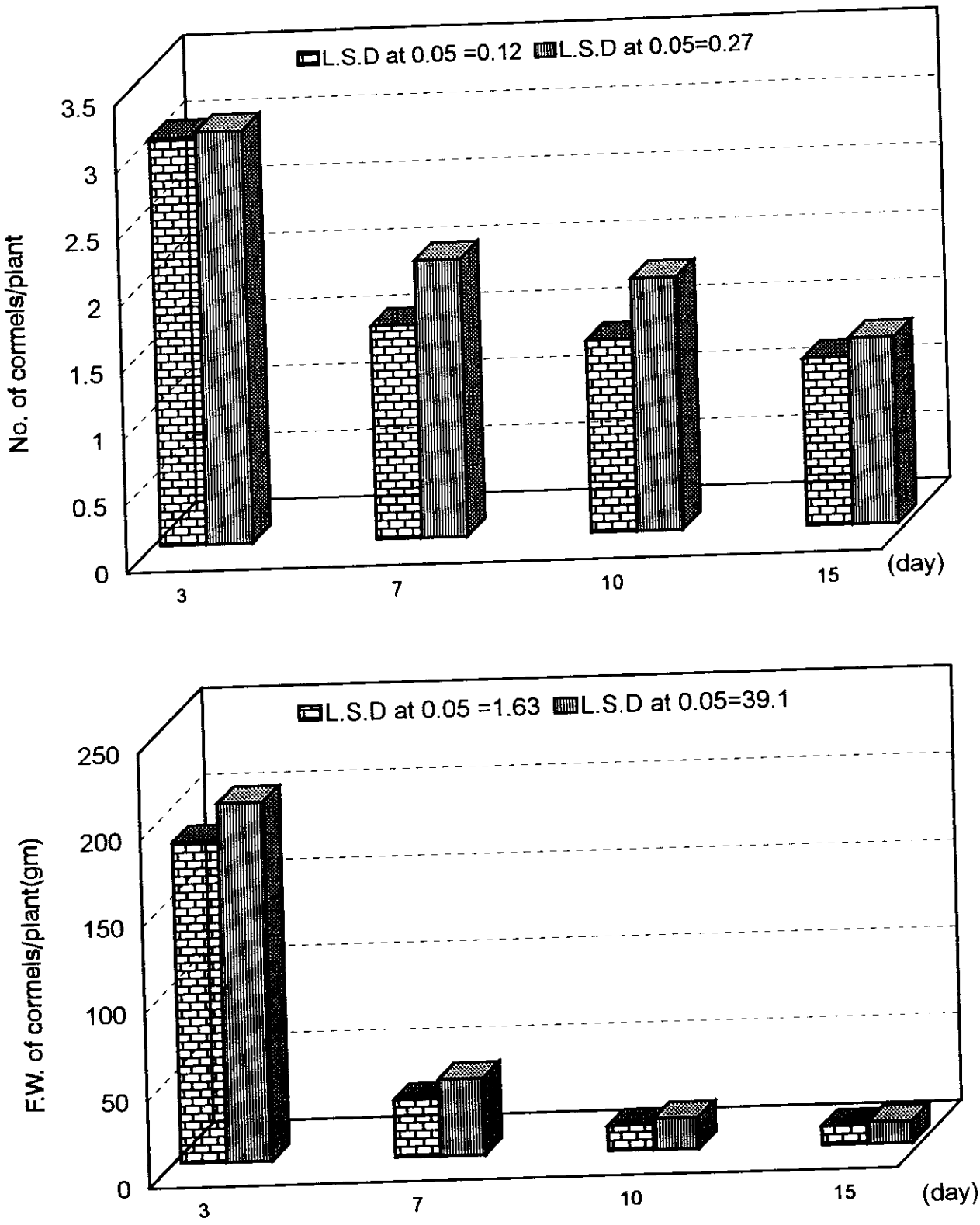


Fig. (9): Effect of irrigation interval on yield and its components of taro plants during 1997 (▭) and 1998 (▨) seasons.

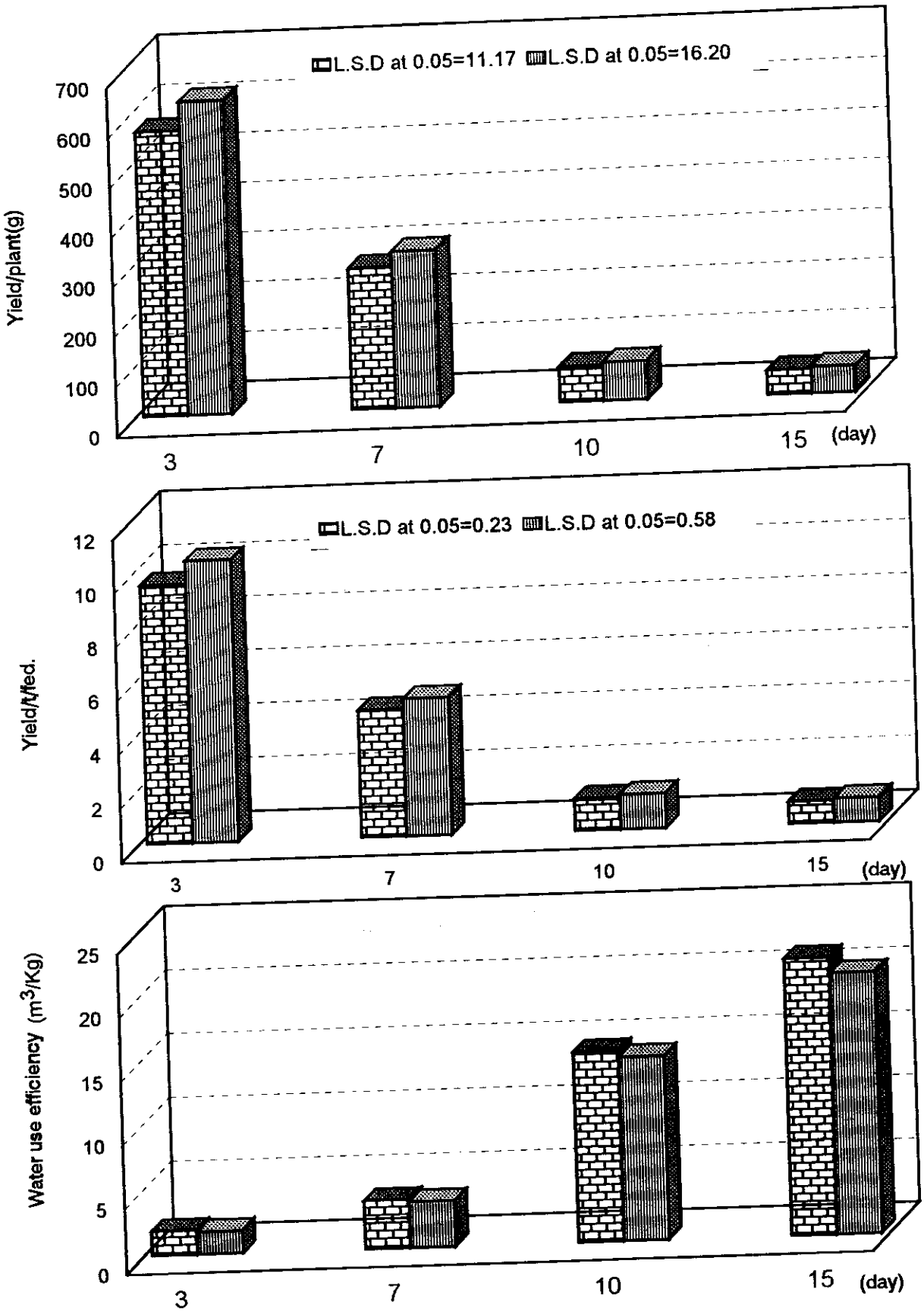

L.S.D at 0.05=11.17
L.S.D at 0.05=16.20
Yield/plant(g)
700
600
500
400
300
200
100
0
3
7
10
15
(day)
L.S.D at 0.05=0.23
L.S.D at 0.05=0.58
Yield/t/fed.
12
10
8
6
4
2
0
3
7
10
15
(day)
Water use efficiency (m3/Kg)
25
20
15
10
5
0
3
7
10
15
(day)

Fig.(9 Cont.) .

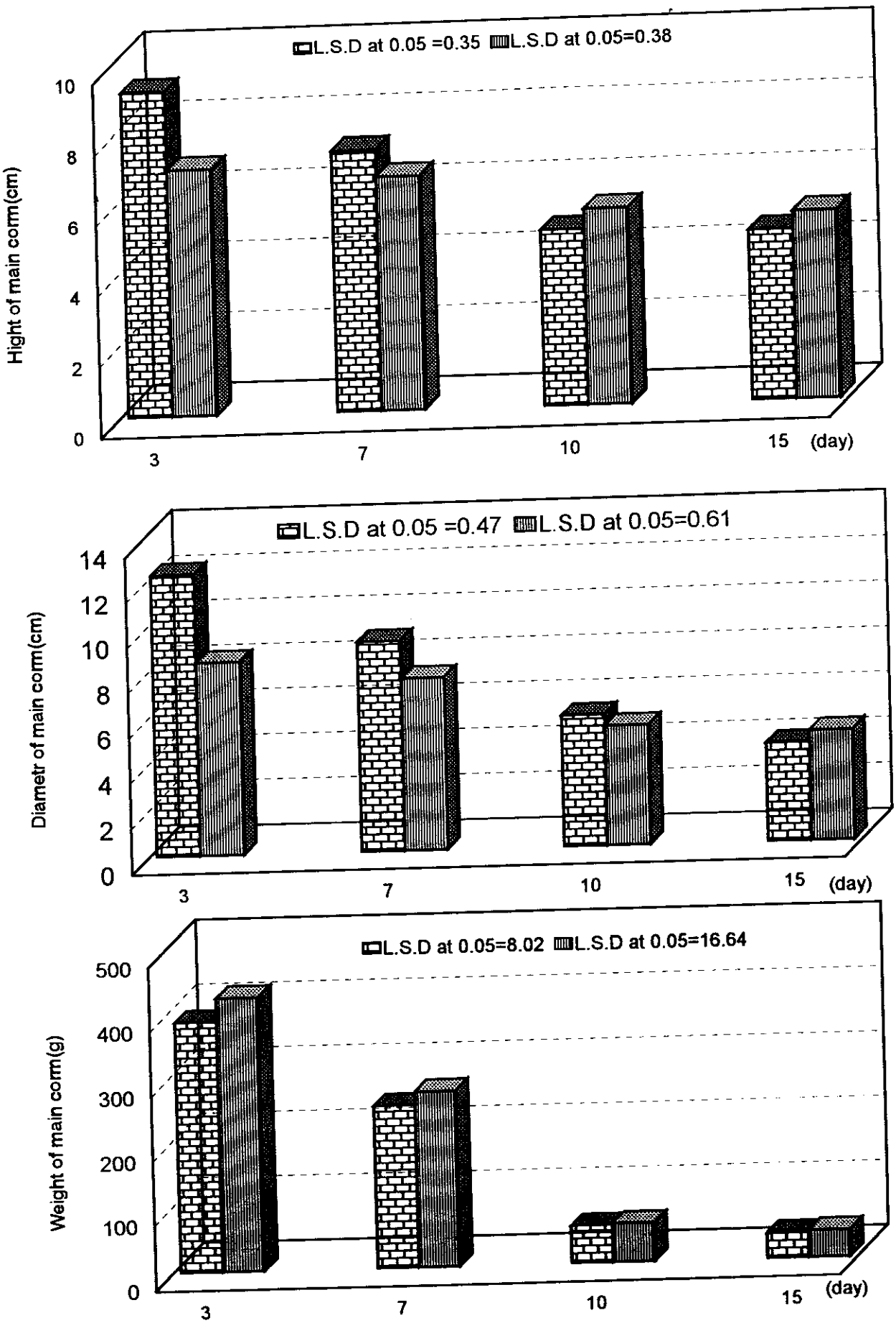

L.S.D at 0.05 =0.35
L.S.D at 0.05=0.38
Hight of main corm(cm)
0
2
4
6
8
10
3
7
10
15
(day)
L.S.D at 0.05 =0.47
L.S.D at 0.05=0.61
Diametr of main corm(cm)
0
2
4
6
8
10
12
14
3
7
10
15
(day)
L.S.D at 0.05=8.02
L.S.D at 0.05=16.64
Weight of main corm(g)
0
100
200
300
400
500
3
7
10
15
(day)

Fig. (9 Cont.).

On the other hand, water stress through increasing the irrigation periods up to 2 weeks by intervals led to a great depression in the yield and its components. Such decreasing in the total yield reached to 91.49% and 94.45 % during the first and the second season, respectively . From the aforementioned results, it could be concluded that irrigation is the major and detrimental factor for taro production. Obtained results can be explained on the base of the effect of irrigation treatments on vegetative growth Table (4) and Fig. (1) photosynthetic assimilates Table (6) and Fig. (3) and plant chemical constituents Table (8) and Fig. (5) which were increased with increasing irrigation frequencies.

Obtained results are in agreement with those reported by **Ezumah (1973), Carrilo** and **Urrutia (1979)** and **Ravi** and **Chowdhury (1991)** on taro. They reported that yield was increased with increasing soil water supply. 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),**all working on potato, found that water stress decreased yield and size of tubers.

IV-3-2- Effect of fertilization levels :

Concerning the effect of fertilization levels obtained data in Table (12) and Fig. (10) illustrate that the total yield per fed. and its component ,i.e. number and weight of cormels per plant , fresh weight , and diameter of main corm and yield per plant were significantly affected as a result of different used levels of fertilization.

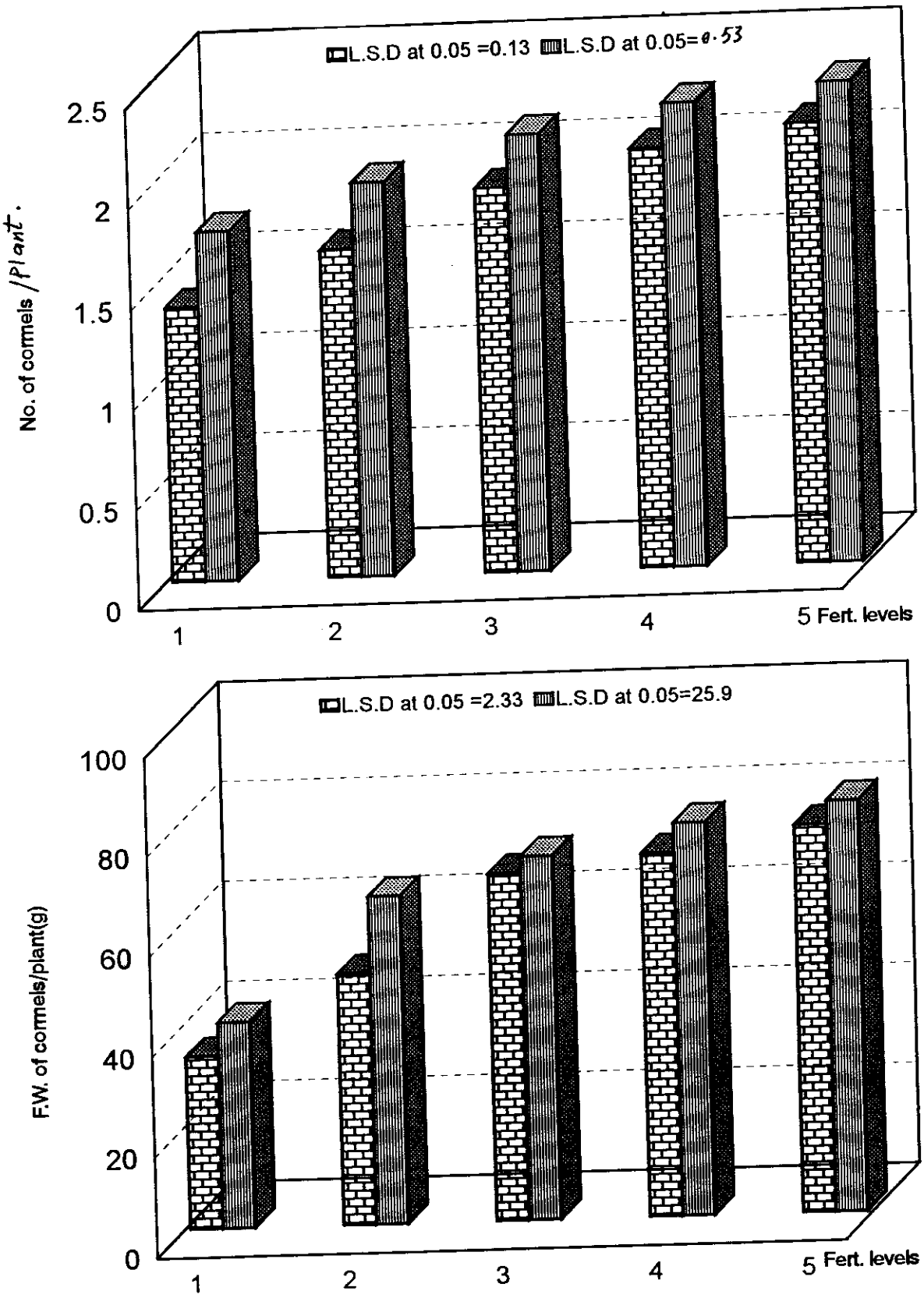
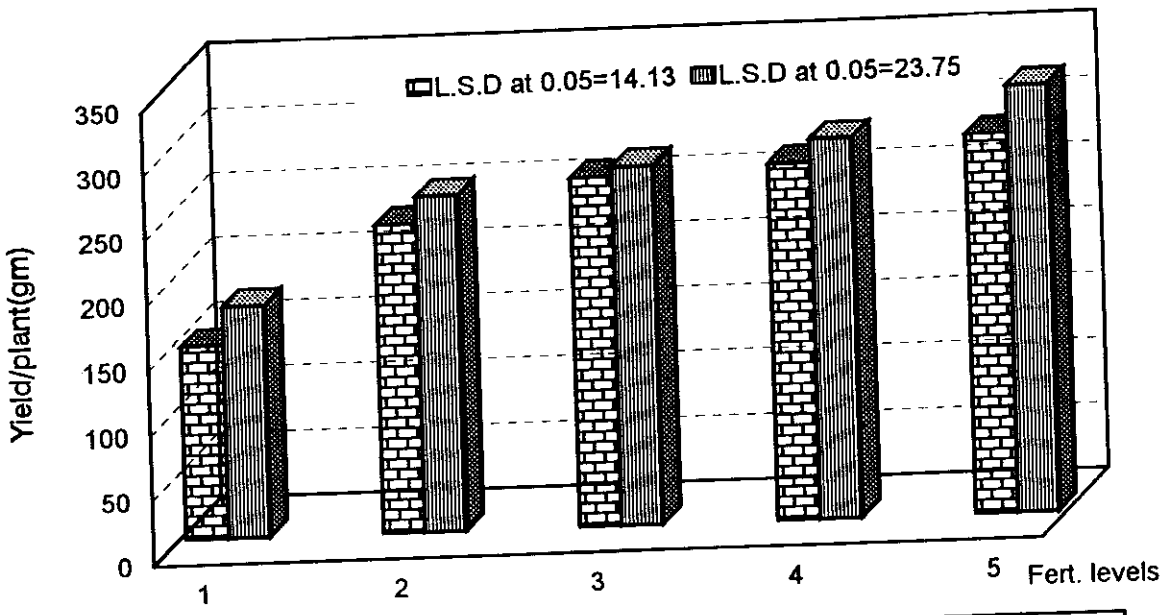
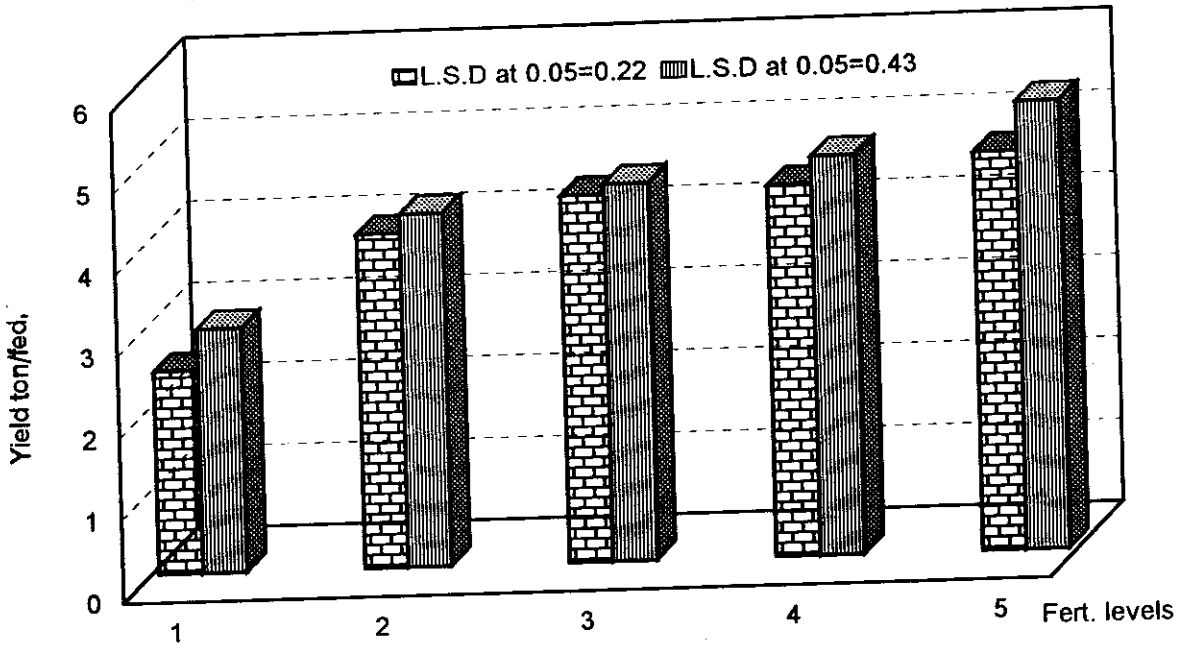
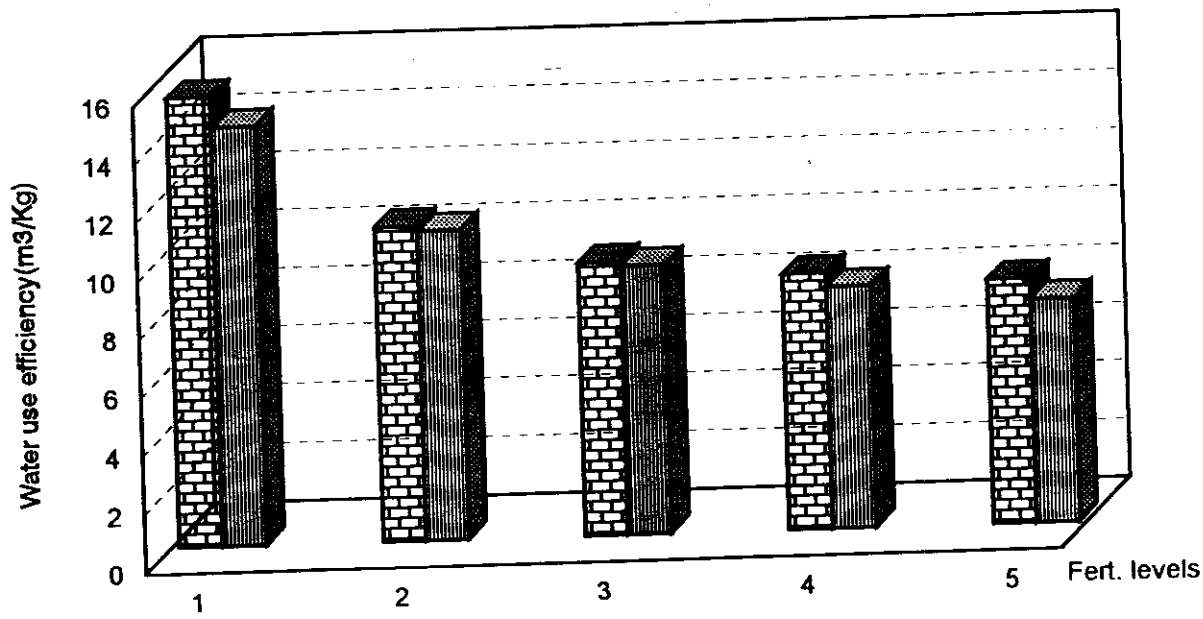


Fig. (10): Effect of fertilization level on total yield and its components of taro plants. during 1997 (▭) and 1998 (▭) seasons.


L.S.D at 0.05=14.13
L.S.D at 0.05=23.75
Yield/plant(gm)
350
300
250
200
150
100
50
0
1
2
3
4
5
Fert. levels


L.S.D at 0.05=0.22
L.S.D at 0.05=0.43
Yield ton/fed.
6
5
4
3
2
1
0
1
2
3
4
5
Fert. levels


Water use efficiency(m3/Kg)
16
14
12
10
8
6
4
2
0
1
2
3
4
5
Fert. levels

Fig(10 Cont.).

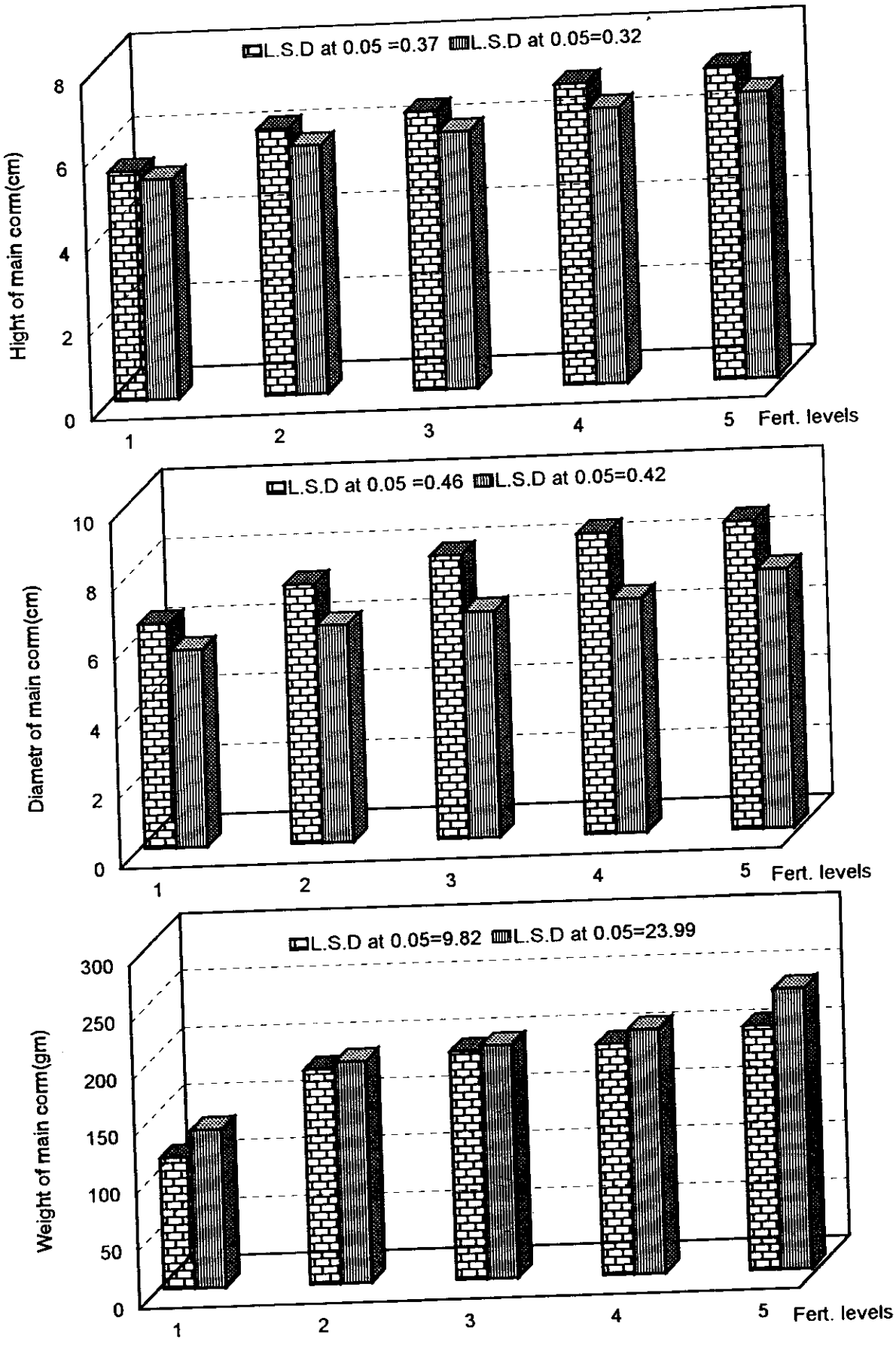

L.S.D at 0.05 =0.37
L.S.D at 0.05=0.32
Hight of main corn(cm)
0
2
4
6
8
1
2
3
4
5
Fert. levels
L.S.D at 0.05 =0.46
L.S.D at 0.05=0.42
Diametr of main corn(cm)
0
2
4
6
8
10
1
2
3
4
5
Fert. levels
L.S.D at 0.05=9.82
L.S.D at 0.05=23.99
Weight of main corn(gm)
0
50
100
150
200
250
300
1
2
3
4
5
Fert. levels

Fig.(10 Cont.) .

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 aforementioned studied yield components .

On the other hand, the lowest values were obtained in case of the control treatment .Obtained results may be attributed to the main role of such macronutrents on vegetative growth Table (4) and Fig. (2) and consequently such enhancing effect was reflected on the productivity of plant .In this regard , **Makram (1958), Das** and **Sethumadhavan (1980), Portieles *et al.* (1982), Ramaswamy *et al.* (1982), Barroso *et al* (1986), Portieles *et al.* (1988), Mohankumar** and **Sadanadan (1990) Mohankumar *et al.* (1990) , Abd El-Hamed (1993)** and **Verma *et al* (1996)** on taro and **Ahita *et al* (1981)** and **Kasele (1984)** and **Bioumy (1991)** ,on cassava, reported that applying nitrogen , phosphorus and potassium either in a single form or as a compound fertilizer increased the total produced yield . In addition , **Hossain** and **Rashid (1982)** and **Bhuyan** and **Quasem (1983)** on taro and **Cremaschi (1982)** on potato found that number of cormels/hill responded only to the highest nitrogen rate .

IV-3-3- Effect of Interaction between irrigation intervals and fertilization levels :

As for the effect of the Interaction between irrigation intervals and fertilization levels on plant yield , data in Table (13) show clearly that total produced yield and its studied 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

Table (13) : Effect of interaction between irrigation intervals and NPK fertilization levels on taro yield and its components .

1997 season									
Treatments		Cormels/plant		Main corm			Total yield		Water use efficiency (m^3/kg)
Irrigation interval (days)	NPK Fertilizer level	Number	Weight (g)	Length (cm)	Diameter (cm)	Fresh weight	Plant (gm)	Ton/fed.	
½	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
	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	438.20	672.02	11.200	1.50
1	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
	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	268.0	301.21	5.020	3.36
	5	1.79	40.70	8.52	11.52	307.31	348.01	5.800	2.91
1½	1	1.0	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
	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
2	1	1.0	5.21	4.0	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
	3	1.12	10.0	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	43.0	59.15	0.985	17.16
L. S. D. at 0.05		0.26	10.13	0.75	0.92	19.64	28.27	0.44	

Table : (13 Cont.) .

1998 season									
Treatments		Cormels/plant		Main corm			Total yield		Water use efficiency (m^3/kg)
Irrigation interval (weeks)	NPK Fertilizer levels	Number	Weight (g)	Length (cm)	Diameter (cm)	Fresh weight	Plant (gm	Ton/fed.	
½	1	2.46	118.0	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
	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	435.0	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	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
	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
1½	1	1.68	9.0	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
	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	6.0	6.40	73.23	96.06	1.601	10.90
2	1	1.0	7.20	4.27	3.56	29.40	36.6	0.610	28.61
	2	1.25	7.95	5.0	4.50	40.83	48.78	0.813	21.46
	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		1.20	5.37	N.S	N.S	47.98	47.50	0.87	

used levels of NPK fertilizers . Obtained results are true during both seasons of this study. In this regard, **Abd-El-Rahman (1990)** indicated that the highest total yield and its components for carrot plant were obtained in case of the highest used quantity of water and application of NPK fertilization at rate of (40 kgN+32kg P_2o_5+100kg K_2o/fed.) .

IV-4- Water use efficiency :

IV-4-1- Effect of irrigation intervals :

Concerning the water use efficiency (expressed as m^3/kg produced yield) as affected by applied water frequency , data in Table (12) and Fig. (9) indicate 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 growth . 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 irrigations throughout the two growing seasons, respectivily. This means that the water use efficiency was increased with increasing the applied quantity of water .

IV- 4-2- Effect of fertilization levels :

With respect to the effect of NPK fertilizers on water use efficiency date in Table (12) and Fig. (10) show clearly that the amounts of water required to produce one kg of corms was decreased with increasing the used levelsof NPK fertilizers during