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SUGAR BEET YIELD AND QUALITY AS AFFACTED BY WATER REGIME BEFOR HARVEST, DENSITY AND SOME CULTIVARS IN NEW RECLAIMED SOILS.

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ABSTRACT

Field experimental was carried out at Kalabsho - El-Dakhlia Governorate, Egypt, in 2013/14 and 2014/2015 winter growing seasons. To study effect of last regime irrigation before harvest by 15 and 30 days and spacing hills 15, 20 and 25 cm between plants in addition to three cultivars (Sultan, Farida and Samba) on sugar beet yield and quality under reclaimed soils in Kalabsho location. Split-Split plot design were used in both season. Main plots allocated with regime irrigation befor harvest, sub-plots were take with hill spacing between plants whearas, cultivars were arranged in sub-sub plots. Main results were obtained can summarized as folllow: Wih decreasing the gap between last irrigation and harvest to 15 days caused to gave significant increase in value of top fresh weight and root yields, this was true in both seasons (0.361and 0.283 kg/plant) and (25.59 and 26.00 ton/fed.) respectivety. On the other direction,with increasing the gab between last irrigation and harvest untill 30 days resulting in significant differences among mean values of root fresh weight kg/plant,sugar yield ton/fed.,sucrose %,total soluble solids and purity percentages in both seasons. These trends due to,with elonation the period before harvest with out water supply reduced water content in roots through 30 days compared to 15 days befor harvest which was notenough to exhibited any enjourity to plants, or decreasing in water root content. Planting sugar beet seeds at 20 cm. between hills progressive than other distance (15 and 25 cm.) for most important characters,root,top fresh weight, sucrose and purity %. On the other hand space 15 cm. between hills gave the highest values of top fresh weight,root yield, sugar yield and sucrose % in the first season. Cultivar,Farida gave the highest values of root fresh weight,root yields,sugar yields,sucrose % and T.ss % in the first season and purity in the second season. Significant interaction effects were found between main three factors under study illustrated that spacing hill 20 cm. between plants,preventation irrigation befor harvest by 30 days with used Farida cultivare gave the highest values for most important characters under study.

Indexing terms/Keywords

Sugar beet

Academic Discipline And Sub-Disciplines

Agriculture

SUBJECT CLASSIFICATION

Agronomy

TYPE (METHOD/APPROACH)

Provide examples of relevant research types, methods, and approaches for this field: E.g., Historical Inquiry; Quasi-Experimental; Literary Analysis; Survey/Interview

INTRODUCTION

The length of the interval between the last irrigation and harvest can be tolerated will depend on local weather, soil type, soil depth, root distribution, and the extent to which the soil water reservoir is filled at irrigation cutoff. Cultivar is considered the cornerstone for production process, selecting the superior varieties from the imported one is the main purpose to the breeder, in addition to the recommended package of the agronomical practices, reported by **Ramadan (1999 a** and **b)**. Sugar beet is becoming one of the important sugar crops. It grows well in the new reclaimed soils; maturity take short time compared to sugar cane and contains high sugar content. Improving quality parameters of sugar beet juice is the main demand for sugar companies to increase the extracted sugar as well as for the growers to increase their net income.**Awad *et al*.,(2013a).**

Limited moisture stress to increase concentration without reducing or only slightly reducing gross sugar yield can be profitable practice. The length of the interval between the last irrigation and harvest can be tolerated will depend on local weather, soil type, soil depth, root distribution, and the extent to which the soil water reservoir is filled at irrigation cutoff.

Cultivar is considered the cornerstone for production process, selecting the superior varieties from the imported one is the main purpose to the breeder, in addition to the recommended package of the agronomical practices. The differences among cultivars in gen make up expression may be throwing some light on the relative importance of studying varietals behavior through the growing season. Harvesting age one of the main factors which directly affected on maturity consequently juice quality. The differential response of sugar beet cultivar to plant density has been reported by **Hanna, et al. (1988)** found a significant interaction between cultivar and plant density for root yield and sugar content. **Kamel, et al. (1989) and Lauer (1995)** obtained the highest sugar yield from 70 to 100 thousand plants/ha. Studies carried out in Egypt

demonstrated that the highest root and sugar yields were obtained from 20x50 cm spacing. **Bailey (1990)** found that ceasing irrigation from 10 to 30 days before harvest decreased fresh weight of root and top, root yield and sugar yield. On the other hand, sucrose % was increased from 13.8 to 15.0%. **Shalaby (1998)** used different intervals (10, 17, 24 and 31 days) between the last irrigation and harvest date. He found that the interval of irrigation cut off 31 days, reduced top fresh weight per plant, individual root weight as well as root yield, top yield and sugar yield per fed. On the other hand, sucrose, purity percentages increased.**Ramadan (1999 a** and **b)** reported that sucrose content, purity percentages were linearly reduced with the reduction in plant density. While, root and sugar yields were maximized when beets were growing at 42000 plants/fed, while interaction effect between cultivars x plant density was significant on sucrose % and purity %.

El- Taweel (1999) in Egypt, found that sugar beet cultivar Top, Kawemira and Pleno did not differ significantly in sugar yield tons/fed, sucrose, TSS and purity%. The cultivar Pleno was the highest one in this respect followed by Kawemira and Top in a descending order. **Aly (2000)** found that root yield/fed was increased when with-held 10 days before harvest, on the other hand, sucrose, purity percentages increased with-hold irrigation was in 20 days before harvest. However, some workers reported that sucrose and purity percentage decreased linearly as population density decreased. **Saif, Laila. (2000)** tested four sugar beet cultivar viz. Marcopoly, M 9680, M 9681 and Mito. She found a significant differences among cultivar in root fresh weight, sucrose, purity and root yield. **Ismail (2002)** found that sugar beet cultivar did not differ significantly in root length and diameter as well as sucrose and purity% in both seasons, while cultivars significantly differentin root fresh weight (g/plant), root and sugar yields (ton/fed.) in the 1st season only. **Abo El-Magd et al (2003)** tested the effect of three harvesting dates i.e. 180, 195 and 210 days from sowing on sugar beet cultivar Gloria. The results indicated that harvesting dates affected significantly productivity traits such as root length, root diameter, root, top weight/plant, sugar yields/fed and root quality i.e. reducing sugar , TSS, sucrose and juice purity % in both seasons. The highest productivity and quality traits were produced from harvesting after 210 days from sowing. **Osman et al (2003)** found that sugar beet variety Toro surpassed the other two varieties in root length and total soluble solids percentage.

Nafei et al (2010) found that increasing plant pacing from 20cm to 30cm caused significant response in root length, diameter, fresh weight/plants, sucrose%, total soluble solids, phosphorus% in roots as well as top, root and sugar yield (ton/fed) in both seasons. **Shalaby et al (2011)** they found that significantly increase in root fresh weight, sucrose% and root and sugar yields/fed with increasing distance between hills from 15 to 25cm. **Yousef and Gholamrez (2011)** found that increasing length of irrigation cutoff date from 10 to 40 days before harvest reduced root yield but increased purity% and sucrose% and sugar yield. Studies carried out in Egypt demonstrated that the highest root and sugar yields were recommended spacing of 15 or 20 cm between hills and 60 cm between rows for the highest root and sugar yields.

Awad et al (2014) to evaluate yield, yield components and quality of six sugar beet cultivar namely (Soltan, Demapoly, Farida , Pleno , Kawemira and Lola) under three harvesting dates (175, 195 and 215 days after sowing). Results revealed that superiority of Demaploy in root weight, root yield, recoverable sugar yield (ton/fed), sucrose %, sugar recovery % and purity % when it was harvested after 215 days from sowing in the two growing seasons.

This study was conducted to determine the effect of the optimum time to regime irrigation before harvest and density population on performance of some sugar beet cultivars in new reclaimed soils.

MATERIALS AND METHODS

Normal or Body Text

This investigation was carried out at Kalabsho-El-Dakhlia Governorate during 2013/2014 and 2014/2015 seasons. To study the effect of regime irrigation (15 and 30 days before harvest) and three hill spaces 60 × 15 cm. (44465 plants/fed.), 60 × 20 cm. (33335 plants/fed.) and 60 x25 cm. (26665) plants/fed. on three sugar beet varieties, (Sultan, Farida and Samba).

Treatments were arranged in a split-split plot design of three replicates. Regime irrigation days was placed in the main plots, while hill spaces treatments and sugar beet cultivars were placed in sub plots and sub-sub plots respectively. Each sub plot consisted of 5 rows, 6 m long and 60 cm apart, the area of sub-sub plot about $18m^2$ (1/233) per fed. Phosphorus at the rate of 30 kg P_2O_5 fed^{-1} and Potassium at rate of 24 kg K_2O fed^{-1} were applied through preparing the soil. Nitrogen was applied as ammonium nitrate (33.5% N) at the rate of 100 kg N/fed. as two equal doses after thinning and after month later. The trials were planted on 6^{th} October and 11^{rd} October in 2012/2013 and 2013/2014, respectively. Harvest was done after 7 months from planting. The sugar beets plants were hand harvested and hand topped. Roots were weighted to determine root yield /fed., number of harvested roots/fed. At harvest a sample of ten roots were taken at random each sub-sub plots to determine.

Table 1. Mechanical and chemical soil properties at the experimental site during the two growing seasons.

Soil analysis		2012/2013 season	2013/2014 season
A: Mechanical properties:			
Fine sand (%)		3.40	4.00
Coarse sand (%)		68.00	67.30
Silt (%)		18.00	18.30
Clay (%)		10.60	10.40
Texture		Loamy sand	Loamy sand
B: Chemical analysis			
Soil reaction pH		7.20	7.50
Available N (ppm)		28.40	25.6
Available P (ppm)		11.00	10.8
Exchangeable K (ppm)		100.00	95.50
Fe (ppm)		3.40	3.31
Mn (ppm)		0.90	0.85
Zn (ppm)		2.20	2.15
Cu (ppm)		0.50	0.48
Soluble cations meq/100 g soil	Ca^{++}	0.44	0.43
	Mg^{++}	0.42	0.45
	Na^{+}	0.89	0.96
	K^{+}	0.04	0.05
Soluble anions meq/100 g soil	CO_3^{--}	0.00	0.00
	HCO_3^{-}	0.90	0.95
	Cl^{-}	0.71	0.82
	SO_4^{--}	0.20	0.21

Data recorded

At harvest the four guarded rows of each plot were topped and weighed to estimate the following dat:.

1- Root yield (ton/fed.)

2- Top yield (ton/fed.)

3- Sugar yield (ton/fed.) was amounted by using the following equation:

Theoretical sugar yield = Root yield (ton/fed.) x sucrose %.

A sample of five plants was taken at random from each treatment to estimate the following growth and quality parameters:

1- Root fresh weight (g/plant).

2- Total soluble solids (TSS %): It was determined by hand refractometer.

3- Sucrose percentage was determined according to Le Docte (1927).

4- Purity percentage: It was estimated according to the following equation

Purity %= 99.36-{14.27(V1+V2+ V 3/ V 4)}

Where: V1=Na, V2= K, V3= α-amino-N, V4= sucrose %, Where, K, Na and α -amino N determined as milleq /100 gm beet.

The collected data were statistically analyzed according to procedures out lined by Snedecor and Cochran (1981).

RESULTS AND DISCUSSION

1-Root and top fresh weight kg/plant: Data presented in Table 1a showed effect of regime irrigation to 15 days before harvest on root and top fresh weight in both growing seasons. Decreasing period between last irrigation and harvest to 15 days gave plants advantages more than 30 days before harvest and recorded the highest values of root and top fresh weight in both seasons (1.132 and 1.119 kg/plant) and (0.361 and 0.283 kg/plant).

Planting sugar beet seed at space 20 cm. between hills progressive than other spaces 15 or 25 cm. and gave the highest weights in both seasons. As for effect of cultivars on these two traits, Farida cultivars recorded maximum values compared to other cultivars which gave lowest ones. Similar results were obtained by **Kamel et al (1989) , Ramadan, (1999 a and b), Yousf and Gholamerez (2001), Ismail (2002), Awad et al (2012)** and **Awad *et al* (2013a,b and c).**

Table 1a. Some sugar beet characteristics as affected by regime irrigation, spacing hills and sugar beet cultivars in 2012/2013 and 2013/2014 seasons.

Treatments	Root fresh weight/ plant(kg)		Top fresh weight/ plant(kg)		Root yield (ton/fed.)		Sugar yield (ton/fed.)	
	2012/ 13	2013/ 14	2012/ 13	2013/ 14	2012/ 13	2013/ 14	2012/ 13	2013/ 14
A Regime irrigation								
15 days	1.132	1.119	0.361	0.283	25.59	26.00	4.32	4.43
30 days	1.053	1.048	0.322	0.256	25.46	25.68	4.42	4.58
F-test	*	*	*	*	-	*	-	*
LSD at 5%	0.024	0.019	0.018	0.019	N.S	0.11	N.S	0.09
B Spacing hills								
15 cm	1.042	1.065	0.355	0.298	31.52	32.40	5.45	5.63
20 cm	1.097	1.081	0.357	0.265	24.97	24.72	4.19	4.33
25 cm	1.091	1.104	0.313	0.245	19.97	20.39	3.47	3.54
F-test	*	*	*	*	**	**	*	*
LSD at 5%	0.017	0.029	0.016	0.019	1.51	1.18	0.16	0.29
C Cultivars								
Sultan	1.090	1.073	0.345	0.270	25.25	25.89	4.26	4.49
Farida	1.054	1.089	0.348	0.277	25.72	25.79	4.61	4.62
Samba	1.086	1.087	0.333	0.261	25.01	25.84	4.23	4.40
F-test	*	*	-	-	*	*	*	*
LSD at 5%	0.013	0.010	N.S	N.S	0.18	0.03	0.10	0.06
Interactions								
AB	*	*	*	*	*	*	*	*
AC	*	*	N.S	N.S	*	*	*	*
BC	*	*	N.S	N.S	*	*	*	*
ABC	N.S	N.S	N.S	N.S	N.S	*	*	N.S

Significant interaction effects were found between regime water before harvest x spacing hills on all factors under study except TSS % in the second seasons.

Data in tables 2a and 2b pointed out that maximum values of these tao traits were obtained when water supply was regime before harvest by 15 days and spacing hills was 15 cm. On the other direction the interaction between three factors was not significant on those two traits.

The interaction effect between last irrigation x hill pacing under study were significant effect on root and sugar yields in both seasons in Table 2a and 2b.

Table (1b). Some sugar beet quality characteristics as affected by regime irrigation, hill spacing and sugar beet cultivars in 2012/2013 and 2013/2014 seasons

Treatments	Sucrose %		TSS %		Purity %	
	2012/13	2013/14	2012/13	2013/14	2012/13	2013/14
A Regime irrigation						
15 days	16.52	17.01	19.99	20.82	84.41	81.74
30 days	17.60	17.84	20.73	22.12	84.89	84.38
F- test	*	*	**	**	*	**
LSD at 5%	0.17	0.25	0.27	0.31	0.16	1.03
B Spacing hills						
15 cm	17.32	17.41	20.08	21.13	84.79	82.02
20 cm	17.17	17.49	19.95	21.20	85.47	84.19
25 cm	16.70	17.38	20.20	21.75	83.68	82.98
F- test	*	-	*	*	**	**
LSD at 5%	0.18	N.S	0.11	0.12	0.42	0.22
C Cultivars						
Sultan	16.53	17.36	19.80	21.52	85.05	82.49
Farida	17.87	17.88	20.33	21.17	84.77	83.81
Samba	16.78	17.04	20.10	21.40	84.13	82.89
F- test	**	**	*	*	**	**
LSD at 5%	0.35	0.26	0.15	0.08	0.45	0.36
Interaction						
AB	*	*	*	N.S	*	*
AC	*	*	*	N.S	N.S	*
BC	*	*	*	*	*	*
ABC	*	N.S	N.S	N.S	N.S	N.S

Maximum yields were obtained when sugar beet sown in 15 cm.between plants and water supply regime befor harvest by 15 days.

Significant interaction effect between last irrigation time x cultivars were found in root and sugar yields in both seasons in Table 3.

Elongation time of last irrigation befor harvest to 30 days gave the highest yields (26.320 and 4.840 ton fed.) compared with other treatments.

As respect to cultivars effect on root and sugar yields datd in Table 1a showed that Farida cultivar progressive than other two cultivars Sultan and Samba,gave the highest yields 25.720 ton/fed.in the first season and miximum sugar yields 4.610 and 4.620 ton/fed.in both seasons.

The same trend was found by **Kamel *et al* (1989), Ismail (2002), Awad *et al* (2012) and Awad *et al* (2013a,b and c).**

2-Root and sugar yields ton/fed.: It quite be seen from data shown in Table 1a that significant differences between mean values of these two traits were found in the second season only resulted from effect of time of last irrigation befor harvest.

Table (2a): Interaction effect between by regime irrigation and hill spacing on some characters of sugar beet in seasons 2012/2013 and 2013/2014 .

Regime irrigation × hill spacing	Root fresh weight/ plant(kg)		Top fresh weight/ plant (kg)		Root yield (t/fed.)		Sugar yield (t/fed.)	
	2012/ 13	2013/ 14	2012/ 13	2013/ 14	2012/ 13	2013/ 14	2012/ 13	2013/ 14
15 days x 15 cm	1.073	1.119	0.386	0.317	31.78	33.87	5.35	5.81
15 days x 20 cm	1.112	1.108	0.381	0.279	24.83	23.57	4.07	4.00
15 days x 25 cm	1.118	1.129	0.317	0.252	19.93	20.55	3.53	3.47
30 days x 15 cm	1.011	1.010	0.325	0.279	31.27	30.92	5.54	5.45
30 days x 20 cm	1.083	1.055	0.333	0.251	25.11	25.88	4.30	4.66
30 days x 25 cm	1.064	1.078	0.309	0.238	20.01	20.24	3.42	3.62
F- test	*	*	*	*	**	**	**	**
LSD at 5%	0.042	0.067	0.041	0.055	2.89	3.12	0.87	0.68

Table (2b): Interaction effect between by regime irrigation and hill spacing on some characters of sugar beet in seasons 2012/2013 and 2013/2014 .

Regime irrigation × hill spacing	Sucrose %		TSS %	Purity%	
	2012/ 13	2013/ 14	2012/ 13	2013/ 14	2012/ 13
15 days x 15 cm	16.90	17.18	21.27	84.06	80.80
15 days x 20 cm	16.57	16.98	20.63	85.26	82.30
15 days x 25 cm	16.10	16.87	20.57	83.91	82.13
30 days x 15 cm	17.73	17.63	22.00	85.52	83.25
30 days x 20 cm	17.77	17.99	21.77	85.69	86.08
30 days x 25 cm	17.30	17.89	22.60	83.45	83.82
F- test	**	**	**	**	**
LSD at 5%	0.61	0.42	0.56	0.91	1.82

Decreasing the period between last irrigation and harvest to 15 days gave the highest root yield while,in case of increasing this period to 30 days caused to increasing sugar yield in second season only.

Regarding to effect of hill spacing between plants,narrow spacing between plants 15 cm.preduced maximum root and sugar yields in both seasons (31.520 and 32.400 ton/fed.) and (5.450 and 5.630 ton/fed.) respectively.Copared with other two wide spacing 20 or 25 cm.which recorded lowest ones. **Ramadan, (1999 a and b), Shalaby *et al* (2011), Yousef Sohrabi and Gholamreza Heidri (2011) and Awad *et al* (2013a,b and c)** found similar observations.

3-Sucrose and total soluble solids(TSS) percentages: Water regime befor harvest is very important factor affected in sucrose and T.SS in both seasons in Table 1b.Weaning sugar beet plant from water supply with 30 days befor harvest caused to gave the highest values of these two traits (17.60 and 17.84 %) and (20.73 and 22.12 %) in both seasons respectively.

Elongation the period of preventation of water supply weaning gave a good chance to increase concentrations of total soulble solids and sucrose content after decrease water content,compared to other treatment 15 days befor harvest which recorded the lowest values of these traits in both seasons, **Ramadan, (1999 a and b), Shalaby *et al* (2011), Yousef Sohrabi and Gholamreza Heidri (2011) and Awad *et al* (2013a,b and c)** found similar observations.

Regarding to effect of density on sucrose and total soluble solids(T.SS) percentages data in Table 1b.Cleared that with narrow space 15 cm.between hills the highest sucrose % was found in the first season only 17.32 %. While,in the

second seasons there were no significant differences between mean values of sucrose % was found these advantage due to smal root size which caused to raising sucrose %,total soluble solids (T.SS %) significantly affected hill spacing between plants in both seasons. Sowing sugar beet plants at 25 cm.gave the highest (T.ss %) in both seasons.Similar results were reported by **Yousef Sohrabi** and **Gholamreza Heidri (2011) and Awad** *et al* **(2013a,b and c).**

Table (3): Interaction effect between by regime irrigation and cultivars on some characters of sugar beet in seasons 2012/2013 and 2013/2014 .

Regime irrigation(days) × Cultivars	Root fresh weight (kg)		Root yield (ton/fed.)		Sugar yield (ton/fed.)		Sucrose %		TSS %	Purity %
	2012/13	2013/14	2012/13	2013/14	2012/13	2013/14	2012/13	2013/14	2012/13	2013/14
15 days x Sultan	1.120	1.099	25.30	26.19	4.20	4.48	15.90	17.10	20.73	82.53
15 days xFarida	1.147	1.114	25.98	25.26	4.55	4.40	17.47	17.35	21.00	82.68
15 days x Samba	1.131	1.142	25.49	26.55	4.20	4.41	16.20	16.58	20.73	80.02
30 days x Sultan	1.061	1.048	25.20	25.58	4.33	4.51	17.17	17.62	21.37	82.46
30 days xFarida	1.056	1.064	25.46	26.32	4.66	4.84	18.27	18.40	21.67	84.94
30 days x Samba	1.041	1.031	24.54	25.13	4.27	4.39	17.37	17.50	20.42	85.75
F- test	*	*	**	**	*	*	**	**	**	**
LSD at 5%	0.073	0.059	0.46	0.51	0.21	0.26	0.93	0.79	0.55	2.44

Table (4a): Interaction effect between by hill spacing and cultivars on some characters of sugar beet in seasons 2012/2013 and 2013/2014 .

Hill spacing × Cultivars	Root fresh weight/ plant(kg)		Sugar yield (ton/fed)		Root yield (ton/fed)	
	2012/13	2013/14	2012/13	2013/14	2012/13	2013/14
15cm x Sultan	1.086	1.011	5.34	5.68	32.11	32.93
15cm x Farida	0.978	1.128	5.62	5.55	30.76	30.91
15cm x Samba	1.063	1.056	5.37	5.66	31.71	33.45
20cm x Sultan	1.079	1.084	4.09	4.23	23.99	24.18
20cm x Farida	1.104	1.077	4.41	4.60	24.55	25.65
20cm x Samba	1.110	1.083	4.06	4.16	23.65	24.35
25cm x Sultan	1.107	1.125	3.35	3.56	19.66	20.54
25cm x Farida	1.082	1.064	3.80	3.70	21.84	20.91
25cm x Samba	1.085	1.122	3.27	3.37	19.67	19.72
F- test	*	*	**	**	**	**
LSD at 5%	0.041	0.055	0.45	0.53	1.22	1.35

Concerning the cultivars effect on sucrose and (T.SS) percentages in both seasons data tabulated in Table 1b, pointed out that Farida cultivar progressive than other two cultivar in both seasons in (sucrose and T.SS %) in the first season only.While,Sultan cultivar recorded the highest T.SS % in the second season 21.52 %. These results are in line with those found by **Awad *et al* (2012).**

Significant interaction effects were found between two factors under study on quality characters sucrose and T.SS %,in Tables 2a and 2b.

The highest values of these two characters were found when water supply was regime before harvest by 15 days and used spacing hills 20 cm.between plants.While,with last irrigation at 30 days before harvest with Farida cultivar gave the highest values for two characters sucrose and T.SS percentages (18.27 and 18.40 %) and (21.67 %) respectively in Table 3.

Table (4b): Interaction effect between by hill spacing and cultivars on some characters of sugar beet in seasons 2012/2013 and 2013/2014 .

Hill spacing × Cultivars	Sucrose %		TSS %		Purity%	
	2012/13	2013/14	2012/13	2013/14	2012/13	2013/14
15cm x Sultan	16.65	17.28	19.80	21.50	84.08	80.35
15cm x Farida	18.35	18.01	20.45	20.85	85.57	83.39
15cm x Samba	16.95	16.94	20.00	21.05	84.74	82.34
20cm x Sultan	16.55	17.48	19.69	21.45	85.55	83.31
20cm x Farida	17.95	17.89	20.10	21.10	85.27	83.98
20cm x Samba	17.00	17.10	20.05	21.05	85.61	85.27
25cm x Sultan	16.40	17.33	19.90	21.60	85.52	83.82
25cm x Farida	17.30	17.73	20.45	21.55	83.47	84.06
25cm x Samba	16.40	17.09	20.25	22.10	82.06	81.05
F- test	**	**	**	**	**	**
LSD at 5%	0.74	0.38	0.42	0.51	1.02	1.11

Table (5): Interaction effect between among regime rrigation, spacing hills and cultivars on some characters of sugar beet in 2012/2013 and 2013/2014 seasons

Regime irrigation X Spacing hills X Cultivars	Sucrose%	Root yield (t/fed)	Sugar yield (t/fed)
	2012/13	2013/14	2012/13
15 days X 15cm X Sultan	16.20	34.95	5.23
15 days X 15cm X Farida	17.84	31.35	5.46
15 days X 15cm X Samba	16.50	35.32	5.36
15 days X 20cm X Sultan	16.80	23.27	4.03
15 days X 20cm X Farida	17.70	23.02	4.30
15 days X 20cm X Samba	16.54	23.43	3.88
15 days X 25cm X Sultan	17.02	20.35	3.34
15 days X 25cm X Farida	16.91	21.41	3.89
15 days X 25cm X Samba	16.33	19.89	3.35
30 days X 15cm X Sultan	17.10	30.91	5.46
30 days X 15cm X Farida	18.70	30.27	5.78
30 days X 15cm X Samba	17.40	31.58	5.39
30 days X 20cm X Sultan	17.30	25.10	4.15
30 days X 20cm X Farida	18.20	28.27	4.51
30 days X 20cm X Samba	17.80	24.26	4.24
30 days X 25cm X Sultan	17.10	20.74	3.37
30 days X 25cm X Farida	17.90	20.41	3.70
30 days X 25cm X Samba	16.90	19.55	3.18
F- test	**	**	**
LSD at 5%	1.07	4.92	1.11

5-Purity %

Results in Table 1b indicated that weaning sugar beet plants from water supply befor harvest by 30 days significantly affected on purity % in both seasons and gave maximum purity % (84.89 and 84.38 %) compared to lowest ones (84.41 and 81.47 %) in both seasons. This trnd was attributed with trend of sucrose and total soulbale solids in both seasons.

As for effect of spacing hills (15,20 and 25 cm.) between plants on purity %,data in Table 1b showed that significant differences between values of purity % in both seasons were observed.Sowing sugar beet at space 20 cm. between hills gave the highest purity % in both season. Results are given in Table 1b cleared that cultivars Sultan followed by Farida recorded the highest purity % in the first and second seasons respectively (85.05 and 83.81 %),compared to Samba wich recorded the lowest value (84.13 and 82.89 %). Concrning the interaction between hill space and cultivars factors and its effects on purity % in both seasons,data in Table 4b,pointed out that hill space 20 cm. X Samba cultivar gave maximum purity % (85.61 and 85.27 %),compared with either space hills or cultivars which recorded the lowest values.

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