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YIELD AND QUALITY OF SUGAR BEET AS AFFECTED BY IRRIGATION INTERVALS AND HOEING FREQUENCY UNDER TWO IRRIGATION SYSTEMS

Ouda,Sohier M. M.
Sugar Crop Research Institute , Agric. Res., Center , Giza , Egypt.

ABSTRACT

The present study was carried out in two successive seasons of 1998/1999 and 1999/ 2000 to find out the relative importance of irrigation interval and hoeing frequency under two irrigation systems on yield and quality of sugar beet in sandy soil at Ismaillia Governorate. The study included 12 treatments which were the combination between two irrigation systems (drip and surface), two hoeing regimes (every 7 and 14 days) ano tnree irrigation intervals (every 3, 5 and 7 days). The results showed that surface irrigation out yielded drip irrigation system in most studied characters. Hoeing at intervals of 7 days produced higher root length, root diameter, root and top yields/ fed , sucrose % TSS %, sugar yield / fed and LUE compared with 15 days ones. While purity % was not affected by hoeing interval. Irrigation intervals (at 3,5 and 7 days) exercised a significant effect on all studied characters except, purity % which was not significantly affected
For the interaction effects , the effect of hoeing intervals on root yield was significant only when surface irrigation was followed . Sucrose % behaved like root yield and sugar yield /fed , prolonging hoeing interval to 15 days, decreased sucrose % and sugar yield / fed. Sugar yield / fed / day showed similar reaction to increasing hoeing interval only under surface irrigation.

Simple correlation coefficients proved positive and highly significant correlation between sugar yield (t/ fed) and the studied eight characters.
According to the obtained results, it could be recommended that surface irrigation system is considered the best one as it, hoeing at intervals of 7 days and scheduling irrigation at 5 days interval. This treatments were more suitable for growing sugar beet plants under newly reclaimed land conditions.

INTRODUCTION

The last two decades of the twentieth century showed a gradual increase in sugar consumption. Thereby Egypt suffers from a gap between consumption and production of sugar which reaches nearly 650,000 ton/annually. As an attempt to narrow the gap of that strategic commodity i.e., sugar, expanding the area under sugar beet becomes a main target for increasing the raw materials used in sugar extraction. Nowaday there is a tendency to sugar beet crop in the newly reclaimed land to fulfill the manufacturing capacity of sugar factories. Furthermore water consumption of sugar beet to produce one ton of sucrose is about 1300m3 whereas sugar cane plant needs about 4000m3 water to produce the same quantity of sucrose.

Increasing productivity yield of any crop is the final goal of many factors such as irrigation system, irrigation interval and hoeing time. Arroyo *et al.* (1999) reported that drip irrigation resulted in higher yields of sugar beet (80.8 and 73.7t/ha at 70 and 50% Evapotranspiration, respectively) than sprinkler irrigation. The highest sugar content was found at 90%

Evapotranspiration for drip irrigation. Kunzelmann (1999) in Germany, noticed that drip irrigation used smallest amount of water compared with another irrigation methods . Slavil and Zavadil (1999) showed that there was no statistically significant difference in dry yields under micro irrigation and drip irrigation. Sharmasarkar *et al.* (2001a) showed that sugar beet root and sugar yields were higher under drip irrigation than furrow irrigation at P= 0 5. Sharmasarker *et al.* (2001b) mentioned that sugar beet yields and sugar contents under drip irrigation were higher than those with flood irrigation.

Tayebi and Ghasanfari (1978) reported that root yield was 31.5 tons/ha by using shelf method but it was 24.7 tons/ha by using hand hoe method. Moreover, Rola *et al.* (1979) cleared that sugar beet yielded 29 tons/ha with hand hoeing application. Simon (1992) noticed that on light sandy loam in the absence of irrigation (40% of soil available water), loosening by hoeing increased root yields by 7.9%. Loosening increased the response of root yields to N application and affected soil water content only in dry years. Abd El-Aal (1995) noticed that hand hoeing 4-times produced the highest sugar and root yields followed using by herbicide +2 hoeings and hand weddings treatment and in third order with herbicide + one hoeing treatment, whereas single herbicide was the lowest. Also, he added that the highest values of root dimensions and purity percentage were obtained by hoeing sugar beet field 4-time, but the differences between weed control treatments did not reach the level of significance in their effect on TSS%. Single herbicide alone and/or in combination with hoeing mostly increased sucrose percentage of sugar beet roots. El-Geddawy *et al.* (2001) reported that increasing hoeing number from two to three times produced a relative advantage in the values of root and sugar yields, while hoeing number had no significant effect on root length and its diameter and quality characters.

Gaber *et al.* (1986) showed that increasing the irrigation intervals decreased significantly the root and leaf yields, while the sugar content was not affected with irrigation intervals. Attia and Sultan (1987) reported that irrigation every 12 days gave significantly higher values of root diameter and root yield/fed, while irrigation evry 18 days gave the highest sucrose percentage, but purity percentage did not significantly influenced by irrigation intervals. Emara (1990) recorded that all yield components were significantly affected by irrigation when sugar beet was irrigated at 28 days instead of 14 days intervals. He added that irrigation every 28 days caused a significant reduction in root diameter and root length. Ibrahim *et al.* (1993) reported that root yield of sugar beet gradually increased by increasing number of farrow irrigation from 4 to 6 times. Kumar (1993) found that sugar yield increased from 3.56 t/ha with three irrigations to 8.36 t/ha with eight irrigations and sucrose content was 12.8% with three irrigations and increased to 14% with eight irrigations. But impurity index decreased as irrigation frequency increased. Azzazy (1998) reported that applying irrigation water at intervals of 7 days attained higher root yield compared with 14 days, while sucrose content, sugar yield, TSS%, purity % and root diameter as well as its length were not significantly affected by irrigation intervals. Sharief *et al.* (1999) found that the highest irrigation volume of 2500m3/fed, resulted in the highest values of sucrose and TSS%. However, the highest percentage of purity was obtained from the irrigation volume of 1500m3/fed. Margotti (2000)

in Italy, showed that sugar content was increased by 40% with drip irrigation every 2-3 days, and generally the use of infrared remote sensing techniques to assess canopy temperature is the most accurate indicator for irrigation scheduling.

MATERIALS AND METHODS

Two field experiments were couducted at El-Kassassien Agricltural Research Station of ARC in Ismaillia Governorate during two winter successive seasons of 1998/ 1999 and 1999 /2000 to study the effect of two irrigation systems, three irrigation intervals and two hoeing frequency. This study included 12-treatments which were the combination between two irrigation systems viz. (surface and drip), two hoeing treatments (every 7 and 14 days) and three irrigation intervals (every 3,5 and 7 days). Treatments were taken place after thinning (45 days after sowing). Asplit - split plot desing with three replications was used, where the two irrigation systems were allocated in the main plots, two hoeing frequency were in the sub-plots and three irrigation intervals were in the sub- sub- plots. Sub - sub - plots area was 15m2 , 5m in length and 3 m in width. Each sub- sub- plots included 5 ridges 60 cm in width . Sowing date was in 14th October in both seasons and harvest date was at 200 days after sowing. A fixed amount of phosphorus (30kgP_2O5/fed) and (48kg K_2O/fed) were used. Potassium fertilizer was added once with the 2nd dose of nitrogen (75 days after sowing). Whereas phosphorus was applied with land preparation. Nitrogen fertilizer 100 kg N/ fed was applied in two equal splits, the first was after thinning and the second was applied at 75 days from sowing under two irrigation systems. The plants were thinned at on plant/ hill. The previous crop was sorghum in both seasons. Acommercial sugar beet variety pleno poly germ was used in both seasons. All the recommended agronomical practices in sugar beet field were done . In both seasons, at 200 days from sowing, five roots were uprooted randomly from each sub-sub-plot to determine the following parameters: 1- Root diameter (cm). 2- Root length (cm). 3- Total soluble solids in beet root (TSS%) which was determined by hand refractometer. 4-Sucrose percentage was determined polarimetrically on lead acetate extract of fresh macerated roots, using Pol-400 Saccharimeter according to the method described by Le-Docte (1927). 5-Apparent purity percentage (the ratio of sucrose to total soluble solids expressed as percentage) purity% = sucrose% / TSS % X 100. Two inner ridges from each sub-sub-plot were harvested to determine the yield and its attributes which are root yield t/fed and top yield t/fed. Gross sugar yield t/fed was calculated by multiplying root yield t/fed by sucrose % and Land use efficiency (LUE) which was computed by the following formula : LUE (kg sugar/fed/day) = sugar yield/fed/ number of days from sowing to harvest.

Analysis of variance and combined analysis for the two seasons were conducted on the obtained data according the method described by Snedecor and Cochran (1981). For comparison between means lest differences significant method was followed. The combined data of yield and yield attributes were subjected to simple correlation according to Svab

(1973). In interaction Tables, capital and small letters were used to compare row and column means, respectively.

Calculation of quantity of irrigation water. Irrigation treatments commenced 45 days after sowing and seased 15 days before harvest so that the period of irrigation treatments reached 140 days wherever sugar beet plants were harvested at 200 days after sowing in the two seasons . The discharge of each drip is amounted to 30 cm3/minute so that the amount of irrigation water discharged in an hour which is the period of irrigation time is 1.8 liter / drip. Number of drips / m2= 10 drip (20 x 50 cm). Total amount of irrigation water/fed = 75.6m3. Number of irrigations for three intervals were 46.66,28 and 20 times for intervals of 3, 5 and 7 days, respectively. The amount of irrigation water / fed= (3527,2116 and 1512 m3) for intervals of 3, 5 and 7 days, respectively. For surface irrigation the discharge was calculated on the basis of 1.5 hour consumed in each irrigation so that the amount of water was 1.5 times the amount consumed in drip irrigation.

Mechanical and chemical analysis of the experimental site and the underground irrigation water chemical and analysis wewe in tables (1 -a) and (1 – b), respectively.

RESULTS AND DISCUSSION

A- Irrigation systems effect :

The results presented in Tables 2 and 3 cleared that surface irrigation outyellded drip irrigation system in all studied characters except purity % which was not affected by changing the irrigation method. Slavil and Zavadil (1999) showed that there was no statistically significant difference in dry yields under microirrigation and drip irrigation. Higher utilization of irrigation water was found for drip irrigation. Sharmasarkar *et al.* (2001a) reported that sugar beet and sugar yields were higher under drip irrigation than furrow irrigation at p=0.05. Sharmasarkar *et al.* (2001b) noticed that sugar beet yields and sugar contents under drip irrigation were higher than those with flood irrigation .

B- Hand hoeing intervals effect :

Data demonstrated in Tables 2 and 3 showed that applying hoeing at intervals of 7 days generally produced higher root length, root diameter, root and top yields/ fed, sucrose %, TSS.%, sugar yield/fed and LUE compared with 15 days ones being 4.04%,4.47%, 7.12%, 8.37%, 1.92%, 1.77%, 9.72% and 8.64% concerning the combined analysis. While purity % was not affected by hand hoeing interval . These results coincide with that found by Simon (1992) who reported that loosening increased root, top, sugar yields and sucrose content. Also, loosening improved the response of root yields to N application on and affected soil water content only in dry years. These results are in harmony with those reported by Abd El-Aal (1995) and El-Geddawy *et al.* (2001).

This indicates that hoeing the sugar beet fields more frequently during the season favours the growth of beet roots beneath the soil because hoeing makes the land more friable and more erected.

El-Kassassin Research Station Ismillia Governorate

RHAvg	PresAvg	Dew Point Avg	Dew Point Min	Dew Point Mix	TMin	TMax	TAvg	Cloud Avg	WindSp Avg	WindDr Avg	Month	Year
65.18	1018.38	8.34	1.00	14.00	5.00	23.00	13.82	1.55	3.42	138.58	1	1998
59.29	1017.46	8.04	1.00	16.00	3.00	31.00	14.87	1.36	3.93	115.07	2	1998
55.68	1013.97	8.96	1.00	18.00	9.00	31.00	17.76	1.07	4.98	132.34	3	1998
57.50	1018.31	10.66	1.00	17.00	8.00	35.00	20.17	0.97	4.98	128.62	4	1998
63.62	1013.24	14.45	3.00	19.00	14.00	36.00	24.10	0.44	5.13	101.71	5	1998
68.93	1010.02	17.71	6.00	22.00	16.00	39.00	28.71	0.99	8.72	221.75	6	1998
72.01	1000.68	19.94	2.00	25.00	21.00	40.00	28.61	0.47	8.51	251.64	7	1998
7202	1008.08	2044	11.00	25.00	21.00	39.00	29.25	1.44	6.93	209.84	8	1998
72.71	1009.90	19.00	8.00	24.00	20.00	38.00	26.94	1.10	5.48	178.50	9	1998
74.33	1013.94	17.07	6.00	21.00	15.00	33.00	23.66	1.35	4.64	200.54	10	1998
65.20	1017.84	11.97	1.00	19.00	7.00	34.00	19.34	1.52	4.19	158.82	11	1998
64.82	1018.90	9.12	1.00	17.00	4.00	25.00	15.00	2.72	3.58	155.37	12	1998
57.88	1017.35	7.14	1.00	16.00	3.00	22.00	12.88	2.78	8.27	207.52	1	1999
58.15	1019.19	7.10	2.00	17.00	5.00	22.00	13.42	2.41	5.41	207.02	2	1999
58.40	1017.65	8.19	1.00	14.00	8.00	31.00	15.16	1.98	5.83	154.41	3	1999
58.84	1011.17	11.58	1.00	18.00	11.00	39.00	21.39	1.51	7.31	175.91	4	1999
60.88	1012.27	13.19	4.00	20.00	13.00	39.00	23.24	2.06	7.40	133.16	5	1999
68.05	1009.52	17.14	5.00	23.00	18.00	43.00	26.92	0.58	7.90	212.22	6	1999
67.87	1006.59	18.82	1.00	24.00	20.00	42.00	29.02	0.21	7.28	199.64	7	1999
73.50	1008.02	20.20	1.00	25.00	21.00	40.00	28.28	0.82	8.34	256.60	8	1999
71.99	1010.42	18.29	5.00	23.00	17.00	38.00	26.29	1.13	7.08	212.22	9	1999
73.37	1014.84	15.72	1.00	27.00	13.00	40.00	22.13	1.73	6.56	172.95	10	1999
71.49	1015.93	12.70	2.00	19.00	10.00	40.00	18.76	1.02	5.38	97.45	11	1999
71.72	1017.14	10.30	1.00	21.00	7.00	29.00	14.89	2.79	4.08	125.48	12	1999
84.01	1019.50	8.19	1.00	14.00	5.00	40.00	13.92	2.72	4.24	126.85	1	2000
50.35	1017.51	6.39	1.00	19.00	7.00	29.00	14.27	2.47	6.19	164.78	2	2000
85.93	1014.17	11.42	1.00	19.00	7.00	36.00	19.07	1.87	7.48	155.17	3	2000
55.87	1012.99	10.84	1.00	19.00	11.00	39 00	21.28	2.15	8.08	131.79	4	2000
58.45	1011.05	13.23	1.00	30.00	9.00	43.00	24.38	1.57	9.18	168.95	5	2000
63.54	1009.43	15.95	3.00	22.00	12.00	39.00	26.51	0.55	8.42	156.79	6	2000
71.89	1006.901	20.02	1.00	28.00	21.00	39.00	28.79	1.12	7.78	238.96	7	2000
72.02	008.08	20.44	11.00	25.00	23.00	38.00	29.25	1.44	8.93	209.84	8	2000
72.51	1011.18	19.11	11.00	25.00	18.00	39.00	27.13	1.04	8.42	180.39	9	2000
71 01	1014.27	15.81	9.00	20.00	12.00	32.00	22.98	2.44	4.87	141.32	10	2000
64 29	1013.38	11.35	4.00	19.00	8.00	29.00	18.57	2.14	5.61	138.10	11	2000
54.83	1017.80	7.18	1.00	18.00	5.00	28.00	14.33	1.85	7.40	188.62	12	2000

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Table 1-a: Mechanical and chemical analysis of the experimental site.

Seasons	Soluble salts millions/cm	Anions meg/100g soil			Cations meg/100g soil				pH	Organic Matter %	Cross sand %	Fine sand %	Site %	Clay%	Available millíon (ppm)			Tertuyre class
		MOC3	Cl⁻	SO=4	Mg++	Ca++	Na+	K+							N	P	K	
First season	0 2	0 12	0 11	0 36	0 05	0.10	0 11	0.006	8 10	0 10	79	14.90	1.34	5 04	29 90	4 99	84 52	Sandy soil
Second season	0.6	0.09	0.27	0.32	0.16	0.21	0.30	0.010	7.50	0.21	80	15.00	1.39	4.99	30 04	6 81	70 00	

Table 2 : Effect of *irrigation systems* and hoeing treatments as well as irrigation intervals on root diameter and its length and quality of sugar beet during the two seasons.

Main effects nd interactions	Root diameter (cm)			Root length (cm)			T.S.S. %			Sucross %			Purity %		
	1st season	2nd season	Com-bined	1st season	2nd season	Com-bined	1st season	2nd season	Com-bined	1st season	2nd season	Com-bined	1st season	2nd season	Com-bined
Irrigation systems (S)															
Drip	10 831	11.827	11 329	26.697	26.538	26.617	23.291	20.351	21.821	17.883	17 297	17.590	76 812	85 004	80.908
Surface	11.974	12.413	12 193	29.124	27.510	28.317	23.416	20.868	22.142	18 045	17,530	17 787	77 020	84 004	80.512
F. Test	**	**	**	**	**	**	*	*	**	*	*	**	NS	NS	NS
Hoeing intervals (H)															
Every 7 days	11.557	12.481	12.019	28.570	27 455	28.012	23.500	20.850	22 175	18.208	17 507	17.857	77 766	83.995	80 730
Every 15 days	11 249	11 759	11.504	27.252	26.592	26.922	23.208	20.370	21 789	17 721	17,320	17 520	76.366	85 012	80.689
F test	**	**	**	**	**	**	*	*	**	*	*	**	NS	NS	NS
Irrigation intervals (I)															
Every 3 days	10 947b	11.587b	11.2676	27.853b	26.913b	27.383b	23 125b	20.400b	21.762b	7.462b	7 091b	17.276b	75 543	83.768	79.655
Every 5 days	12.287a	13.214a	12 750a	29.292a	28.433b	28.862a	24.000a	21.282a	22.641a	8.793a	8.056a	18.424a	78.306	85.081	81 693
Every 7 days	10.974b	11.559b	11 265b	26.587c	25.726c	26.156c	22.937b	20.147b	21.542b	7.637b	7 092b	17.364b	76.909	84.662	80.781
F. test	**	**	**	**	**	**	**	**	**	**	**	**	NS	NS	NS
Sx H	NS	NS	NS	*	**	NS	NS	NS	NS	*	NS	*	NS	NS	NS
S x I	**	NS	**	**	**	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
H x I	NS	NS	NS	NS	NS	NS	NS	NS	NS	*	*	**	NS	NS	NS

Table 1-b: The underground irrigation water chemical and analysis.

Characteristics	First season	Second season
E. C. M. mhos/cm	4.16	5.6
Soluble cations m/l		
Ca^{++}	9.98	14.15
Mg^{++}	7.26	7.28
No^{+}	23.86	34.4
K^{+}	0.40	0.40
Soluble anions m/l		
CO_3	-	-
HCO_3	15.50	8.40
SO_4	5.00	12.60
Cl	26.00	35.00

C- Irrigation intervals effect :

Also data presented in Tables 2 and 3 indicate that irrigation intervals i.e. at 3, 5 and 7 days exercised a significant effect on all studied characters and this was clearly true in both seasons and the combined except, purity %, which was not significantly affected by irrigation intervals. Scheduling irrigation at 5 days intervals surpassed 3 and 7 days interval. These results are in agreement with those obtained by Attia and Sultan (1987), Emara (1990), Sharief *et al.* (1999) and Margotti (2000). This results may be explained on the light of the fact that the soil is sandy textural soil. Three days interval on one hand makes the soil wet for longer period for the weak water holding capacity of the soil and it seasons that for such soil 5 days interval is more optimum for sugar beet crop. Also comparing 3 with 7 days interval, sugar beet plants suffer from less available water under 7 days interval but they suffer more under wet soil of the 3 days interval resulted in more root yield under 7 days interval.

Table 2-a: Interaction effect between irrigation systems and irrigation intervals on root diameter (cm) combined data

Irrigation system	Irrigation interval days		
	3	5	7
Drip	B 10.491b	A 12.179b	B 11.318a
Surface	B 12.044a	A 13.323a	B 11.216a

Table 2-b: Interaction effect between irrigation systems and hoeing intervals on sucrose % (combined data)

Irrigation system	Hoeing interval days	
	7	15
Drip	A 17.664b	A 17.517a
Surface	A 18.051a	B 17.524a

Table 2-b: Interaction effect between Irrigation systems and irrigation intervals on sucrose

Irrigation system	Irrigation interval days		
	3	5	7
Drip	B 17.118a	A 18.593a	A 17.861a
Surface	B 17.736a	A 18.256a	B 16.868b

D- Interaction effects :

a- Irrigation systems x hoeing intervals

As seen in Tables 3- a , 2-b , 3-c and 3-d the interaction effect between irrigation systems and hoeing intervals on root yield t / fed, sucrose %, sugar yield t/fed and sugar production kg/fed / day (LUE), respectively. The highest root yield t/fed, sugar yield t/fed and sugar production kg / fed / day (LUE) were obtained when sugar beet plants were hoeined every 7 days under surface irrigation system . While , the highest sucrose % was obtained with surface irrigation when 7 days hoeing interval or with drip irrigation when 15 days hoeing interval were applied . This could be explained on the light of the effect of irrigation on compacting the soil, so that frequent hoeing is required to make the soil more friable. On the other hand surface irrigation out yielded drip irrigation irrespective to hoeing interval.

Table 3-a: Interaction effect between irrigation systems and irrigation intervals on root yield (t/yield) combined data

Irrigation system	Irrigation interval days		
	3	5	7
Drip	C 11.651b	A 15.315b	B 13.746b
Surface	C 13.806a	A 18.814a	B 17.195a

Table 3-a: Interaction effect between irrigation systems and hoeing intervals on root yield (t/fed) combined data)

Irrigation system	Hoeing interval days	
	7	15
Drip	A 13.730b	A 13.538a
Surface	A 17.548a	B 15.562a

Table 3-b: Interaction effect between irrigation systems and irrigation intervals on top yield (t/fad) combined data.

Irrigation system	Irrigation interval days		
	3	5	7
Drip	C 3.372a	A 4.945b	B 4.189b
Surface	C 3.787a	A 6.334a	B 5.584a

Table 3-c: Interaction effect between irrigation systems and hoeing intervals on sugar yield (t/fad) (combined data)

Irrigation system	Hoeing interval days	
	7	15
Drip	A 2.437b	B 2.378b
Surface	A 3.069a	B 2.639a

Table 3-c: Interaction effect between irrigation systems and hoeing intervals on land use efficiency (LUE) (kg sugar/fad/day) combined data.

Irrigation system	Hoeing interval days	
	7	15
Drip	A 12.166b	A 11.866b
Surface	A 15.325a	B 13.170a

b) Irrigation systems x irrigation intervals

The results presented in Tables 2-a, 2-b , 3-a and 3-b indicate that root diameter (cm) , sucrose (%), root yield t/fed and top yield t / fed in combined data were significantly affected by the interaction between irrigation systems and irrigation intervals. In general , under surface irrigation system the highest root and top yields t/fed and root diameter (cm) were obtained when sugar beet plants were irrigated every 5 days frequency . While , the highest sucrose (5) was when applied drip irrigation system every 7 days intervals .

E- Yield analysis :

Correlation study :

The interrelations between gross sugar yield and yield contributing characters measured as simple correlation coefficients are shown in Table 4. Simple correlation was positive and highly significant when was made between sugar yield t/fed and each of root yield t/fed, top yield t/fed TSS % , root length and sugar production (kg / fed/day) . While there was positively and significantly correlated with sucrose % and root diameter and positively correlated with purity % only. Root yield t/fed was positively and significantly correlated with top yield , sucrose %, TSS%, root length and it's diameter and sugar production (kg /fed/ day) . Also , root yield was positively correlated with purity % but the coefficient was not significant.

Top yield on the one hand was positively and significantly correlated with each of TSS % , root length, root diameter and sugar production (kg / fed/ day) on the other hand. Similar results are aggreed by Gewifel (1982) and Sohier Ouda (1986). Top yield was positively but not significnatly correlated with sucrose % and negatively correlated with sugar production (kg / fed/ day) .

For sucrose % , the results indicated that sucrose % was psotively and significantly correlated with TSS% , root length and it's diameter and sugar production (kg/fed/ day). But the coefficient between sucrose % and purity % did not reach significance level .

TSS% was significantly correlated with each of root length and it's diameter and sugar production (kg / fed/ day) and did not significantly correlated with purity % .

Root length was positively and highly significantly correlated with root diameter and sugar production (kg /fed/day) . Root length was psoitively but not signifiantly correlated with purity %.

Root diameter was positively and significantly correlated with sugar production (kg/ fed/ day) . But, the correlation did not reach the significant level with purity %.

Purity % was positively corrrelated with sugar production (kg/fed/day) only .

F- Path analysis :

The method of path coefficients included the three yield components i.e. root yield t/fed, sucrose % and top yield t/fed. The effect of direct and indirect path coefficients of root yield, sucrose % and top yield on sugar yield are shown in Table 5. These effects were computed by partitioning the simple correlation coefficient into its components . Root yield / fed, demonstrated to have a high direct effect (0.8928) on sugar yield, while the direct effect of top yield / fed was very low (0.0504) . But the direct effect of surcose % was less from the direct effect of root yield on sugar yield. On oposite the indirect effects of surcrose % and top yield / fed were relatively high compared with that of root yield/ fed. Since the indirect effects were 0.5566, 0.0431 and 0.5235, 0.0953, respectively.

The contributions of the direct effects of root yield / fed, sucrose % and top yield / fed and their interactions on sugar yield as recorded in percentage of the variation are presented in Table 6. Path analysis showed that the direct effects for root yield, sucrose % and top yield were 79.71% , 1.24% and 0.25% , respectively . The indirect path coefficient of three characters were about 12.380% , 5.28% and 0.960% of the sugar yield variation. Also, it's clear from the results that root yield and sucrose percentage contributed much to sugar yield than from top yield. (R2) was 99.82% , of the total sugar yeild variation.

Table 4 : Simple correlation coefficients between gross sugar yield (t/ fad) and other characters of sugar beet (combined data).

Characters	1	2	3	4	5	6	7	8
Y-Sugar yield (t/fad)	0.9586**	0.9141**	0.6412*	0.7499**	0.7701**	0.7228**	0.7238	0.9996**
1-Root yield (t/fad)		0.9483**	0.6283*	0.6943*	0.6223*	0.5864*	0.3239	0.9611**
2-Top yield (t/fad)			0.5626	0.6952*	0.6513*	0.5855**	0.3755	0.9141**
3- Root length (cm)				0.8475**	0.6946*	0.8401**	0.1262	0.6448*
4- Root diameter (cm)					0.7948**	0.9037**	0.2040	0.7485**
5- Sucrose %						0.8550**	0.6862*	0.7652**
6- TSS%							0.2135	0.7159**
7- Purity %								0.4233
8- Sugar production (kg / fad/ day)								

Table 5: Partitioning of simple correlation coefficients between sugar yield (t/fad) and its components of sugar beet (combined data).

Sources	Values
Root yield (t/ fad).	
Direct effect	0.8972
Indirect effect via sucrose %	0.1843
Indirect effect via top yield (t/fad)	0.1229
Total (ry_1)	0.9586
Sucrose %	
Direct effect	0.2962
Indirect effect via root yield (t/fad)	0.5583
Indirect effect via top yield (t/fad)	0.0844
Total (ry_2)	0.7701
Top yield (t/fad)	
Direct effect	0.1296
Indirect effect via root yield (t/fad)	0.8508
Indirect effect via sucrose %	0.1929
Total (ry_3)	0.9141

Table 6 : Direct and joint effects of yield components presented as percentage of yield variation in sugar beet

Sources of variation	C.D	%
Root yield (t/fad)	0.8050	80.50
Sucrose %	0.0877	8.77
Top yield (t/fad)	0.0168	1.68
Root yield (t/fad) x sucrose %	0.3307	33.07
Root yield (t/fad) x top yield (t/fad)	0.2206	22.06
Sucrose % x top yield (t/fad)	0.0500	5.0
R^2	0.9696	96.96
Residual factors	0.0304	3.040
Total	1.000	100.00

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مدى تأثير محصول بنجر السكر وجودته بفترات السرى ، مرات العزيق تحت نظامين من الرى

سهير محمود
معهد بحوث المحاصيل السكرية – مركز البحوث الزراعية – الجيزة – مصر

أجرى هذا البحث فى الاراضى الرملية بمحطة البحوث الزراعية بالقصاصين بمحافظة الاسماعلية بهدف دراسة مدى تأثر محصول بنجر السكر وجودته بفترات الرى (رى كل ٣ ، ٥ و ٧ أيام) وعدد مرات العزيق (كل ٧ و ١٥ يوم) وذلك تحت نظامى السرى السطحى والتنقيط خلال موسمى الزراعة ١٩٩٨/١٩٩٩ – ١٩٩٩/٢٠٠٠ باستخدام تصميم القطع المنشقة مرتين فى أربعة مقررات وقد أوضحت النتائج ما يلى :

- تفوق نظام الرى السطحى على الرى بالتنقيط لكل الصفات المدروسة ما عدا النسبة المئوية للنقاوة .
- العزيق كل سبعة أيام أدى الى زيادة معنوية فى كثير من الصفات منها محصول الجذور / فدان ، محصول العرش / فدان ، النسبة المئوية للسكروز ، النسبة المئوية للمواد الصلبة الزائبة الكلية ، ومحصول السكر / فدان / يوم وكذلك زيادة معنوية فى طول الجذر وقطرة مقارنة بالعزيق كل ١٥ يوم
- بالنسبة لفترات الرى (كل ٣ ، ٥ ، ٧ أيام) فقد تأثرت جميع الصفات المدروسة تأثرا معنويا بفترات الرى ما عدا النسبة المئوية للنقاوة فلم تتأثر معنوياً .
- وعن تداخل الفعل بين عوامل الدراسة أوضحت النتائج تناقص محصول السكر / فدان بإطالة فترة العزيق الى ١٥ يوم تحت نظام الرى السطحى .
- لوحظ ارتباط موجب ومعنوى بين محصول السكر / فدان وجميع الصفات المدروسة وقد أشار تحليل المحصول ومكوناته الى ان مصادر الاختلاف المؤثرة فى محصول السكر ترجع الى التأثير المباشر لمحصول الجذور بدرجة اكبر من التأثير المباشر للنسبة المئوية للسكروز .
- وقد بلغ معامل التحديد ٧٩,٧١ لمحصول الجذور ، ١,٢٤ % للنسبة المئوية للسكرور .
- توصى الدراسة التى اجريت على محصول بنجر السكر فى الأراضى المستصلحة حديثا باستخدام الرى السطحى وعزيق النباتات كل أسبوع بغرض التهوية و التربيم وأن تروى النباتات كل خمسة أيام .