RESULTS AND DISCUSSION

The collected data could be presented and disscussed under the following topics:

I. Effect of irrigation regime, nitrogen fertilizer level, planting density and their interactions on growth characters of the plant crop sugar cane.

II. Effect of irrigation regime, nitrogen fertilizer level, planting density and their interactions on cane quality and chemical attributes of the plant crop sugar cane.

III. Effect of irrigation regime, nitrogen fertilizer level and planting density, and their interactions on yield and yield components of the plant crop sugar cane.

IV. Water use efficiency (W.U.E.).

I. Effect of Irrigation Regime, Nitrogen Fertilizer Level, Planting Density and Their Ineractions on Growth Characters of the Plant Crop Sugar Cane at Different Growth Stages:

1. Number of plants/m:

Sugar cane is propagated vegetatively by planting stem cuttings (setts) from which axillary buds grow to produce primary stalks (main stem). Secondary and tertiary stalks (tillers) are produced at the base of the primary stalks. The number of plants emergened on soil surface is mainly affected by agronomical treatments as well as genetical make-up.

Means of the number of plants/m at different samplang dates as affected by irrigation regime, nitrogen fertilizer levels, planting density and their interactions on the plant crop sugar cane in 1994/1995 and 1995/1996 seasons are presented in Tables (4) and (5).

Results obtained showed that there was no significant effect on the number of sugar cane plants due to the used water regimes at the various growth stages in both seasons. However, it was observed that the second water regime positively affected number of plants/m at 120 and 150 days from planting as well as in both seasons, compared with the traditional regime (first regime) and the third irrigation regime as well.

Table (4) Effect of irrigation regime, N fertilizer level, planting density and their interactions on number of plants/m in 1994/1995 growing season.

Irrigation regime	Nitrogen	120 days			150 days		
Season and Irrigation Interval	kg N/ Fed.	Planting density		Average	Planting density		Average
		1.5 drill	2 drills		1.5 drill	2 drills	
1. Summer (10-day), Moderates (15-day) and Winter (20-day)	120	17.000	17.600	**17.300**	16.850	17.750	**17.300**
	180	18.100	16.550	**17.325**	17.950	18.100	**18.025**
	240	16.950	20.100	**18.525**	15.900	19.650	**17.775**
Average		**17.350**	**18.083**	**17.717**	**16.900**	**18.500**	**17.700**
2. Summer (7-day), Moderates(14-day) and Winter (21-day)	120	19.500	18.100	**18.800**	18.300	17.450	**17.875**
	180	18.700	16.800	**17.750**	16.950	18.000	**17.475**
	240	17.150	20.200	**16.675**	17.500	19.150	**18.325**
Average		**18.450**	**18.367**	**18.408**	**17.583**	**18.200**	**17.892**
3. Summer (14-day), Moderates (21-day) and Winter (28-day)	120	15.400	18.350	**16.875**	16.700	16.800	**16.750**
	180	19.200	17.650	**18.425**	16.450	17.200	**16.825**
	240	17.400	18.200	**17.800**	17.800	18.100	**17.950**
Average		**17.333**	**18.067**	**17.700**	**16.983**	**17.367**	**17.175**
Interaction of Nitrogen X Planting density	120	17.300	18.017	**17.658**	17.283	17.333	**17.308**
	180	18.667	17.000	**17.833**	17.117	17.767	**17.442**
	240	17.167	19.500	**18.333**	17.067	18.967	**18.017**
Total average of planting density		**17.711**	**18.172**	**17.942**	**17.156**	**18.022**	**17.589**

L.S.D at 5 % level for:

		120 days	150 days
Irrigation regime	(A)	NS	NS
N level	(B)	NS	NS
Planting density	(C)	NS	0.826
AxB		NS	NS
AxC		NS	NS
BxC		1.762	NS
AxBxC		NS	NS

Table (5) Effect of irrigation regime, N fertilizer level, planting density and their interactions on number of plants/m in 1995/1996 growing season.

Irrigation regime	Nitrogen	120 days			150 days		
Season and Irrigation Interval	kg N/ Fed.	Planting density		Average	Planting density		Average
		1.5 drill	2 drills		1.5 drill	2 drills	
1. Summer (10-day),	120	12.650	15.000	**13.825**	13.065	15.000	**14.033**
Moderates (15-day) and	180	14.100	15.250	**14.675**	14.135	14.425	**14.280**
Winter (20-day)	240	14.550	14.550	**14.550**	15.780	14.495	**15.138**
Average		**13.767**	**14.933**	**14.350**	**14.327**	**14.640**	**14.483**
2. Summer (7-day),	120	14.950	15.800	**15.375**	14.570	14.656	**14.568**
Moderates(14-day) and	180	15.220	15.700	**15.450**	15.355	14.855	**15.105**
Winter (21-day)	240	14.250	14.950	**14.600**	13.710	16.995	**15.352**
Average		**14.800**	**15.483**	**15.142**	**14.445**	**15.472**	**15.008**
3. Summer (14-day),	120	11.950	12.650	**12.300**	12.285	14.780	**13.532**
Moderates (21-day) and	180	13.250	16.400	**14.825**	13.065	13.425	**13.245**
Winter (28-day)	240	14.100	14.100	**14.100**	13.710	13.355	**13.533**
Average		**13.100**	**14.383**	**13.742**	**13.020**	**13.853**	**13.437**
Interaction of	120	13.183	14.483	**13.833**	13.307	14.782	**14.044**
Nitrogen X	180	14.183	15.783	**14.983**	14.185	14.235	**14.210**
Planting density	240	14.300	14.533	**14.417**	14.400	14.948	**14.674**
Total average of planting density		13.889	14.932	14.112	13.964	14.655	14.309

L.S.D at 5 % level for:

Irrigation regime (A)	NS	NS
N level (B)	NS	NS
Planting density (C)	NS	NS
AxB	NS	NS
AxC	NS	NS
BxC	NS	NS
AxBxC	NS	2.393

In 1994/1996 season, the application of the second water regime insignificantly increased number of stalks/m by 3.9 and 6.24% at 120 days from planting, compared with the first (traditional) and third regime, respectively. Also, in the same season, the second regime insignificantly increased number of stalks/m by 1.08 and 4.17% at 150 days from planting compared with the first and third regime, respectively. Similarly, in 1995/1996 season, the second irrigation regime insignificantly increased number of stalks/m by 5.25 and 10.19% at 120 days from planting compared with the first and third irrigation regimes, respectively. Also, in the same season and at 150 days from planting, increases of 3.62 and 11.69% were recorded in number of stalks/m due to applying the second regime compared with the first and third regimes.

It could be concluded that scheduling irrigation rotations at shorter intervals of the second regime favourably affected number of stalks/m compared with adopting irrigation at longer intervals in the first and third regimes. However, all differences in number of stalks/m due to irrigation regimes were not great enough to reach the level of significance.

The data presented in Table (2) showed that the amount of water applied in the second regime at 120 days in 1994/1995 season was 4964.3 m^3 against 3879.1 and 4032.2 in the first and third regime, respectively. Also, in 1995/1996 season, 5423.8 $m^3$of water were applied to cane plants in the second regime against 4073.8 and 4272.8 m^3 with the first and third regime, respectively. Similarly, at 150 days, the amount of water applied to cane plants increased by 26 and 27% compared with the first and third regime in the first season, corresponding to 32 and 31% in the second season for the respective regimes.

Such result may be due to the availability of sufficient moisture around sugar cane cuttings by reducing irrigation intervals (in April, May, June, July and August) leading to accelerate bud growth and root development which ensured sprouting and germination.

The present results are in general agreement with those reported by **Lakshmikantham (1983)** who found that increasing water content of the setts increased the moisture in the bud and root primordia until they attained the critical level when sprouting was hastened.

Concerning the effect of N level, results in Tables (4 and 5) indicated no significant effect of N level on number of stalks/m either at 120 or 150 days from planting as well as in both seasons. However, in most cases, the increase in N level insignificantly increased number of stalks/m at both growth stages and in both seasons. In 1994/1995, increasing N level from 120 to 180 and 240 kg/ fed insignificantly increased number of stalks/m by 0.99 and 3.82% at 120 days from planting, respectively. Similarly, increases of 0.77 and 4.10% due to increasing N level from 120 to 180 and 240 kg/fed were observed at 150 days from planting in the same season.

In 1995/1996 season, the increase in N level from 120 to 180 kg/fed insignificantly increased number of stalks/m by 8.31 and 1.18% at 120 and 150 days from planting, respectively. Similarly, increasing N level from 120 to 240 kg/fed in 1995/1996 insignificantly increased number of stalks/m by 4.22 and 4.49% at 120 and 150 days, respectively. However, all these increases were below the significant level.

It could generally concluded that the increases in N level favourably affected stalks number/m at the different stages of growth. This result may be due to the role of N in stimulating plant growth and the production of plant organs.

The present results are in general agreement with those reported by **Jayabal *et al.* (1989)** and **Abd El-Gawad *et al.* (1992-a)**.

Planting density markedly affected number of stalks/m as showedn in Tables (4 and 5) The effect of planting density on number of stalks/m reached the significant level in one case only, being at 150 days from planting in 1994/1995 season.

In general, it was observed, that planting double drills increased number of stalks/m by 2.60 and 7.51% at 120 days in the first and second season, respectively when compared with growing 1.5 drill. Similarly, double drills surpassed 1.5 drill in number of stalks/m at 150 days from planting by 5.05 and 4.95% in 1994/1995 and 1995/1996 season, respectively.

It could be concluded that growing double drills produced higher number of cane plants/m. The present result coincides with that obtained by **Ahmed (1995)**.

Interaction Effects:

Results in Table (4) indicated that the interaction between Nitrogen level and planting density significantly affected number of stalks/m at 120 days from planting in 1994/1995 season.

The results showed clearly that double drills outnumbered 1.5 drill at 120 and 240 kg/fed N levels, but on the other hand, 1.5 drill outnumbered double drills at 180 kg N/fed Also, the highest number of stalks/m was recorded at 180 kg N/fed by growing 1.5 drill, whereas by growing double drills, the highest number of stalks was recorded at 240 kg N/fed level.

In general, the maximum number of stalks/m at 120 days in 1994/1995 season was 19.500 which was recorded by growing double drills supplied with 240 kg N/fed

Also, results in Table (5) showed that the second order interaction was sgnificant on number of stalks/m at 150 days in 1995/1996 season. These results revealed that the maximum number of stalks /m at this stage was 16.995 which was recorded by applying the second irrigation regime and growing double drills combined with 240 kg N /fed

All other effects of interaction were not significant.

2. Stalk height:

Tables (6 and 7) reveals the effect of irrigation regimes, nitrogen fertilizer level, planting density and their interactions on stalk height (cm) of the plant crop sugar cane at different sampling dates in 1994/1995 and 1995/1996 seasons.

Results showed that there was no significant response in respect to stalk height could be referred to the used water regimes at all sampling dates in both growing seasons. Meanwhile, it could be observed that the most

Table (6) Effect of irrigation regime, N fertilizer level, planting density and their interactions on stalk height (cm) in 1994/1995 growing season.

	Nitrogen	135 days		Average	200 days		Average	265 days		Average	330 days		Average
	kg N/	Planting density			Planting density			Planting density			Planting densi[illegible]		
	Fed.	1.5 drill	2 drills		1.5 drill	2 drills		1.5 drill	2 drills		1.5 drill	2 dr[illegible]	
	120	138.300	165.500	**150.900**	244.500	264.800	**245.650**	296.000	289.000	**292.500**	319.550	310.[illegible]00	**315.175**
d	180	139.700	148.200	**143.950**	234.000	251.500	**242.750**	292.500	305.100	**298.800**	303.150	330.[illegible]00	**316.575**
	240	148.800	156.800	**152.800**	252.500	251.500	**253.250**	304.800	308.600	**306.700**	319.300	323.[illegible]00	**321.550**
		142.267	**156.167**	**149.217**	**244.667**	**255.767**	**250.217**	**297.767**	**300.900**	**299.333**	**314.000**	**321.[illegible]33**	**317.767**
	120	156.200	166.000	**161.100**	245.500	261.500	**235.500**	307.800	296.300	**302.050**	315.000	325.[illegible]00	**320.400**
	180	162.300	148.800	**155.550**	260.500	263.000	**261.750**	308.150	297.300	**302.725**	321.500	325.[illegible]00	**323.650**
	240	158.200	173.100	**165.650**	275.800	270.500	**264.150**	296.150	325.300	**310.725**	317.500	342.[illegible]00	**330.000**
		158.900	**162.633**	**160.767**	**254.600**	**265.000**	**259.800**	**304.033**	**306.300**	**305.167**	**318.000**	**331.[illegible]67**	**324.688**
	120	135.700	125.100	**143.900**	232.000	245.000	**238.500**	273.450	272.150	**272.800**	302.450	302.[illegible]50	**302.450**
nd	180	142.600	135.400	**139.000**	259.000	247.500	**253.250**	289.300	304.300	**296.800**	314.100	324.[illegible]50	**319.525**
	240	141.400	155.100	**148.250**	254.500	250.000	**252.250**	291.150	315.800	**303.475**	300.800	342.[illegible]50	**321.650**
		139.900	**147.533**	**143.717**	**248.500**	**247.500**	**248.000**	**284.633**	**297.417**	**291.025**	**305.783**	**323.[illegible]83**	**314.533**
	120	143.400	160.533	**151.967**	240.676	257.100	**248.883**	292.417	285.817	**289.117**	312.333	313.[illegible]17	**312.675**
	180	148.200	144.133	**146.167**	251.167	254.000	**252.583**	296.650	302.233	**299.442**	312.917	326.[illegible]17	**319.917**
	240	149.467	161.667	**155.567**	255.933	257.167	**256.550**	297.367	316.567	**306.967**	312.533	336.[illegible]50	**324.392**
ting density		**147.002**	**155.444**	**151.233**	**249.256**	**256.089**	**252.672**	**295.478**	**301.539**	**298.805**	**312.594**	**325.[illegible]94**	**318.994**

NS	NS	NS	NS
6.797	NS	11.846	NS
5.550	6.080	NS	9.560
NS	NS	NS	NS
NS	NS	NS	NS
9.612	NS	NS	NS
NS	NS	NS	NS

Table (7) Effect of Irrigation regime, N fertilizer level, planting density and their interactions on stalk height (cm) in 1995/1996 growing season.

Irrigation regime: Season and Irrigation Interval	Nitrogen kg N/ Fed.	135 days Planting density 1.5 drill	135 days 2 drills	Average	200 days Planting density 1.5 drill	200 days 2 drills	Average	265 days Planting density 1.5 drill	265 days 2 drills	Average	330 days Planting density 1.5 drill	330 days 2 drill	Ave[rage]
1. Summer (10-day), Moderates (15-day) and Winter (20-day)	120	182.000	200.000	191.000	266.500	270.500	268.500	276.000	287.5000	281.750	303.350	303.900	303
	180	187.500	187.000	187.250	261.000	270.5000	265.750	280.5000	293.000	286.750	305.250	311.250	308
	240	189.5000	187.200	188.350	260.000	262.000	261.000	286.000	285.500	285.750	299.350	305.450	302
Average		186.333	191.400	188.867	262.500	267.667	265.083	280.833	288.667	284.750	302.650	306.867	304.
2. Summer (7-day), Moderates(14-day) and Winter (21-day)	120	189.700	189.000	189.350	274.500	261.500	268.000	289.000	287.000	288.000	305.850	297.800	301.
	180	196.000	196.500	196.250	271.000	275.500	273.250	303.000	284.500	293.750	309.300	311.500	310.
	240	185.600	191.400	188.500	258.500	270.00	264.250	293.500	293.000	293.250	308.700	320.600	314.
Average		190.433	192.300	191.367	268.000	269.00	268.500	295.167	288.167	291.667	307.950	309.967	308.
3. Summer (14-day), Moderates (21-day) and Winter (28-day)	120	193.000	177.800	185.400	261.000	260.500	260.750	277.000	287.500	282.250	297.900	301.100	299.5
	180	189.500	187.300	188.400	263.000	270.500	266.750	277.500	288.000	282.750	309.700	299.900	304.8
	240	180.000	182.100	181.050	258.500	265.000	261.750	290.000	282.000	286.000	292.950	304.9000	298.9
Average		187.500	182.400	184.950	260.833	265.333	263.083	281.500	285.833	283.667	300.183	301.967	301.0
Interaction of Nitrogen X Planting density	120	188.233	188.933	188.583	267.333	264.167	265.750	280.667	287.333	284.000	302.367	300.933	301.6
	180	191.000	190.267	190.633	265.000	272.167	268.583	287.000	288.500	287.750	308.083	307.550	307.8
	240	185.033	186.900	185.967	259.000	265.667	262.333	289.833	286.833	288.333	300.333	310.317	305.32
Total average of planting density		188.089	188.700	188.394	263.778	267.333	265.556	285.833	287.556	286.694	303.594	306.267	304.93

L.S.D at 5 % level for:	135 days	200 days	265 days	330 days
Irrigation regime (A)	NS	NS	NS	NS
N level (B)	NS	NS	NS	NS
Planting density (C)	NS	NS	NS	NS
AxB	NS	NS	NS	NS
AxC	NS	NS	NS	NS
BxC	NS	NS	NS	NS
AxBxC	NS	NS	NS	NS

frequent irrigation (The second irrigation regime) mostly gave the highest stalk length followed by the traditional water regime (Irrigating at average intervals of 10 days in Summer, 15 days in Spring, Autumn and 20 days in Winter), then the least frequent irrigation treatment.

The results in Table (5) showed that in 1994/1995 season , stalk height at 135 days insignificantly increased due to applying the second irrigation regime by 7.74 and 11.86% over the first regime (traditional regime) and the third regime, respectively. The corresponding increase in stalk hight due to the second regime at the same period in 1995/1996 season was 1.32 and 3.47% compared with the first and third regime, respectively. Similarly, the second regime insignificantly increased stalk height compared with the first regime (traditional) by 3.83, 1.95 and 2.18% at 200, 265 and 330 days in 1994/1995 respectively. The corresponding increases in plant height in 1995/1996 season were 1.30, 2.43 and 1.01%, for the respective growth periods.

The second irrigation regime positively affected stalk height compared with the third regime where increases in plant height of 4.76, 4.86 and 3.23% at 200, 265 and 330 days in 1994/1995, respectively, corresponding to 2.06, 2.82 and 2.62% for the same respective growth stages in 1995/1996 season.

It could be concluded that scheduling irrigation at 7-day intervals in Summer, 14-day in Spring and Autumn, 21-day in Winter positively affected stalk height of sugar cane through out the different growth stages. However, the increases were below the level of significance, probably due to high experimental error.

The good effect of the second regime is mainly due to the shorter intervals of irrigation throughout the growing season, particularly during the Summer season.

The data presented in Table (1) showed that the amount of water applied in the second regime was higher than that applied in the first regime by 21.1, 22.5, 23.7 and 19.7% at 135, 200, 265 and 330 days, respectively in the first season, corresponding to 27.1, 28.0, 28.5 and 24.0% in the second season at the same growth stages. Similarly, in the second irrigation regime, the amount of irrigation water was increased by 23.4, 28.5, 29.8 and 28.6%

over the third regime at 135, 200, 265 and 330 days, respectively in 1994/1995 season, corresponding to 20.1, 31.5, 31.8 and 30.5% in 1995/1996 season.

The present results are in general agreement with those obtained by **Lakshmikantham (1983)** who stated that growth is largely a process of cell elongation associated with intake of water and a close relationship exists between the water content of cane plant and its elongation rate.

The results in Tables (6 and 7) indicated that the increase in N level almost increased stalk height at the different stages but without significant differences except at 135 and 265 days from planting in 1994/1995 season where the differences in plant height reached the level of significance.

The results showed that increasing N level from 120 to 240 kg/fed increased stalk height by 2.37, 3.45, 6.17 and 3.75% at 135, 200, 265 and 330 days from planting, respectively in 1994/1995 season. The increases in stalk height in 1995/1996 season due to increasing N level from 120 to 240 kg/fed were very slight even a reduction in plant height was recorded at 135 and 200 days. The effect of N in the second season was not evident on stalk height as in the first season.

It was observed in 1995/1996 season, that the 180 Kg N level was more effective on stalk height than the higher level. In that season, increasing N level from 120 to 180 kg/fed induced an increase of 1.09, 1.07, 1.32 and 2.04% at 135, 200, 265 and 330 days, respectively.

The present results are in general agreement with those reported by **Abd El-Gawad *et al.* (1992-a)**.

Concerning the effect of planting density on stalk height, results in Tables (6 and 7) indicated that using double drills increased stalk height at all growth stages as well as in both seasons. The effect of planting density on stalk height recorded the significant level at 3 growth stages (at 135, 200 and 330 days) in 1994/1995 season, but in 1995/1996 season all differences were below the level of significance.

The results showed that growing double drills increased stalk height by 5.74, 2.74, 2.05 and 4.09% at 135, 200, 265 and 330 days from planting, respectively compared with growing 1.5 drill. The corresponding increases in 1995/1996 season were 0.32, 1.35, 0.60 and 0.88% at the same growth stages.

It is quite evident that the effect of planting density on plant height was more evident in the first season, probably due to the environmental conditions prevailing in that season.

The increase in stalk height by growing double drills is mainly due to the increase in competition for light within plants at denser population leading to the elongation of internodes and consequently taller plants.

Interaction Effects:

The results in Tables (6 and 7) indicated that all effects of the interaction between the stuied factors on stalk height were not significant except that between N level and planting density at 135 days in 1994/1995 season.

The results in Table (6) showed that at 135 days in 1994/1995 season, growing double drills produced taller stalks than 1.5 drill at 120 and 240 kg N level, whereas at 180 kg N level, growing 1.5 drill increased stalk height over double drills.

In general, the highest plant height was 161.67 cm which was recorded by growing double drills and applying 240 kg N/fed at 135 days in 1994/1995 growing seasons.

3. Stalk diameter:

Results in Tables (8 and 9) showed the effects of irrigation regime, N fertilizer level, planting density and their interactions on stalk diameter of the plant crop sugar cane at four different growth stages in 1994/1995 and 1995/1996 seasons.

Table (8) Effect of irrigation, N fertilizer, planting density and their interactions on stalk diameter (cm) in 1994/1995 growing season.

Irrigation regime	Nitrogen	135 days			200 days			265 days			330 days		
Season and Irrigation Interval	kg N/ Fed.	Planting density		Average	Planting density		Average	Planting density		Average	Planting density		Average
		1.5 drill	2 drills		1.5 drill	2 drills		1.5 drill	2 drills		1.5 drill	2 drill	
1. Summer (10-day),	120	2.440	2.550	2.495	2.510	2.560	2.535	2.715	2.810	2.762	2.855	2.950	2.903
Moderates (15-day) and	180	2.470	2.550	2.510	2.630	2.600	2.615	2.795	2.665	2.730	2.935	2.805	2.870
Winter (20-day)	240	2.620	2.500	2.560	2.640	2.560	2.600	2.830	2.895	2.863	2.970	3.035	3.002
Average		2.510	2.533	2.522	2.593	2.573	2.583	2.780	2.790	2.785	2.920	2.930	2.925
2. Summer (7-day),	120	2.610	2.580	2.595	2.670	2.570	2.620	2.530	2.780	2.655	2.670	2.925	2.797
Moderates(14-day) and	180	2.730	2.710	2.720	2.670	2.620	2.645	2.810	2.880	2.845	2.960	3.025	2.993
Winter (21-day)	240	2.710	2.590	2.650	2.580	2.670	2.625	3.005	2.845	2.925	3.155	3.000	3.077
Average		2.683	2.627	2.655	2.640	2.620	2.630	2.782	2.835	2.808	2.928	2.983	2.956
3. Summer (14-day),	120	2.420	2.380	2.400	2.570	2.300	2.435	2.715	2.615	2.665	2.845	2.750	2.798
Moderates (21-day) and	180	2.420	2.430	2.425	2.570	2.460	2.515	2.600	2.765	2.683	2.740	2.900	2.820
Winter (28-day)	240	2.460	2.370	2.415	2.600	2.650	2.580	2.800	2.480	2.640	2.940	2.615	2.778
Average		2.433	2.393	2.413	2.580	2.440	2.510	2.705	2.620	2.663	2.842	2.755	2.798
Interaction of	120	2.490	2.503	2.497	2.583	2.477	2.530	2.653	2.735	2.694	2.790	2.875	2.833
Nitrogen X	180	2.540	2.563	2.552	2.623	2.560	2.592	2.735	2.770	2.752	2.878	2.910	2.894
Planting density	240	2.597	2.487	2.542	2.607	2.597	2.602	2.878	2.740	2.809	3.002	2.883	2.952
Total average of planting density		2.542	2.518	2.530	2.604	2.544	2.574	2.756	2.748	2.752	2.897	2.889	2.893

L.S.D. at 5% level for:

	135 days	200 days	265 days	330 days
Irrigation regime (A)	NS	NS	NS	NS
N level (B)	NS	NS	NS	NS
Planting density (C)	NS	NS	NS	NS
AxB	NS	NS	NS	NS
AxC	NS	NS	NS	NS
BxC	NS	NS	NS	NS
AxBxC	NS	NS	NS	NS

Table (9) Effect of irrigation regime, N fertilizer level, planting density and their interactionon on stalk diameter (cm) in 1995/1996 growing season.

Irrigation regime	Nitrogen	135 days			200 days			265 days			330 days		
Season and Irrigation Interval	kg N/ Fed.	Planting density		Average	Planting density		Average	Planting density		Average	Planting density		Averag
		1.5 drill	2 drills		1.5 drill	2 drills		1.5 drill	2 drills		1.5 drill	2 drill	
1. Summer (10-day),	120	2.490	2.370	**2.430**	2.420	2.490	**2.455**	2.660	2.490	**2.575**	2.715	2.690	**2.703**
Moderates (15-day) and	180	2.500	2.530	**2.515**	2.650	2.540	**2.595**	2.680	2.680	**2.680**	2.805	2.750	**2.778**
Winter (20-day)	240	2.510	2.360	**2.435**	2.640	2.570	**2.605**	2.800	2.655	**2.728**	2.880	2.685	**2.783**
Average		**2.500**	**2.420**	**2.460**	**2.570**	**2.533**	**2.525**	**2.713**	**2.608**	**2.661**	**2.800**	**2.708**	**2.754**
2. Summer (7-day),	120	2.480	2.560	**2.520**	2.560	2.570	**2.565**	2.700	2.660	**2.680**	2.755	2.735	**2.745**
Moderates(14-day) and	180	2.640	2.510	**2.475**	2.640	2.450	**2.590**	2.730	2.700	**2.715**	2.840	2.770	**2.805**
Winter (21-day)	240	2.480	2.410	**2.445**	2.780	2.560	**2.670**	2.800	2.720	**2.760**	2.830	2.725	**2.778**
Average		**2.533**	**2.493**	**2.513**	**2.660**	**2.557**	**2.608**	**2.743**	**2.693**	**2.718**	**2.808**	**2.743**	**2.776**
3. Summer (14-day),	120	2.400	2.470	**2.435**	2.460	2.480	**2.470**	2.660	2.420	**2.540**	2.590	2.615	**2.602**
Moderates (21-day) and	180	2.510	2.540	**2.525**	2.520	2.610	**2.565**	2.700	2.690	**2.695**	2.900	2.710	**2.805**
Winter (28-day)	240	2.560	2.440	**2.500**	2.555	2.530	**2.542**	2.595	2.570	**2.542**	2.780	2.810	**2.795**
Average		**2.490**	**2.483**	**2.487**	**2.512**	**2.540**	**2.526**	**2.652**	**2.560**	**2.606**	**2.575**	**2.712**	**2.734**
Interaction of	120	2.457	2.467	**2.462**	2.480	2.513	**2.497**	2.673	2.523	**2.598**	2.687	2.680	**2.683**
Nitrogen X	180	2.550	2.529	**2.538**	2.603	2.563	**2.583**	2.2.703	2.690	**2.697**	2.848	2.743	**2.796**
Planting density	240	2.517	2.403	**2.460**	2.658	2.535	**2.606**	2.732	2.648	**2.690**	2.830	2.740	**2.782**
Total average of planting density		**2.508**	**2.466**	**2.487**	**2.581**	**2.543**	**2.562**	**2.703**	**2.621**	**2.662**	**2.788**	**2.721**	**2.755**

L.S.D at 5 % level for:

	135 days	200 days	265 days	330 days
Irrigation regime (A)	0.023	0.043	NS	NS
N level (B)	NS	0.061	0.061	0.074
Planting density (C)	NS	NS	0.050	0.061
AxB	NS	NS	NS	NS
AxC	NS	NS	NS	NS
BxC	NS	NS	NS	NS
AxBxC	NS	NS	NS	NS

The results showed that irrigation intervals of the second regime, including Summer intervals of 7 days, Spring and Autumn intervals of 14 days and Winter intervals of 21 days, positively affected stalk diameter compared with the first (traditional) regime (10-15-20 days) and the third regime (14-21-28 days). It is also evident that the effect of irrigation regime on stalk diameter was more clear in 1995/1996 season than in 1994/1995 season where differences in stalk diameter at three stages out of four were significant (Table 9).

The results indicated that scheduling irrigation of the second regime increased stalk diameter of sugar cane by 5.27, 1.82, 0.83 and 1.06% at 135, 200, 265 and 330 days, respectively, compared with the traditional regime in 1994/1995 season. The corresponding increases in 1995/1996 season were 2.15, 3.29, 2.14 and 0.80% at the same respective growth stages. Similarly, applying the second regime increased stalk diameter over the third regime by 10.03, 4.78, 5.44 and 5.56% at 135, 200, 265 and 330 days, respectively in 1994/1995, being 1.05, 3.25, 4.30 and 1.54% for the respective growth periods in 1995/1996 season.

Significant differences in this trait were only observed in 1995/1996 season.

It could be concluded that reducing irrigation intervals affected stalk diameter of sugar cane due to increase in the amount of irrigation water.

Concerning the effect of N level, the results in Table (8 and 9) showed that increasing N level from 120 to 180 and 240 kg/fed increased stalk diameter. Significant effect for N level on stalk diameter was detected in 1995/1996 season at three stages out of four.

The results revealed that increasing N level from 120 to 180 kg/fed increased stalk diameter by 2.20, 2.45, 2.15 and 2.15%, respectively at 135, 200, 265 and 330 days in 1994/1995 season, corresponding to 3.09, 3.44, 3.18 and 4.21% in 1995/1996 season. Similarly, increasing N level from 120 to 240 kg/fed increased stalk diameter at the respective growth stages by 1.80, 3.96, 4.27 and 4.20% in 1994/1995, corresponding to (- 0.08), 4.37, 3.54 and 3.69% in 1995/1996 season.

The results showed also that there were no any apparent differences in stalk diameter due to applying 180 and 240 kg N level in both season.

The positive effect of N on stalk diameter is mainly due to important role of N as the most important element in building up plant organs.

The present results are in general agreement with those obtained by **Abd El-Gawad *et al.*(1992-a)**.

The results in Tables (8 and 9) revealed that growing 1.5 drills of cane setts favourably affected stalk diameter compared with growing double drills in both seasons and at the different growth stages.

It was observed that the effect of planting density on stalk diameter was mor evident in 1995/1996 season where this effect reached the level of significance at two periods (265 and 330 days) out of four. The effect of planting density on this trait was not significant in 1994/1995 season throughout the four growth periods.

The results revealed that growing 1.5 drill increased stalk diameter over double drills by 0.95, 2.36, 0.29 and 0.28% at 135, 200, 265 and 330 days in 1994/1995 season, respectively, corresponding to 1.70, 1.49, 3.13 and 2.46% in 1995/1996 season.

The thinner stalks observed with growing double drills is mainly due to the increase in plant population density leading in turn to increase competition among growing cane plants for light, water and nutrients.

The present results agree with those obtained by **Ahmed (1995)**.

Interaction Effects:

The results in Tables (8 and 9) indicated that all effects of the interaction between the experimental factors on stalk diameter at the different growth stages and in both seasons were not significant. These results indicated that each experimental factor affected this trait independently.

4. Elongation rate of cane stalks (ER):

Results presented in Tables (10 and 11) showed the effects of irrigation regime, N fertilizer level, planting density and their interactions at three different growth stages of the plant crop sugar cane on the elongation rate (mm/day) in 1994/1995 and 1995/1996 seasons.

The results indicated that elongation rate tended to decrease with the advance towards maturity. That may be due to the reduction in the meristimatic activity and cell elongation with the progress in plant age.

The results showed that in 1994/1995, elongation rate was 16.622, 7.461 and 2.861 mm/day at the first (135-200 days), second (200-265 days) and third (265-330 days) growth stage, respectively. The corresponding elongation rates were 12.686, 3.725 and 2.972 in 1995/1996 season, respectively. Similar results were also reported by Abd **El-Gawad *et al.*(1992-a)** and **Ahmed (1995)**.

The results indicated that irrigation regime had no significant effect on this trait at the different growth periods and in both seasons as well.

In 1994/1995 season, no any specific trend for the effect of irrigation regime on elongation rate could be detected. The arrangement of the three regimes on this trait was quite different in the three periods. The second regime was only of better effect on elongation rate during the last period (265-330 days) where it increased this rate by 19.90% compared with the first and third regimes as well. However, this marked increase failed to reach the level of significance.

In 1995/1996 season, the effect of irrigation regime on elongation rate was also insignificant in spite of the superiority of the second irrigation regime over the two other regimes throughout the growing season. The results in Table (11) indicated that scheduling irrigation at 7-14-21 days in Summer, Moderates and Winter increased elongation rate by 1.18, 3.42 and 2.22%, respectively at 135-200, 200-265 and 265-330 days from planting compared with the first regime (traditional); also, the second regime was superior than the third one in affecting elongation rate where increases of 1.92, 2.02 and

Table (10) Effect of Irrigation regime, N fertilizer level, planting density and their interations on elongation rate (mm/day) in 1994/1995 growing season.

Irrigation regime	Nitrogen	135-200 days			200-265 days			265-330 days		
Season and Irrigation Interval	kg N/ Fed.	Planting density		Average	Planting density		Average	Planting density		Average
		1.5 drill	2 drills		1.5 drill	2 drills		1.5 drill	2 drills	
1. Summer (10-day), Moderates (15-day) and Winter (20-day)	120	16.200	16.850	**16.525**	8.550	4.050	**6.300**	2.850	2.550	**2.700**
	180	15.700	17.150	**16.425**	9.750	8.900	**9.325**	1.750	4.100	**2.925**
	240	17.750	15.650	**16.700**	8.150	9.550	**8.550**	2.350	2.500	**2.455**
Average		**16.550**	**16.550**	**16.550**	**8.817**	**7.500**	**8.158**	**2.317**	**3.050**	**2.683**
2. Summer (7-day), Moderates(14-day) and Winter (21-day)	120	14.850	15.850	**15.350**	8.350	5.750	**7.050**	1.200	4.850	**3.025**
	180	16.300	19.00	**17.650**	7.900	5.650	**6.775**	3.250	3.700	**3.475**
	240	16.650	16.200	**16.425**	6.350	9.100	**7.725**	3.500	2.800	**3.150**
Average		**15.933**	**17.017**	**16.475**	**7.533**	**6.833**	**7.183**	**2.650**	**3.783**	**3.217**
3. Summer (14-day), Moderates (21-day) and Winter (28-day)	120	16.050	15.450	**15.750**	6.850	3.950	**5.400**	1.700	2.850	**2.275**
	180	18.350	18.650	**18.500**	5.000	9.450	**7.225**	4.100	1.500	**2.800**
	240	16.800	15.800	**16.300**	6.100	10.900	**8.500**	1.550	4.400	**2.975**
Average		**17.067**	**16.633**	**16.850**	**5.983**	**8.100**	**7.042**	**2.450**	**2.917**	**2.683**
Interaction of Nitrogen X Planting density	120	15.700	16.050	**15.875**	7.917	4.583	**6.250**	1.917	3.417	**2.667**
	180	16.783	18.267	**17.525**	7.550	8.000	**7.775**	3.033	3.100	**3.067**
	240	17.067	15.883	**16.475**	6.867	9.850	**8.358**	2.467	3.233	**2.850**
Total average of planting density		**16.517**	**16.733**	**16.652**	**7.444**	**7.478**	**7.461**	**2.472**	**3.250**	**2.861**

L.S.D at 5 % level for:	135-200 days	200-265 days	265-330 days
Irrigation regime (A)	NS	NS	NS
N level (B)	NS	NS	NS
Planting density (C)	NS	NS	NS
AxB	NS	NS	NS
AxC	NS	NS	NS
BxC	NS	3.102	NS
AxBxC	NS	NS	2.544

Table (11) Effect of Irrigation regime, N fertilizer level, planting density and their interactions on elongation rate (mm/day) in 1995/1996 growing season.

Irrigation regime	**Nitrogen**	135-200 days		Average	200-265 days		Average	265-330 dys		Average
Season and Irrigation Interval	kg N/ Fed.	**Planting density**			**Planting density**			Planting density		
		1.5 drill	2 drills		1.5 drill	2 drills		1.5 drill	2 drills	
1. Summer (10-day),	120	14.050	11.700	**12.875**	3.600	2.800	**3.200**	3.000	2.700	**2.850**
Moderates (15-day) and	180	12.200	13.900	**13.050**	3.200	3.700	**3.450**	3.600	3.000	**3.300**
Winter (20-day)	240	11.700	12.450	**12.075**	3.400	5.300	**4.350**	2.200	3.300	**2.750**
Average		**12.650**	**12.683**	**12.667**	**3.400**	**3.993**	**3.667**	**2.933**	**3.000**	**2.967**
2. Summer (7-day),	120	14.100	12.050	**13.075**	2.400	3.150	**2.775**	2.800	2.900	2.850
Moderates(14-day) and	180	12.450	13.150	**12.800**	3.600	4.000	**3.800**	1.000	4.450	**2.725**
Winter (21-day)	240	12.100	13.050	**12.575**	5.800	3.800	**4.800**	2.500	4.550	**3.525**
Average		**12.883**	**12.750**	**12.817**	**3.993**	**3.650**	**3.792**	**2.100**	**3.967**	**3.033**
3. Summer (14-day),	120	11.300	12.750	**12.025**	2.650	4.450	**3.550**	3.450	2.150	**2.800**
Moderates (21-day) and	180	11.700	13.850	**12.775**	3.550	3.900	**3.725**	5.000	2.700	**3.850**
Winter (28-day)	240	12.550	13.300	**12.925**	3.700	4.050	**3.875**	0.450	3.750	**2.100**
Average		**11.850**	**13.300**	**12.575**	**3.300**	**4.133**	**3.717**	**2.967**	**2.867**	**2.917**
Interaction of	120	13.150	12.167	**12.658**	2.883	3.467	**3.175**	3.083	2.583	**2.833**
Nitrogen X	180	12.117	13.633	**12.875**	3.450	3.867	**3.658**	3.200	3.383	**3.292**
Planting density	240	12.117	12.933	**12.525**	4.300	4.383	**4.342**	1.717	3.867	**2.792**
Total average of planting density		**12.461**	**12.911**	**12.686**	**3.544**	**3.906**	**3.725**	**2.667**	**3.278**	**2.972**

L.S.D at 5 % level for:			
Irrigation regime (A)	NS	NS	NS
N level (B)	NS	NS	NS
Planting density (C)	NS	NS	NS
AxB	NS	NS	NS
AxC	NS	NS	1.170
BxC	NS	NS	1.170
AxBxC	NS	NS	2.027

3.98% were recorded at the growth periods of 135-200, 200-265 and 265-330 days, respectively.

It could be concluded that the second irrigation regime insignificantly increased elongation rate in the second season throughout the growth periods due to the increase in the applied water. In the second irrigation regime, the increase in the applied water reached 19.68 and 23.98% over the first regime (traditional) in 1994/1995 and 1995/1996, respectively. Also, the increase of the second regime over the third one was 28.56 and 30.53%, respectively as indicated from Table (1).

The present results are mainly due to the effect of irrigation at shorter intervals on the growth of cane plants.

The results in Tables (10 and 11) showed that the increase in N level did not significantly affect elongation rate at all growth periods and in both seasons in spite of some differences observed in the trait due to the different N levels.

The highest elongation rate was obtained almost at the second N level (180 kg/fed). In general, no any specific trend for the effect of N level on this trait could be detected, probably due to the fertility of the soil. The present results agree with those obtained by **Abd El-Gawad *et al.*(1992-a)**.

Concerning the effect of planting density on elongation rate, the results in Tables (10 and 11) showed that growing double drills insignificantly increased elongation rate at all growth stages and in both seasons as well compared with growing 1.5 drill.

In 1995/1995 season, growing double drills increased elongation rate over 1.5 drill by 1.31, 0.46 and 31.47%, respectively at the first, second and third growth stages. Also, in 1995/1996 season, double drills increased elongation rate over 1.5 drill by 3.61, 10.21 and 9.27% at the first, second and third growth period, respectively. However, all differences in elongation rate due to the different planting densities were below the level of significance.

The increases in elongation rate due to the increase in planting density is mainly due to the increase in plant height as a result of the increased competition for light at dense population.

Interaction Effects:

The results showed that irrigation regime x planting density significantly affected elongation rate at the third growth stages (265-330 days) in 1995/1996. The results showed that at this period, planting density had a significant effect on elongation rate under the second irrigation regime where double drills significantly surpassed 1.5 drill but under the first and third regimes, both densities were similar in their effect on elongation rate.

The results showed that the greatest elongation rate was 3.867 mm/day which was recorded with the second regime combined with double drills planting density or the third regime combined with 1.5 drill.

The results showed also that N level x planting density interaction significantly affected elongation rate at the second growth period (200-265 days) in 1994/1995 season and at the third growth period (265-330 days) in 1995/1996.

The results in Table (10) showed that double drills was more effective on elongation rate than 1.5 drill at 180 and 240 kg N/fed levels, whereas at 120 kg N/fed, growing 1.5 drill significantly surpassed double drills in affecting elongation rate. This effect was evident at the second stage in 1994/1995 season. Also, at the third growth stage in 1995/1996 season, double drills significantly surpassed 1.5 drill in affecting elongation rate at 240 kg N/fed, whereas no significant differences were detected at the lower N level.

The results in Tables (10 and 11) indicated also a significant effect of the second order interaction on elongation rate at the third growth periods and in both seasons of experimentation.

The results showed that the highest elongation rate at the third stage was 4.850 mm/days in 1994/1995 season which was recorded by the second irrigation regime combined with 120 kg N/fed and growing double drills. Also, in 1995/1996 season, the greatest elongation rate at the third stages was 5.000 mm/day which was recorded by the second regime combined with 180 kg N/fed and using 1.5 drill.

5. Total soluble solids percentage (TSS%):

The percentage of total soluble solids (TSS%) throughout the growing season is a good indication in respect to juice quality and cane maturity. In addition, it is also an approximate measurement to the expected sugar recovery.

Results presented in Tables (12 and 13) showed the effect of irrigation regime, N fertilizer level, planting density and their interactions on the percentage of total soluble solids in plant sugar cane at three distinct growth stages in 1994/1995 and 1995/1996 growing seasons.

The results showed some differences in the TSS% due to the different irrigation regimes in both seasons, particularly at the last stage of growth at 265 days from planting where the effect of water regime reached the level of significance. Prolonging the irrigation intervals in the third regime to 14, 21, 28 days in Summer, Moderates and Winter, respectively, significantly increased TSS% by 1.141 and 0.231 compared with the second regime (7-14-21 days) and the first regime (10-15-20 days), respectively in 1994/1995 season, corresponding to 0.574 and 0.312 in 1995/1996 season. Similarly, TSS% of the third irrigation regime was generally higher than in the first and third regimes at 135 and 200 days from planting, but the differences in TSS% were too slight to reach the level of significance.

It could be concluded that the TSS% was influenced by the irrigation intervals. It was reduced by reducing the intervals in the second irrigation regime due to the increase in the amount of applied water. On the other hand, prolonging the irrigation intervals increased TSS% due to the reduction in the irrigation water applied.

The results presented in Table (1) showed that the amount of irrigation water was 6620.8, 7923.9 and 6163.5 m^3 for the first, second and third regime, respectively in 1994/1995 season, corresponding to 6982.2, 8657.2 and 6632.2 m^3 in 1995/1996 season, respectively.

The effect of water regime was evident at the advanced stage of growth. Similar results were also reported by **Said *et al.* (1991)** who found

Table (12) Effect of irrigation regime, N fertilizer level, planting density and their interactions on total suloble solids percentage on in 1994/1995 growing season.

Irrigation regime	Nitrogen	135 days		Average	200 days		Average	265 days		Average
		Planting density			Planting density			Planting density		
Season and Irrigation Interval	kg N/ Fed.	1.5 drill	2 drills		1.5 drill	2 drills		1.5 drill	2 drills	
1. Summer (10-day), Moderates (15-day) and Winter (20-day)	120	4.330	4.300	**4.315**	10.850	9.280	**10.065**	18.765	17.395	**18.080**
	180	3.870	3.210	**3.540**	9.580	10.080	**9.830**	17.595	17.080	**17.337**
	240	4.100	3.500	**3.800**	9.380	10.210	**9.795**	17.880	17.830	**17.855**
Average		**4.100**	**3.670**	**3.885**	**9.937**	**9.857**	**9.897**	**18.080**	**17.435**	**17.758**
2. Summer (7-day), Moderates(14-day) and Winter (21-day)	120	4.650	4.360	**4.505**	10.200	10.040	**10.120**	17.765	16.915	**17.340**
	180	4.430	3.880	**4.155**	9.500	9.550	**9.525**	18.945	16.180	**17.563**
	240	4.170	3.490	**3.830**	9.910	9.650	**9.780**	14.765	16.515	**15.640**
Average		**4.417**	**3.910**	**4.163**	**9.870**	**9.747**	**9.808**	**17.158**	**16.537**	**16.848**
3. Summer (14-day), Moderates (21-day) and Winter (28-day)	120	3.910	4.590	**4.250**	9.150	10.080	**9.615**	17.760	18.265	**18.013**
	180	4.300	4.500	**4.400**	10.620	9.680	**10.150**	17.715	18.430	**18.073**
	240	4.320	4.090	**4.205**	10.340	9.610	**9.975**	17.915	17.850	**17.883**
Average		**4.177**	**4.393**	**4.285**	**10.037**	**9.790**	**9.713**	**17.797**	**18.182**	**17.989**
Interaction of Nitrogen X Planting density	120	4.297	4.417	**4.357**	10.067	9.800	**9.933**	18.097	17.525	**17.811**
	180	4.200	3.863	**4.032**	9.900	9.770	**9.835**	18.085	17.230	**17.658**
	240	4.197	3.693	**3.945**	9.877	9.823	**9.850**	16.853	17.398	**17.126**
Total average of planting density		**4.231**	**3.991**	**4.111**	**9.948**	**9.798**	**9.873**	**17.678**	**17.384**	**17.531**

L.S.D at 5 % level for:	135 days	200 days	265 days
Irrigation regime (A)	NS	NS	0.879
N level (B)	NS	NS	NS
Planting density (C)	NS	NS	NS
AxB	NS	NS	NS
AxC	NS	NS	NS
BxC	NS	NS	NS
AxBxC	NS	NS	

Table (13) Effect of irrigation regime, N fertilizer level, planting density and their interactions on total suloble solids percntage in 1995/1996 growing season.

Irrigation regime	Nitrogen	135 days			200 days			265 days		
Season and Irrigation Interval	kg N/ Fed.	Planting density		Average	Planting density		Average	Planting density		Average
		1.5 drill	2 drills		1.5 drill	2 drills		1.5 drill	2 drills	
1. Summer (10-day),	120	7.680	7.810	**7.745**	14.000	12.580	**13.300**	17.325	16.675	**17.000**
Moderates (15-day) and	180	8.530	7.860	**8.195**	12.600	12.930	**12.765**	16.825	17.150	**16.887**
Winter (20-day)	240	7.640	6.870	**7.255**	12.500	12.800	**12.650**	17.000	16.675	**16.838**
Average		**7.950**	**7.513**	**7.732**	**13.400**	**12.770**	**12.905**	**17.050**	**16.833**	**16.942**
2. Summer (7-day),	120	7.770	7.370	**7.570**	12.900	12.900	**12.900**	16.440	17.290	**16.865**
Moderates(14-day) and	180	8.460	7.070	**7.765**	12.950	12.800	**12.875**	16.950	16.600	**16.775**
Winter (21-day)	240	7.250	8.310	**7.780**	12.400	12.300	**12.350**	16.425	16.375	**16.400**
Average		**7.827**	**7.583**	**7.705**	**12.750**	**12.676**	**12.708**	**16.605**	**16.755**	**16.680**
3. Summer (14-day),	120	7.130	8.720	**7.925**	13.500	12.660	**13.080**	17.125	17.125	**17.125**
Moderates (21-day) and	180	9.720	9.300	**9.510**	12.700	13.580	**13.140**	17.450	17.950	**17.700**
Winter (28-day)	240	7.610	8.140	**7.875**	13.300	12.600	**12.950**	17.200	16.675	**16.938**
Average		**8.153**	**8.720**	**8.437**	**13.167**	**12.947**	**13.057**	**17.258**	**17.250**	**17.254**
Interaction of	120	7.527	7.967	**7.747**	13.473	12.713	**13.093**	16.963	17.030	**16.997**
Nitrogen X	180	8.903	8.077	**8.490**	12.750	13.103	**12.927**	17.075	17.233	**17.154**
Planting density	240	7.500	7.773	**7.637**	12.733	12.567	**12.650**	16.875	16.575	**16.725**
Total average of planting density		**7.977**	**7.939**	**7.958**	**12.986**	**12.794**	**12.890**	**16.971**	**16.746**	**16.959**

L.S.D at 5 % level for:	135 days	200 days	265 days
Irrigation regime (A)	NS	NS	0.104
N level (B)	NS	NS	NS
Planting density (C)	NS	NS	NS
AxB	NS	NS	NS
AxC	NS	NS	NS
BxC	NS	NS	NS
AxBxC	NS	NS	NS

that increasing irrigation intervals adversely affected the quality characters of sugar cane.

Concerning the effect of N fertilizer level on TSS%, the results in Tables 12 and 13 revealed that no significant effect was detected at the three growth stages in both seasons. However, very slight differences could be seen due to N level and in general, the the lowest TSS% was almost observed at the highest N level (240kg N/fed) compared with the medium (180 kg N/fed) or the lowest level (120 kg N/fed).

The present results are in general agreement with those reported by **Abd El-Gawad *et al.* (1992-b)** who found that the lower the N fertilizer level the higher the TSS%.

With regard to the effect of planting density on TSS%, the results presented in Tables (12 and 13) showed that no significant effect was observed on this trait at the three growth stages in both seasons of experimentation. However, growing 1.5 drill nevertheless produced higher TSS% compared with growing double drills. That was observed throughout the growth stages. Growing 1.5 drill increased insignificantly TSS% by 0.240, 0.150 and 0.294% at the first, second and third growth stages, respectively in 1994/1995 season, being 0.380, 0.195 and 0.225% in 1995/1996 season for the three respective growth stages. However, all these differences were below the level of significance.

The reduction of TSS% at the higher popuation density is logical due to the increase in the competition among growing plant for the soil nutrients.

The insignificant effect of planting density on TSS% was also reported by **Ahmed (1995)**.

Interaction Effects:

The results in Tables (12 and 13) indicated that all the interactions between the experimental factors had no significant effect on TSS% at all growth stages in both seasons. This result indicated clearly that each experimental factor acted independently in affecting this trait.

II. Effect of Irrigation Regime, Nitrogen Fertilizer Level, Planting Density and Their Interactions on Cane Quality and Chemical Attributes of the Plant Crop Sugar Cane.

1. Brix percentage:

Results of the effects of irrigation, N fertilizer level, planting density and their interaction on brix percentage of sugar cane juice (plant crop) at harvest in 1994/1995 and 1995/1996 seasons are presented in Table (14).

The results indicated that irrigation regime did not significantly influence brix% in both seasons, where no any marked differences were observed among the three irrigation treatments. However, it was observed from the results that the third irrigation regime slightly increased brix% compared with the two other regimes, probably due to the reduced amount of applied water as a result of prolonging the irrigation intervals and the reduction of the applied water.The present results are in agreement with those reported by **Prasad *et al.* (1991)** who found that no significant differences were detected in brix% among the applied four IW:CPE ratios of 0.4, 0.6, 0.8 and 1.0.

Concerning the effect of N fertilizer level on brix%, the results in Table (13) showed insignificant response of this trait to N level was detected in both seasons. The results indicated that no any definite trend for the effect of N level was observed. This result agrees with that observed by **Abd El-Gawad *et al.* (1992-b)** who found that brix% was not significantly affected by N fertilizer level up to 240 kg/fed

Also, planting density did not significantly affect brix% in both seasons, in spite of the slight increase in this trait due to population density of 1.5 drill. The results showed that reducing the population density by growing 1.5 drill insignificantly increased brix% by 0.426 and 0.465% in 1994/1995 and 1995/1996 season, respectively compared with growing double drills. The present results are in agrement with those obtained by **Dominf and Plane (1989)** who found that planting density had no effect on juice quality of sugar cane.

Table (14) Effect of irrigation regime, N fertilizer level, planting density and their interactions on brix percentage of juice at harvest in 1994/1995 and 1995/1996 growing seasons.

Irrigation regime	Nitrogen	1994/1995 season		Average	1995/1996 season		Average
Season and Irrigation Interval	kg N/ Fed.	Planting density			Planting density		
		1.5 drill	2 drills		1.5 drill	2 drills	
1. Summer (10-day), Moderates (15-day) and Winter (20-day)	120	21.125	20.740	20.933	23.030	22.600	22.815
	180	20.930	20.850	20.890	22.670	22.240	22.455
	240	22.310	21.045	21.678	21.975	23.120	22.548
Average		21.455	20.878	21.167	22.558	22.653	22.606
2. Summer (7-day), Moderates(14-day) and Winter (21-day)	120	21.650	21.750	21.200	24.150	21.880	23.015
	180	21.330	18.925	20.128	22.370	22.335	22.353
	240	21.070	20.170	20.620	22.295	22.240	22.267
Average		21.017	20.282	20.649	22.938	22.152	22.545
3. Summer (14-day), Moderates (21-day) and Winter (28-day)	120	20.640	21.040	20.840	22.750	23.035	22.893
	180	22.285	21.805	22.045	23.425	21.690	22.557
	240	21.510	21.690	21.600	22.750	22.090	22.420
Average		21.478	21.512	21.495	22.975	22.272	22.623
Interaction of Nitrogen X Planting density	120	20.805	21.177	20.991	23.310	22.505	22.908
	180	21.515	20.527	21.021	22.822	22.088	22.455
	240	21.630	20.968	21.299	22.340	22.483	22.412
Total average of planting density		21.317	20.891	21.104	22.824	22.359	22.591

L.S.D at 5 % level for:

		1994/1995	1995/1996
Irrigation	(A)	NS	NS
N level	(B)	NS	NS
Planting density	(C)	NS	NS
AxB		NS	NS
AxC		NS	NS
BxC		NS	NS
AxBxC		NS	NS

Interaction Effects:

The results presented in Table (14) indicated no significant effects for the interactions between the experimental factors on brix% at harvest in both seasons. The results indicate that each factor acted independently in affecting this trait.

2. Sucrose percentage:

Results of effects of irrigation regime, N fertilizer level, planting density and their interactions on sucrose percentage in suger cane juice of the plant crop sugar cane at harvest in 1994/1995 and 1995/1996 seasons are presented in Table (15).

The results indicated that prolonging irrigation intervals in the third regime to 14-21-28 days in Summer, Moderates and Winter, respectively slightly increased sucrose% of the cane juice at harvest in both seasons. The increase in sucrose % due to applying the third regime was more evident when compared with the second regime in which irrigation was scheduled at 7-14 and 21 days in Summer, Moderates and Winter, respectively. The third regime insignifcantly increased sucrose % by 1.021 and 0.730% in 1994/1995 and 1995/1996 seasons, respectively compared with the second regime. These increases were, however, below the level of significance and are mainly due to the reduced amount of irrigation water applied in the third regime.

The trend of sucrose % is geneally similar as that of brix% due to the close relationships between both traits as reported by **Lakshnikantham (1983)** who stated that there is a highly positive correlation between juice brix and sucrose percentage.

The results obtained here are in general agreement with those reported by **El-Gibali *et al.* (1967)** and **Patel and Joshi (1990)** who found that sucrose% was not significantly affected by irrigation treatments.

Concerning the effect of N level on sucrose%, results in Table (14) indicated no significant effect in both seasons. However, a slight reduction in sucrose% was observed with the increase in N level from 120 to 240 kg/fed where a reduction in sucrose% of 0.764 and 0.232 was recorded in the first

Table (15) Effect of irrigation regime, N fertilizer level, planting density and their interactions on sucrose percentage at harvest in 1994/1995 and 1995/1996 growing seasons.

Irrigation regime	Nitrogen	1994/1995 season		Average	1995/1996 season		Average
Season and Irrigation Interval	kg N/ Fed.	Planting density			Planting density		
		1.5 drill	2 drills		1.5 drill	2 drills	
1. Summer (10-day), Moderates (15-day) and Winter (20-day)	120	18.665	17.520	18.092	20.850	19.160	20.005
	180	17.885	17.730	17.807	19.640	19.340	19.490
	240	17.320	16.665	16.993	19.080	19.910	19.495
Average		17.957	17.305	17.631	19.857	19.470	19.663
2. Summer (7-day), Moderates(14-day) and Winter (21-day)	120	17.730	17.825	17.778	18.965	18.925	18.945
	180	18.455	16.065	17.260	19.495	19.730	19.613
	240	17.200	16.920	17.060	19.105	19.030	19.067
Average		17.795	16.937	17.366	19.188	19.228	19.208
3. Summer (14-day), Moderates (21-day) and Winter (28-day)	120	18.510	18.510	18.510	19.860	20.015	19.937
	180	18.460	18.770	18.615	20.510	19.990	20.250
	240	18.115	17.955	17.035	19.755	19.500	19.628
Average		18.362	18.412	18.387	20.042	19.835	19.938
Interaction of Nitrogen X Planting density	120	18.302	17.952	18.127	19.892	19.367	19.629
	180	18.267	17.522	17.894	19.882	19.687	19.784
	240	17.545	17.180	17.363	19.313	19.480	19.397
Total average of planting density		18.038	17.551	17.794	19.696	19.511	19.603

L.S.D at 5 % level for:

	1994/1995	1995/1996
Irrigation regime (A)	NS	NS
N level (B)	NS	NS
Planting density (C)	NS	NS
AxB	NS	NS
AxC	NS	NS
BxC	NS	NS
	NS	NS

and second season, respectively. These increases were too slight to reach the level of significance.

The present results are in general agreement with those reported by **Ravindra *et al.* (1989)** who stated that quality parameters of brix, sucrose, purity and recovery percentages were not affected by increasing N level up to 450 kg N/ha.

The results in Table (15) indicated also that planting density had no significant effect on sucrose% in both seasons. A very slight difference was observed in favour of growing 1.5 drill compared with double drills, but the difference was not that great to reach the level of significance.

Similar results were also obtained by **Murayama *et al.* (1990), Singh *et al.* (1990)** and **Ahmed (1995)** who found that sucrose% was not significantly affected by planting sugar cane at different population densities.

Interaction Effects:

The results in Table (15) showed that none of the interactions between the experimental factors significantly affected sucrose % of juice at harvest in both seasons of experimentation.

3. Purity percentage:

Results presented in Table (16) showed the effects of irrigation regime, N fertilizer level, planting desnity and their interactions on purity percentage of sugar cane juice (plant crop) at harvest in 1994/1995 and 1995/1996 growing seasons.

The results indicated that prolonging the irrigation intervals in the third regime increased purity % compared with irrigating at shorter intervals in the first and second regimes.

In 1994/1995 season, scheduling irrigation at 7,14 and 21 days in Summer, Moderates and Winter, respectively insignificantly increased purity% by 0.904 and 1.260% compared with the first (10-15-20 day intervals) and second (7-14-21 day intervals) regime, respectively. Also, in

Table (16) Effect of irrigation regime, N fertilizer level, planting density and their interactions on purity percentage at harvest in 1994/1995 and 1995/1996 growing seasons.

Irrigation regime	**Nitrogen**	1994/1995 season		**Average**	1995/1996 season		**Average**
Season and Irrigation Interval	kg N/ Fed.	**Planting density** 1.5 drill	**Planting density** 2 drills		**Planting density** 1.5 drill	**Planting density** 2 drills	
1. Summer (10-day), Moderates (15-day) and Winter (20-day)	120	88.295	84.400	**86.347**	90.455	84.745	**87.600**
	180	85.390	85.010	**85.200**	86.595	86.935	**86.765**
	240	82.975	85.135	**84.055**	86.835	86.115	**86.475**
Average		**85.553**	**84.848**	**85.201**	**87.962**	**85.932**	**86.947**
2. Summer (7-day), Moderates(14-day) and Winter (21-day)	120	85.780	81.900	**83.840**	84.455	83.990	**84.222**
	180	87.525	84.825	**86.175**	87.075	88.195	**87.635**
	240	83.870	83.370	**83.620**	85.715	85.540	**85.627**
Average		**85.725**	**83.365**	**84.545**	**85.748**	**85.908**	**85.828**
3. Summer (14-day), Moderates (21-day) and Winter (28-day)	120	91.800	85.965	**88.882**	86.620	86.835	**86.727**
	180	84.700	84.200	**84.450**	89.630	90.025	**89.827**
	240	84.585	83.580	**84.082**	86.830	88.260	**87.545**
Average		**87.028**	**84.582**	**85.805**	**87.693**	**88.373**	**88.033**
Interaction of Nitrogen X Planting density	120	88.625	84.088	**86.357**	87.177	85.190	**86.183**
	180	85.872	84.678	**85.275**	87.767	88.385	**88.076**
	240	83.810	84.028	**83.919**	86.460	86.638	**86.549**
Total average of planting density		**86.102**	**84.265**	**85.184**	**87.134**	**86.738**	**86.936**

L.S.D at 5 % level for:

		1994/1995	1995/1996
Irrigation regime	(A)	NS	0.612
N level	(B)	NS	1.557
Planting density	(C)	NS	NS
AxB		NS	NS
AxC		NS	NS
BxC		NS	NS
AxBxC		NS	NS

1995/1996 season, the third regime significantly surpassed the first and second regime in purity% by 1.086 and 2.205%, respectively.

It is worth mentioning that the first regime significantly surpassed the second regime in purity % in 1995/1996 season.

It could be concluded that prolonging the irrigation intervals positively affected purity% due to the reduction of the applied water as shown in Table (1).

The present results are generally in agreement with the results reported by **El-Gebali *et al.* (1978)**.

Concerning the effect of N fertilizer level on purity%, the results in Table (16) indicated a significant effect of N level on purity% in the second season where the medium N level (180 kg N/fed) recorded the highest purity% which significantly surpassed that recorded at the lowest and the highest level as well. Applying N at 120, 180, and 240 kg/fed recorded purity% of 86.183, 88.076 and 86.549%, respectively in 1995/1996 season.

In 1994/1995 season, a different trend was observed where the increase in N level insignificantly reduced purity%. The results in the first season are in full agreement with the results reported by **Patil and Khot (1986)** who found that the lowest N level resulted in producing the highest purity%.

The results in Table (16) indicated also that planting density had no significant effect on purity % of juice at harvest in both seasons. However, growing 1.5 drill insignificantly increased purity% in both seasons compared with growing double drills.

The present results are in general agreement with the results reported by **Dominf and Plana (1989)** who found the planting density had no significant effect on cane quality.

Interaction Effects:

The results in Table (16) showed that all effects of the interaction between the studied factors on juice purity% were not significant in both seasons.

In general, the highest purity % in 1994/1995 season was 91.80% which was recorded with applying the third irrigation regime supplied with 120 kg N/fed and planted with 1.5 drill.

In 1995/1996 season, applying the first regime combined with 120 kg N/fed and growing 1.5 drill recorded the maximum purity %, being 90.455.

4. Reducing Sugar percentage : (RS%)

Results presented in Table (17) showed the effects of irrigation regime, N fertilizer level, planting density and their interactions on reducing sugar% in the plant crop sugar cane in 1994/1995 and 1995/1996 seasons.

The results indicated no significant effect could be detected for irrigation regime on RS% in both seasons. However, a very slight reduction in RS% was found in the thrid regime where the amount of irrigation water was reduced due to prolonging irrigation intervals (14-21-28 days in Summer, Moderates and Winter, respectively).

It could be concluded that sugar cane grown under the lowest irrigation water applied (6163.5 and 6632.2 m3 in 1994/1995 and 1995/1996, respectively) contained the lowest RS% compared with the first regime (6620.8 and 6982.2 m3 in 1994/1995 and 1995/1996, respectively) as well as the second regime (7923.9 and 8657.2 m3 in 1994/1995 and 1995/1996, respectively).

It is worth mentioning that the third regime recorded also the highest sucrose and purity percentages in both seasons compared with the other regimes. The results indicate clearly the opposite relationship between each of sucrose and purity percentages on one hand and RS% on the other hand where the lower the RS% the higher the sucrose and purity percentages and vice versa.

Table (17) Effect of irrigation regime, N fertilizer level planting density, and their interactions on reducing sugar percentage at harvest in 1994/1995 and 1995/1996 growing seasons.

Irrigation regime	Nitrogen	1994/1995 season		Average	1995/1996 season		Average
Season and Irrigation Interval	kg N/ Fed.	Planting density			Planting density		
		1.5 drill	2 drills		1.5 drill	2 drills	
1. Summer (10-day), Moderates (15-day) and Winter (20-day)	120	0.450	0.200	**0.325**	0.410	0.400	**0.405**
	180	0.310	0.575	**0.443**	0.455	0.440	**0.447**
	240	0.390	0.455	**0.422**	0.445	0.415	**0.430**
Average		**0.383**	**0.410**	**0.397**	**0.437**	**0.418**	**0.427**
2. Summer (7-day), Moderates(14-day) and Winter (21-day)	120	0.215	0.370	**0.293**	0.475	0.365	**0.420**
	180	0.340	0.430	**0.385**	0.420	0.420	**0.420**
	240	0.450	0.555	**0.502**	0.465	0.450	**0.457**
Average		**0.335**	**0.452**	**0.393**	**0.453**	**0.412**	**0.432**
3. Summer (14-day), Moderates (21-day) and Winter (28-day)	120	0.355	0.325	**0.340**	0.400	0.431	**0.415**
	180	0.425	0.325	**0.375**	0.425	0.495	**0.460**
	240	0.405	0.365	**0.385**	0.370	0.430	**0.400**
Average		**0.395**	**0.338**	**0.367**	**0.398**	**0.452**	**0.425**
Interaction of Nitrogen X Planting density	120	0.340	0.298	**0.319**	0.428	0.399	**0.413**
	180	0.358	0.343	**0.401**	0.433	0.452	**0.442**
	240	0.415	0.458	**0.437**	0.427	0.432	**0.429**
Total average of planting density		**0.371**	**0.400**	**0.386**	**0.429**	**0.427**	**0.428**

L.S.D at 5 % level for:

		1994/1995	1995/1996
Irrigation regime	(A)	NS	NS
N level	(B)	0.092	NS
Planting density	(C)	NS	NS
AxB		NS	NS
AxC		NS	NS
BxC		NS	NS
AxBxC		NS	NS

The results in Table (17) indicated also that the increase in N level increased RS% in both seasons with significant differences in 1994/1995 season. Applying N at 120, 180, and 240 kg/fed recorded RS% of 0.319, 0.401 and 0.437% respectively in 1994/1995, corresponding to 0.413, 0.442 and 0.429% in 1995/1996 season.

This result is in general agreement with that reported by **Abd El-Gawad *et al.* (1992-b)**.

Concerning the effect of planting density on RS% the results in Table (17) showed that planting density had no significant effect on RS% in both seasons.

Interaction Effects:

The results in Table (17) indicated no significant interaction effects between the experimental factors on RS% in both seasons, indicating that each experimental factor acted independently in affecting this trait.

5. Sugar recovery percentage (SR%):

Results presented in Table (18) indicate the effects of irrigation regime, N level, planting density and their interactions on sugar recovery percentage (SR%) in 1994/1995 and 1995/1996 growing seasons of the plant cane.

The results revealed no significant influence for irrigation regime on SR% was recorded in both seasons. However, a general trend was observed where the third regime, with the lowest amount of water applied and the prolonged irrigation intervals (14-21-28 days), recorded the highest SR% in both seasons compared with first (10-15-20 days) and the second (7-14-21 days) regimes.

Concerning the effect of N level, results in Table (18) showed that increasing the level of N from 120 to 180 and 240 kg/fed significantly reduced SR% in the first season. The SR% of the three N levels 120, 180, and 240 kg/fed were 11.579, 11.421 and 10.903%, respectively in 1994/1995 season.

Table (18) Effect of irrigation regime, N fertilizer level planting density, and their interactions on sugar recovery percentage at harvest in 1994/1995 and 1995/1996 growing seasons.

Irrigation regime	Nitrogen	1994/1995 season			1995/1996 season		
Season and Irrigation Interval	kg N/ Fed.	Planting density		Average	Planting density		Average
		1.5 drill	2 drills		1.5 drill	2 drills	
1. Summer (10-day), Moderates (15-day) and Winter (20-day)	120	12.000	11.293	**11.647**	14.225	12.245	**13.235**
	180	11.400	11.510	**11.455**	12.835	12.710	**12.773**
	240	10.877	11.137	**11.007**	12.535	12.915	**12.725**
Average		**11.426**	**11.313**	**11.369**	**13.198**	**12.623**	**12.911**
2. Summer (7-day), Moderates(14-day) and Winter (21-day)	120	11.353	10.893	**11.123**	11.995	12.385	**12.040**
	180	12.013	10.190	**11.102**	12.515	13.140	**12.827**
	240	11.232	10.610	**10.917**	12.365	12.295	**12.330**
Average		**11.530**	**10.564**	**11.047**	**12.192**	**12.607**	**12.399**
3. Summer (14-day), Moderates (21-day) and Winter (28-day)	120	12.080	11.853	**11.967**	12.865	12.765	**12.815**
	180	11.660	11.750	**11.705**	13.535	13.235	**13.385**
	240	11.250	10.963	**11.107**	12.930	13.005	**12.967**
Average		**11.663**	**11.522**	**11.593**	**13.110**	**13.002**	**13.056**
Interaction of Nitrogen X Planting density	120	11.811	11.347	**11.579**	12.928	12.465	**12.697**
	180	11.691	11.150	**11.421**	12.962	13.028	**12.995**
	240	11.117	10.903	**11.010**	12.610	12.738	**12.674**
Total average of planting density		**11.540**	**11.133**	**11.336**	**12.833**	**12.744**	**12.789**

L.S.D at 5 % level for:

Irrigation regime	(A)	NS	NS
N level	(B)	0.327	NS
Planting density	(C)	NS	NS
AxB		NS	NS
AxC		NS	NS
BxC		NS	NS
AxBxC		NS	NS

In 1995/1996 season, no clear trend was observed and the highest SR% was recorded with the middle N level (180 kg/fed), being 12.995% compared with 12.697 and 12.674% for the lowest (120 kg/fed) and the highest (240 kg/fed) levels, respectively.

The negative effect of the higher N level on SR% is due to the reduction in sucrose% and purity % which were observed at higher N level.

The present results are in general agreement with those reported by **Mohamed (1989)** and **Abd El-Gawad *et al.* (1992-b)** who found negative relationships in respect to the effect of N on sucrose, purity and sugar recovery percentages.

The results in Table (18) revealed that population density of 1.5 drill slightly and insignificantly increased SR% compared with double drills. The differences in SR% due to planting density were not significant in both seasons.

It could be concluded that reducing the population desnity slightly affected SR% due to increasing sucrose%, purity% and decreasing reducing sugar % which were observed by growing 1.5 drill.

Interaction Effects:

The results showed no significant effect of the interactions between all experimental factors on SR% in both seasons.

6. Nitrogen percentage in stalk at harvest:

Table (19) presents the effects of irrigation regime, N fertilizer level, planting density and their interactions on N% in cane stalk at harvest in 1994/1995 and 1995/1996 seasons.

The results revealed that irrigation regime insignificantly affected N% of cane stalk in both seasons. However, it is clear from the Table (19) that irrigation at shorter intervals in the second regime increased N% in stalk

Table (19) Effect of irrigation regime, N fertilizer level, planting density and their interactions on nitrogen percentage in cane stalk at harvest in 1994/1995 and 1995/1996 growing seasons.

Irrigation regime	**Nitrogen**	1994/1995 season		**Average**	1995/1996 season		**Average**
Season and Irrigation Interval	kg N/ Fed.	**Planting density**			**Planting density**		
		1.5 drill	2 drills		1.5 drill	2 drills	
1. Summer (10-day), Moderates (15-day) and Winter (20-day)	120	0.542	0.450	**0.438**	0.400	0.400	**0.400**
	180	0.525	0.425	**0.475**	0.485	0.385	**0.435**
	240	0.550	0.600	**0.575**	0.520	0.570	**0.545**
Average		**0.500**	**0.492**	**0.496**	**0.468**	**0.452**	**0.460**
2. Summer (7-day), Moderates(14-day) and Winter (21-day)	120	0.475	0.475	**0.475**	0.425	0.425	**0.425**
	180	0.475	0.575	**0.525**	0.435	0.535	**0.485**
	240	0.625	0.675	**0.650**	0.595	0.645	**0.620**
Average		**0.525**	**0.575**	**0.550**	**0.485**	**0.535**	**0.510**
3. Summer (14-day), Moderates (21-day) and Winter (28-day)	120	0.375	0.475	**0.425**	0.350	0.425	**0.388**
	180	0.475	0.500	**0.487**	0.435	0.460	**0.447**
	240	0.475	0.450	**0.462**	0.445	0.425	**0.435**
Average		**0.442**	**0.475**	**0.458**	**0.410**	**0.437**	**0.423**
Interaction of Nitrogen X Planting density	120	0.442	0.467	**0.446**	0.392	0.417	**0.404**
	180	0.492	0.500	**0.496**	0.452	0.460	**0.456**
	240	0.550	0.575	**0.562**	0.520	0.547	**0.533**
Total average of planting density		**0.489**	**0.514**	**0.501**	**0.454**	**0.474**	**0.464**

L.S.D at 5 % level for:		
irrigation regime (A)	NS	NS
N level (B)	0.065	0.055
Planting density (C)	NS	NS
AxB	NS	NS
AxC	NS	NS
BxC	NS	NS
AxBxC	NS	NS

compared with irrigation at longer intervals in the first and third regimes. But the differences in N% were too slight to reach the level of significance..

The results here coincided with those reported by **Sharma and Gupta (1991)** who found that N uptake at harvest increased with increasing irrigation rates from 0.75 to 1.5 IW:CPE.

Concerning the effect of N fertilizer level on N% in stalk, the results in Table (19) indicated that the increase in N level from 120 to 240 or from 180 to 240 kg/fed significantly increased N% in stalk in both seasons.

The results of the present study are in general agreement with those obtained by **Abd El-Gawad *et al.* (1992-b)**.

Planting density did not significantly influence N% in stalk in both seasons.

It could be concluded that N content in cane stalk is adversely corrlated with the quality characters such as sucrose and purity percentages where the higher the N content of cane stalk the lower the sucrose and purity percentages.

Interaction Effects:

The results in Table (19) showed that none of the interactions between the experimental factors had a significant effect on N% in stalk in both seasons indicating that each factor acted independently in affecting the trait.

In general, the highest N% in stalk was 0.625 and 0.595% in 1994/1995 and 1995/1996, respectively, which was recorded by applying the second irrigation regime combined with 240 kg N/fed and using 1.5 drill plant density in both seasons.

On the other hand, applying the third irrigation regime combined with 120 kg N/fed and planting 1.5 drill produced the lowest N% in stalk being 0.375 and 0.350 in the first and second seasons, respectively.

7. Fiber percentage of cane stalk:

The effects of irrigation regime, N fertilizer level, planting density and their interactions on fiber% in cane stalk in 1994/1995 and 1995/1996 growing seasons are presented in Table (20).

The results showed that scheduling irrigation at shorter intervals (7-11-21 days) of the second regime increased fiber% compared with irrigation at longer intervals (14-21-28 days) in the third regime in both seasons. The effect of irrigation regime reached the level of significance in 1995/1996 season. In that season, the third irrigation regime significantly reduced fiber% compared with the second and the first regimes.

It could be concluded that reducing the amount of irrigation water favourably affected juice quality parameters due to the reduction in fiber%. Therefore fiber% is negatively corrlated with sucrose and purity percentages.

The results in Tbale (20) indicated that the increase in N level from 120 to 180 and 240 kg/fed significantly increased fiber% in both seasons. All differences in fiber% were significant due to increasing N level.

The present results are in agreement with those reported by **Abd El-Gawad *et al.* (1992-b)**.

Concerning the effect of planting density on fiber%, the results in Table (20) showed that increasing plant population density by using double drills significantly increased fiber% compared with growing 1.5 drill in both seasons. Growing sugarcane using double drills of cane cuttings significantly increased fiber% by 0.389 and 0.412% in the first and second season, resepectively.

Interaction Effects:

The results in Table (20) showed that the interactions between N level and planting density significantly affected fiber% in 1995/1996 season. In that season, double drills significantly increased fiber% at 180 and 240 kg N/fed levels compared with 1.5 drills, whereas at 120 kg N/fed, both planting densities did not significantly differ in fiber % of cane stalk at harvest.

Table (20)Effect of irrigation, N fertilizer level, planting density and their interactions on fiber percentage in cane stalk at harvest in 1994/1995 and 1995/1996 growing seasons.

Irrigation regime	Nitrogen	1994/1995 season		Average	1995/1996 season		Average
Season and Irrigation Interval	kg N/ Fed.	Planting density			Planting density		
		1.5 drill	2 drills		1.5 drill	2 drills	
1. Summer (10-day). Moderates (15-day) and Winter (20-day)	120	11.800	12.350	**12.075**	11.600	12.150	**11.875**
	180	12.350	12.700	**12.525**	11.950	12.300	**12.125**
	240	12.750	13.200	**12.975**	12.350	12.800	**12.575**
Average		**12.300**	**12.750**	**12.525**	**11.967**	**12.417**	**12.192**
2. Summer (7-day), Moderates(14-day) and Winter (21-day)	120	12.400	12.150	**12.275**	12.150	12.050	**12.100**
	180	12.750	12.950	**12.850**	12.350	12.550	**12.450**
	240	12.350	13.150	**12.750**	11.950	12.750	**12.350**
Average		**12.500**	**12.750**	**12.625**	**12.150**	**12.450**	**12.300**
3. Summer (14-day), Moderates (21-day) and Winter (28-day)	120	11.950	11.750	**11.850**	11.700	11.750	**11.625**
	180	11.800	12.700	**12.250**	11.400	12.300	**11.850**
	240	12.450	13.150	**12.800**	12.050	12.750	**12.400**
Average		**12.067**	**12.533**	**12.300**	**11.717**	**12.200**	**11.958**
Interaction of Nitrogen X Planting density	120	12.050	12.083	**12.067**	11.817	11.917	**11.867**
	180	12.300	12.783	**12.542**	11.900	12.383	**12.142**
	240	12.517	13.167	**12.842**	12.117	12.767	**12.442**
Total average of planting density		**12.289**	**12.678**	**12.483**	**11.944**	**12.356**	**12.150**

L.S.D at 5 % level for:	1994/1995	1995/1996
irrigation regime (A)	NS	0.246
N level (B)	0.268	0.226
Planting density (C)	0.219	0.184
AxB	NS	NS
AxC	NS	NS
BxC	NS	0.319
AxBxC	NS	NS

III. Effect of Irrigation Regime, Nitrogen Fertilizer Level, Planting Density and Their Interactions on Yield and Yield Components of the Plant Crop Sugar Cane:

1. Number of millable cane:

Millable canes are the stalks which succeeded to reach the maturity stage where they can be delivered to the factories for sugar extraction.

Results of the effects of irrigation regime, N fertilizer level, planting density and their interactions on number of millable cane at harvest in 1994/1995 and 1995/1996 growing seasons are presented in Table (21).

The results showed that the shorter irrigation intervals of the second regime (7-14-21 days during Summer, Moderates and Winter , respectively) insignificantly increased number of millable cane/fed compared with the first (10-15-20 days) and the third (14-21-28 days) regimes in both seasons.

The results in Table (21) indicate that an increase in millable cane of 7.90 and 12.55% was recorded in 1994/1995 season due to applying the second regime compared with the first and third regime, respectively. The corresponding increases due to applying the second regime in 1995/1996 season were 8.27 and 15.07% over the two other regimes. These considerable incrases were, however, below the level of significance.

The increase in millable cane is mainly due to the increase in the applied water in the second regime by 19.68 and 23.98% over the first regime in 1994/1995 and 1995/1996, respectively, and over the third regime by 28.56 and 30.53 % in the two successive seasons.

The irrigation at shorter intervals led to an increase in number of cane plants/m at different growth stages due to the increase in tillering in cane plants.

The present results are in line with those obtained by **El-Gibali *et al.* (1978)** and **Subramanian *et al.* (1991)**.

Table (21) Effect of irrigation regime, N fertilizer level, planting density and their interactions on number of millable cane (1000 stalks/fed.) at harvest in 1994/1995 and 1995/1996 growing seasons.

Irrigation regime	Nitrogen	1994/1995 season			1995/1996 season		
Season and Irrigation Interval	kg N/ Fed.	Planting density		Average	Planting density		Average
		1.5 drill	2 drills		1.5 drill	2 drills	
1. Summer (10-day), Moderates (15-day) and Winter (20-day)	120	58.000	58.400	**58.200**	68.970	59.280	**64.125**
	180	63.333	54.267	**58.800**	66.120	65.550	**65.835**
	240	52.533	68.667	**60.600**	68.400	57.570	**62.985**
Average		**57.956**	**60.444**	**59.200**	**67.830**	**60.800**	**64.315**
2. Summer (7-day), Moderates(14-day) and Winter (21-day)	120	66.933	59.067	**63.000**	55.290	72.390	**63.840**
	180	65.067	67.733	**66.400**	78.090	71.250	**74.670**
	240	58.933	62.533	**60.733**	59.850	80.940	**70.395**
Average		**63.644**	**63.111**	**63.378**	**64.410**	**74.860**	**69.635**
3. Summer (14-day), Moderates (21-day) and Winter (28-day)	120	55.333	52.800	**54.067**	49.020	51.300	**50.100**
	180	50.800	66.000	**58.400**	69.540	66.690	**68.115**
	240	54.267	58.667	**56.467**	57.570	68.970	**63.270**
Average		**53.467**	**59.156**	**56.311**	**58.710**	**62.320**	**60.515**
Interaction of Nitrogen X Planting density	120	60.089	56.756	**58.422**	57.760	60.990	**59.375**
	180	59.733	62.667	**61.200**	71.250	67.830	**69.540**
	240	55.244	63.289	**59.267**	61.940	69.160	**65.550**
Total average of planting density		**58.356**	**60.904**	**59.630**	**63.650**	**65.993**	**64.822**

L.S.D at 5 % level for:

	1994/1995	1995/1996
irrigation regime (A)	NS	NS
N level (B)	NS	8.417
Planting density (C)	NS	NS
AxB	NS	NS
AxC	NS	NS
BxC	NS	NS
AxBxC	NS	NS

Concerning the effect of N fertilizer level, results in Table (21) showed that the increase in N level from 120 to 180 kg significantly increased number of millable cane by 17.12 % in 1995/1996 season corresponding to an insignificant increase of 4.76% in 1994/1995 season.

Increasing N level from 180 to 240 kg/fed insignifiacntly decreased number of millable cane/fed by 3.16 and 5.73% in the first and second season, respectively.

It could be concluded that the 180 kg/fed N level was quite satisfactory to produce the maximum number of millable cane plants in both seasons. The results are in agreement with those reported by **Ahmed (1995)**.

The results indicated also insignificant increase in number of millable cane due to planting double drills by 4.37 and 3.86% over planting 1.5 drill in 1994/1995 and 1995/1996 growing season, respectively. The results here are mainly due to the increase in number of cane plants/m at the different growth stages. Similar results were also reported by **Ahmed (1995)**.

Interaction Effects:

The results in Table (21) indicate no significant interactions between the experimental factors on number of millable cane /fed in both seasons.

In general, the highest number of millable cane/fed in 1994/1995 was 68667 plants which was recorded by the first regime supplied with 240 kg N /fed and grown by double drills.

In 1995/1996 season, the combination of the second irrigation regime + 240 kg N/fed + planting double drills produced the maximum number of millable cane/fed, being 80940 plants/fed

2. Cane yield:

Cane yield is considered the final expression for the interaction between the genetical make up (variety) and the external factors in terms of micro climatic and agronomical processes (environment). Therefore, any improvement in the agronomical practices will directly be reflected on cane yield which represents the corner stone in sugar production.

Results presened in Table (22) showed the effects of irrigation regime, N fertilizer level, planting density and their interactions on plant cane yield (ton/fed) in 1994/1995 and 1995/1996 seasons.

The results in Table (22) indicated that scheduling irrigation at shorter intervals of the second regime (7-14-21 days in Summer, Moderates and Winter) increased cane yield compared with the traditional irrigation regime of the first treatment (10-15-20 days) and the third regime in which irrigation intervals were prolonged to reach 14-21 and 28 days (in Summer, Moderates and Winter, respectively).

The second regime insignificanly increased cane yield by 5.54 and 4.45% over the yield of the first regime in 1994/1995 and 1995/1996 season, respectively. The superiority of the second regime was more evident on the third regime where yield increases of 8.64 and 6.27% were recorded in the two successive seasons. The increase in cane yield of the second regime is mainly due to the increase in the amount of irrigation water applied in that regime which was 19.68 and 23.98% higher compared with the first regime in 1994/1995 and 1995/1996 season, respectively. Also, the applied water in the second regime was 28.56 and 30.53% higher than that in the third regime in the two successive seasons.

Presented results are quite expected since the second regime markedly increased growth characters and yield components such as number of cane plants/m (at 120 and 150 days), stalk height (at 135, 200 and 330 days), stalk diameter (at 135, 200 and 330 days), fiber%, and number of millable cane/fed

It could be cocluded that irrigation at shorter intervals increased cane yield. The present results are in general agreement with those outlined by **El-Gibali** ***et al.*** **(1978)** who showed that the frequent irrigation by shorter intervals resulted in higher cane yield.

Concerning the effect of N level, the results in Table (22) indicated no significant effect on cane yield in both seasons. However, a marked increase in cane yield was observed when the N level was raised from 120 to 180

Table (22) Effect of irrigation regime, Nfertilizer level, planting density and their interactions on cane yield (tons/fed.) at harvest in 1994/1995 and 1995/1996 growing seasons.

irrigation regime	Nitrogen	1994/1995 season		Average	1995/1996 season		Average
Season and Irrigation Interval	kg N/ Fed.	Planting density			Planting density		
		1.5 drill	2 drills		1.5 drill	2 drills	
1. Summer (10-day), Moderates (15-day) and Winter (20-day)	120	60.400	76.933	68.667	64.250	71.675	67.962
	180	71.110	74.000	72.550	76.975	76.750	76.863
	240	67.000	66.967	66.983	72.350	64.650	68.500
Average		66.167	72.633	69.400	71.192	71.025	71.108
2. Summer (7-day), Moderates(14-day) and Winter (21-day)	120	73.200	73.167	73.183	67.375	75.500	71.438
	180	78.300	68.400	73.350	74.250	77.000	75.625
	240	65.500	80.900	73.200	75.075	76.450	75.763
Average		72.333	74.156	73.244	72.233	76.317	74.275
3. Summer (14-day), Moderates (21-day) and Winter (28-day)	120	61.000	66.000	63.500	65.375	73.675	69.525
	180	64.600	76.600	70.600	74.050	73.175	73.612
	240	74.000	62.300	68.158	64.075	69.025	66.550
Average		66.533	68.300	67.417	67.833	71.958	69.896
Interaction of Nitrogen X Planting density	120	64.867	72.033	68.450	65.667	73.617	69.642
	180	71.333	73.000	72.167	75.092	75.642	75.367
	240	68.833	70.056	69.444	70.500	70.042	70.271
Total average of planting density		68.344	71.696	70.020	70.419	73.100	71.760

L.S.D at 5 % level for:

	1994/1995	1995/1996
irrigation regime (A)	NS	NS
N level (B)	NS	NS
Planting density (C)	NS	NS
AxB	NS	NS
AxC	NS	NS
BxC	NS	NS
AxBxC	14.909	NS

kg/fed where an increase of 5.43 and 8.22% was recorded in the first and second season, respectively. It is worth mentioning that increasing N level from 180 to 240 kg/fed insignificantly reduced cane yield by 3.92 and 7.25% in the first and second season, respectively, indicating a negative effect of the highest N level on cane yield.

It could be concluded that 180 kg N/fed was quite satisfactory to produce the highest cane yielld/fed under the conditions of the experiment.

The results are expected since 180 kg N/fed positively affected number of cane plants/m , stalk height, stalk diameter, elongation rate which were recorded at different growth stages. Also, the 180 kg N/fed level significantly increased number of millable cane/fed

Similar results were also obtained by **El-Geddawi *et al.* (1988)** , **Rahman (1989), Rahman *et al.* (1989), Rao *et al.*(1989)** and **Yadav and Prasad (1992)**.

In regard to planting density, the results in Table (22) showed a considerable (but insignificant) increase in cane yield/fed due to growing sugar cane by double drills compared with 1.5 drill.

Planting double drills insignificantly increased cane yield by 4.90 and 3.81% compared with 1.5 drill in the first and second season, respectively. This increase in cane yield is mainly due to the increase in number of cane plants/m at different growth stages as well as the increase in number of millable cane/fed obtained by using double drills.

The present results are in line with those obtained by **Yadav (1993)** and **Ahmed (1995)** .

Interaction Effects:

The results in Table (22) showed that all effects of the interactions between the studied factors on cane yield were not significant except the second order interaction in 1994/1995 season.

The results revealed that the maximum cane yield in 1994/1995 season was 80.900 ton/fed which was produced by applying the second irrigation regime combined with 240 kg N/fed and double drills plant density. Also, in 1995/1996 season, the combination of second irrigation regime + 180 kg N/fed + Double drills produced the highest cane yield, being 77.000 ton/fed

3. Sugar yield:

Sugar is the final product of all biological and agronomical processes and interactions occured in sugar cane plant tissues.

The results of the effects of irrigation regime, N fertilizer level, planting density and their interactions on plant sugar cane in 1994/1995 and 1995/1996 seasons are presented in Table (23).

The results showed no significant effect for irrigation regime on sugar yield in both seasons. However, the second irrigation regime produced higher sugar yield which was 2.81 and 1.91% higher than that of the first and third irrigation regime, respectively, in the first season, corresponding to 0.15 and 7.87% in the second one.

The insignificant effect of the applied irrigation regimes may be due to non-significant effect of irrigation regime on cane yield, sugar recovery% , reducing sugar% , and sucrose% . It is well known that sugar recovery % and cane yield are the two wings of sugar production.

The present results are in line with those reported by **Baram *et al.*(1974)** who found no siginificant differences in recoverable sugar yields/ha as a result of applying three irrigation frequencies of 7, 14, 21 days.

Concerning the effect of N level, results in Table (23) indicated that the highest sugar yield was obtained by using 180 kg N/fed in both seasons. The 180 kg N/fed level increased sugar yield over the lower level (120 kg/fed) by 4.39 and 10.45% in the first and second season, respectively. Also, the 180 kg N/fed level increased sugar yield over the highest level (240 kg/fed) by 6.07 and 19.14% in 1994/1995 and 1995/1996 season, respectively. The differences in sugar yield in the second season were quite clear to reach the level of significance.

Table (23) Effect of irrigation regime, N fertilizer level, planting density and their interactions on sugar yield (tons/fed.) at harvest in 1994/1995 and 1995/1996 growing seasons.

irrigation regime	**Nitrogen**	1994/1995 season		**Average**	1995/1996 season		**Average**
Season and Irrigation Interval	kg N/ Fed.	**Planting density** 1.5 drill	**Planting density** 2 drills		**Planting density** 1.5 drill	**Planting density** 2 drills	
1. Summer (10-day).	120	7.240	8.696	**7.698**	9.090	8.794	**8.942**
Moderates (15-day) and	180	8.064	8.518	**8.291**	9.929	9.528	**9.728**
Winter (20-day)	240	7.273	7.447	**7.360**	9.071	8.306	**8.689**
Average		**7.526**	**8.220**	**7.873**	**9.364**	**8.876**	**9.120**
2. Summer (7-day),	120	8.331	7.958	**8.145**	8.435	9.420	**8.928**
Moderates(14-day) and	180	9.411	6.927	**8.169**	10.009	9.686	**9.847**
Winter (21-day)	240	7.359	8.578	**7.968**	8.296	8.959	**8.927**
Average		**8.367**	**7.821**	**8.094**	**8.913**	**9.355**	**9.134**
3. Summer (14-day),	120	7.367	7.785	**7.576**	7.890	9.320	**8.605**
Moderates (21-day) and	180	7.540	8.998	**8.269**	9.339	9.993	**9.666**
Winter (28-day)	240	8.331	7.638	**7.984**	4.789	9.467	**7.128**
Average		**7.746**	**8.141**	**7.943**	**7.339**	**9.594**	**8.467**
Interaction of	120	7.646	8.146	**7.896**	8.472	9.178	**8.825**
Nitrogen X	180	8.338	8.148	**8.243**	9.759	9.736	**9.747**
Planting density	240	7.654	7.888	**7.771**	7.385	8.911	**8.148**
Total average of planting density		**7.880**	**8.061**	**7.970**	**8.539**	**9.275**	**8.907**

L.S.D at 5 % level for:

irrigation regime (A)	NS	NS
N level (B)	NS	1.153
Planting density (C)	NS	NS
AxB	NS	NS
AxC	NS	1.631
BxC	NS	NS
AxBxC	1.773	NS

The negative effect of the highest N level on sugar yield is due to its negative effect on sugar recovery% as well as cane yield.

It could be concluded that the application of 180 kg N/fed is quite satisfactory to produced the highest sugar yield under the conditions of the experiment.

The present results are quite expected since the 180 kg N/fed level/fed produced the highest cane yield and recorded the best recovery%. The present results are in agreement with the results reported by **El-Geddawi *et al.*(1988)**.

Concerning the effect of planting density on sugar yield, the results in Table (23) revealed insignificant increases of 2.30 and 8.62 % due to growing double drills as against 1.5 drill in 1994/1995 and 1995/1996 seasons, respectively. The results here are mainly due to the insignificant increase in cane yield due to planting double drills. Similar results were also reported by **Murayama (1991)** and **Ahmed (1995)**.

Interaction Effects:

The results in Table (23) indicated a significant interaction effect between irrigation regime and planting density on sugar yield in 1995/1996 season.

The results revealed that double drills significantly outyielded 1.5 drill under the second irrigation regime (7-14-21 days), whereas under the first regime (10-15-20 days), 1.5 drill insignificantly increased sugar yield over double drills. Under the third irrigation regime, double drills insignificantly increased sugar yield.

Also, the second order interaction significantly influenced sugar yield in 1994/1995 season. In that season, the maximum sugar yield was 9.411 ton/fed which was produced by the second regime combined with application of 180 kg N/fed and growing 1.5 drill.

IV. Water Use Efficiency (W.U.E.):

In arid and semi-arid regions where water is a limiting factor in the expansion of cultivated area, the primary objective of management is the development of water use program that will provide maximum yield per unit of water consumed by plants.

The term water use efficiency has been widely used in irrigated crop production to describe the efficiency of irrigation with respect to crop yields.

The water use efficiency is expressed as kg of produced cane (or sugar) per one cubic meter of water consumed.

The average values of W.U.E. by sugar cane plant has been calculated here for cane yield and also for sugar yield as affected by irrigation regimes, N levels and planting density in 1994/1995 and 1995/1996 seasons. The results of W.U.E. calculated for cane yield and sugar yield are presented in Tables (24) and (25), respectively.

1. Effect of irrigation regime:

Water use efficiency calculated for cane yield was markedly affected by irrigation regime in both seasons as showedn in Table (24).

The third regime in which irrigation was scheduled at longer intervals (14-21-28 days) produced the highest W.U.E. in both seasons. The third regime was followed by the first (traditional) regime and the least W.U.E. was obtained by the second regime where irrigation was scheduled at shorter intervals (7-14-21 days).

The results showed that applying the third regime increased W.U.E. by 4.58 and 18.51% compared with the first and second regime in 1994/1995 season, respectively. In 1995/1996 season, similarly, the third regime surpassed the first and second regimes by 3.63 and 22.98%, respectively.

It is quite clear that the third regime saved a cosiderable amounts of water without serious cane yield reduction, leading to a marked increase in W.U.E. On the other hand, the second regime in which irrigation was

Table (24) Water use efficiency on cane yield basis [cane yield (kg)/water added (m^3)] as affected by irrigation regime, N fertilizer level, planting density and their interactions in 1994/1995 and 1995/1996 growing seasons.

irrigation regime	**Nitrogen**	1994/1995 season		**Average**	1995/1996 season		**Average**
Season and Irrigation Interval	kg N/ Fed.	**Planting density** 1.5 drill	2 drills		**Planting density** 1.5 drill	2 drills	
1. Summer (10-day),	120	9.400	11.47	**10.43**	9.42	10.13	**9.77**
Moderates (15-day) and	180	10.85	11.40	**11.12**	10.94	11.02	**10.98**
Winter (20-day)	240	10.00	9.76	**9.88**	10.33	9.22	**9.77**
Average		**10.08**	**10.87**	**10.47**	**10.23**	**10.12**	**10.17**
2. Summer (7-day),	120	9.45	9.24	**9.34**	8.02	8.47	**8.24**
Moderates(14-day) and	180	9.95	8.30	**9.12**	8.60	8.57	**8.58**
Winter (21-day)	240	8.35	10.17	**9.26**	8.84	8.94	**8.89**
Average		**9.25**	**9.23**	**9.24**	**8.48**	**8.66**	**8.57**
3. Summer (14-day),	120	10.13	10.88	**10.50**	10.02	11.28	**10.65**
Moderates (21-day) and	180	9.92	13.10	**11.51**	10.74	11.30	**11.02**
Winter (28-day)	240	11.71	9.99	**10.85**	9.57	10.33	**9.95**
Average		**10.58**	**11.32**	**10.95**	**10.11**	**10.97**	**10.54**
Interaction of	120	9.66	10.53	**10.09**	9.15	9.96	**9.55**
Nitrogen X	180	10.24	10.93	**10.58**	10.09	10.29	**10.19**
Planting density	240	10.02	9.97	**9.99**	9.58	9.49	**9.53**
Total average of planting density		**9.97**	**10.47**	**10.22**	**9.60**	**9.91**	**9.76**

Table (25) Water use efficiency on sugar yield basis [sugar yield (kg)/water added (m^3)] as affected by irrigation regime, N fertilizer level, planting density and their interactions in 1994/1995 and 1995/1996 growing seasons.

irrigation regime	**Nitrogen**	1994/1995 season			1995/1996 season		
Season and Irrigation Interval	kg N/ Fed.	**Planting density** 1.5 drill	**Planting density** 2 drills	**Average**	**Planting density** 1.5 drill	**Planting density** 2 drills	**Average**
1. Summer (10-day),	120	1.12	1.29	**1.20**	1.33	1.28	**1.30**
Moderates (15-day) and	180	1.23	1.31	**1.27**	1.41	1.36	**1.38**
Winter (20-day)	240	1.08	1.08	**1.08**	1.29	1.18	**1.23**
Average		**1.14**	**1.22**	**1.18**	**1.34**	**1.27**	**1.30**
2. Summer (7-day),	120	1.07	1.00	**1.03**	1.00	1.05	**1.02**
Moderates(14-day) and	180	1.19	0.84	**1.01**	1.15	1.07	**1.11**
Winter (21-day)	240	0.93	1.07	**1.00**	0.97	1.04	**1.01**
Average		**1.06**	**0.97**	**1.01**	**1.04**	**1.05**	**1.04**
3. Summer (14-day),	120	1.39	1.29	**1.34**	1.21	1.42	**1.31**
Moderates (21-day) and	180	1.15	1.48	**1.31**	1.35	1.54	**1.44**
Winter (28-day)	240	1.31	1.22	**1.26**	0.71	1.14	**1.06**
Average		**1.28**	**1.33**	**1.30**	**1.09**	**1.45**	**1.27**
Interaction of	120	1.13	1.18	**1.15**	1.16	1.22	**1.19**
Nitrogen X	180	1.19	1.18	**1.18**	1.29	1.30	**1.29**
Planting density	240	1.10	1.12	**1.11**	0.99	1.20	**1.09**
Total average of planting density		**1.14**	**1.16**	**1.15**	**1.14**	**1.24**	**1.19**

scheduled at 7-14-21 days, increased markedly the consumptive use of water without great increase in cane yield to compensate the higher water used. The result was a lower value of W.U.E. compared with the traditional irrigation system.

It could be concluded that since water is the limiting factor in the Egyptian agriculture and a rationalized use of water is vitally important, the application of the second regime is not recommended when compared with the traditional regime.

The application of the traditional regime increased W.U.E. by 13.31 and 18.66% in the first and second season, respectively, showeding the superiority of the traditional system over the second one. Similarly, calculating the W.U.E. based on sugar yield indicated clearly the superiority of the third regime in the first season and of the first (traditional) regime in the second season (Table, 25).

The results indicated that the third regime surpassed the first and second regime by 10.16 and 28.71% in 1994/1995 season, respectively. In 1995/1996 season, a very slight increase in W.U.E. compared with the third one due to a higher sucrose%. In that season, applying the first (traditional) regime increased W.U.E. by 25.00 and 2.36% compared with the second and third regime, respectively.

The results indicated clearly that prolonging irrigation intervals in the traditional regime is advisable to save considerable amount of water and to increase W.U.E.

It was indicated that in the first regime, one cubic meter of water produced 1.18 and 1.30 kg sugar in the two successive seasons. With the third regime, one cubic meter of water produced 1.30 and 1.27 kg sugar in the first and second season, respectively. On the other hand, in the second regime with its higher consumptive use of water, one cubic meter of water produced only 1.01 and 1.04 kg sugar in 1994/1995 and 1995/1996 season, respectively.

The present results are in general agreement with those reported by **Yasin *et al.* (1990)** who found that W.U.E. increased with an increase in soil moisture stress. Also, **Prasad *et al.* (1991)** found that W.U.E. decreased with increased irrigation frequency. The results are also in general agreement with those obtained by **Khalil (1995)** who found that higher values of W.U.E. were gained from medium irrigation intervals at 1.0 accumulation pan evaporation intervals, whereas the prolonged irrigation intervals or frequent irrigation intervals beyond 1.0 accumulation pan evaporation treatment resulted in decreasing the values of W.U.E. with faba bean crop.

2. Effect of N fertilizer level:

The results presented in Tables (24 and 25) showed that the application of 180 kg/fed produced the highest W.U.E. in both seasons when W.U.E. was calculated either on cane or sugar basis. The lowest W.U.E. was recorded with the highest N level, i.e. 240 kg/fed

Increasing the N level from 120 to 180 kg/fed increased W.U.E. by 4.85 and 6.70% in the first and second season, respectively when the efficincy was based on cane yield. Similarly, when W.U.E. was calculated on sugar yield basis, increasing N level from 120 to 180 kg/fed increased W.U.E. by 2.60 and 8.40% in the two successive seasons.

Increasing N level to the highest level (240 kg/fed) produced the lowest W.U.E. based either on cane or sugar yield in both seasons.

It could be concluded that the medium N level (180 kg/fed) was the optimum N level for plant cane yield when sugar cane was planted in the summer season. The results are mainly due to the effect of N on cane yield.

The results are in agreement with those obtained by **Kanwar *et al.* (1989)** and **Prasad *et al.* (1991).**

3. Effect of planting density:

Results presented in Tables (24 and 25) showed that increasing the planting density by growing double drills increased W.U.E. in both seasons.

Based on cane yield, double drills increased W.U.E. by 5.01 and 3.23% in 1994/1995 and 1995/1996 growing season, respectively. The increase in W.U.E. based on sugar yield by planting double drills was 1.75

and 8.77% in the first and second season, respectively, compared with planting 1.5 drill.

It could be concluded that increasing the planting density increased W.U.E. as a result of increasing cane yield.

Results reported by **Salib (1991)** showed that thin planting of sesame reduced W.U.E. and the moderate density of 168000 plants/fed produced the highest W.U.E.

It could be concluded that reducing the amount of applied water by prolonging irrigation intervals at 14 days in Summer, 21 days in Spring and Autumn and 28 days in Winter, combined with the application of 180 kg N/fed and growing sugar cane with double three-budded setts (50400 buds/fed) recorded the highest W.U.E. in both seasons, being 13.10 and 11.30 kg cane/one cubic meter in 1994/1995 and 1995/1996 season, respectively. This treatment achieved the maximum W.U.E. and one cubic meter produced 1.48 and 1.54 sugar in the first and second season, respectively.

SUMMARY

WATER REQUIREMENTS FOR SUGARCANE UNDER DIFFERENT LEVELS OF NITROGEN FERTILIZER

Two field experiments were conducted at Shandaweel Research Station (Sohag governorate) in Upper Egypt in the two successive growing seasons of 1994/1995 and 1995/1996 to study the effect of some irrigation regimes, N fertilizer levels and planting densities on yield and quality of sugarcane.

Each experiment included 18 treatments which represent the combination between three irrigation regimes, three N levels and two planting densities.

The levels of studied factors were as follows:

I- Irrigation Regimes:

1- Traditional irrigation regime followed by cane growers [irrigation at 10-day intervals in Summer, 15-day intervals in Spring and Autumn (Moderates), and 15-day intervals in Winter]. The plant cane crop was supplied with a total of 23 irrigations during the whole growing season.

2- Irrigation at 7-day intervals in Summer, 14-day intervals in Spring and Autumn, and 21-day intervals in Winter. The plant cane crop was supplied with a total of 28 irrigations during the whole season growing season.

3- Irrigation at 14-day intervals in Summer, 21-day intervals in Spring and Autumn, and 28-day intervals in Winter. The plant cane crop was supplied with a total number of 17 irrigations during the whole growing season.

II. Nitrogen Fertilizer Levels:

1- 120 kg N/fed.
2- 180 kg N/fed.
3- 240 kg N/fed.