EFFECT OF AGRO-PROCESSING CONDITIONS ON TECHNOCHEMICAL CHARACTERISTICS AND YIELD OF SUGAR BEET UNDER EL-MINIA GOVERNORATE ENVIRONMENT

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Abstract

This study was undertaken in the middle Egypt, Mallawi Agricultural Research Station (El-Minia Governorate) during 2003/2004 and 2004/2005 seasons, to study the effect of processing conditions i. e., irrigation ceasing time, stored period and stored conditions on technochemical parameters and yields of sugar beet after harvest and perior to processing. Combined analysis over both seasons revealed.

Prolonging the period between last irrigation and harvest (ceasing time) from 10 days to 20 and 30 days gradually increased most technochemical parameters and sugar yield (t/f). However, root yield and juice impurities (except potassium) had a vice versa trend.

Losses of beet productivity traits (root and sugar yield) and technochemical parameters (quality, technological and impurities) were increased gradually as time elapsed between harvest and processing. At the meantime, the rate of deterioration in all studied traits was increased in stored roots under open air conditions as compared with those covered by tops.

Under, El-Minia Governorate, the environments of high temperature prevail during beet harvest and processing affect negatively beet root quality, it is recommended delay harvest after the last irrigation for 30 days in order to enhance apparently root quality and technological criteria and hence sugar yield per unit area. Furthermore, results obtained revealed that beet must be processed as soon as possible after harvest and/ or could be delayed for two days if stored beet covered by tops to avoid the deterioration in both productivity and quality, to overcome processing difficulties. Delaying to harvest for 30 days from the last irrigation decreased obviously stored beet deterioration.

INTRODUCTION

Under El-Minia Governorate conditions, beet is processed in Abou Korkas factory after the end of cane milling season during last week of April and May. High temperature and low humidity are prevailing during beet maturity. Harvest and processing are greatly affected and beet root is negatively affected and hence, sugar yield per unit area. Therefore, crop management received great attention especially ceasing period or the period between the last irrigation and harvest. The effect of prolonging ceasing period on beet productivity and quality criteria were studied by

Sobkowick and Lisinska (1979), El-Geddawi (1988), Gouda (1988), Ruzsanyi (1990), Besheit *et al* (1996), Emara *et al* (2000) and Ferweez *et al* (2004).

Furthermore, sugar beet roots are usually delivered to the factory directly from the field, but sometime, beet delivered after few days lifted in the open air under whatever environmental conditions prevail at that time. Even in various storage conditions root moisture and sucrose losses which commence at harvest, continue throughout the post harvest storage period and considerable problems during processing are cited. Mousa (1990), Romero *et al* (1993), Abou Shady (1994), Ferweez (2002) and Gibriel *et al* (2003) who mentioned the effect of storage period and storage conditions on root, sugar yields and root quality.

This study was initiated to study the effect of ceasing period, post harvest storage period and conditions on beet productivity, quality and technological characteristics under El-Minia conditions.

MATERIALS AND METHODS

This study was carried out in middle Egypt, Mallawi Agricultural Research Station El-Minia Governorate during 2003/2004 and 2004/2005 seasons, to study the effect of ceasing time on technochemical parameters and yield of sugar beet stored under open air conditions in addition covering clean beet by tops for 2, 4, 6 and 8 days from harvest.

A split-split plot design with four replications was used, where, irrigation ceasing (the last irrigation) were carried out after 10, 20 and 30 days before harvest and occupied the main plots, post harvest storage for 2, 4, 6 and 8 days before beet processing were in sub plots, while, two storage condition i.e. clean beet (after top removal) stored under open air conditions and clean beet covered with tops were allocated in sub-sub plot. Sub-sub plot size was 30 m^2 (10 ridges 6 m long and 50 cm apart) spacing between hills were 20 cm. The cultivar used was Gloria (Multigem variety). Sowing date was October 15, in both seasons, while, harvest was carried out after 195 days from sowing date (in the first day of May 2004 and 2005 seasons).

Other cultural practices i.e. thinning, hoeing, fertilization, etc were maintained at levels to assure optimum production.

In each season and at harvest, beet of the four middle rows in each replicate were used to determine root yield after cleaning and topping. Piles of highly comparable 50 roots in size and weight were selected and replicated four times for each previous treatments (two storage conditions and posted harvest storage). Roots piles were weighted and then analyzed after slicing to determine chemical and technological parameters before and after storing for 2, 4, 6 and 8 days at 1^{st}, 3^{rd} , 5^{th},

7^{th} and 9^{th} May 2004 and 2005 seasons using an automatic French system (HYCEL) and the quality parameters were determined as follows:

1. Sucrose % (Pol%) was polarimertically determined on a lead acetate extract from fresh macerated root. Meanime this extract was used to determine beet impurities which including: 1. Reducing sugar was determined using Fehling method.
2. Potassium and sodium (Flame photometry).
3. Alpha amino–Nitrogen determined using ninhydrin, hydrindantin method according to Carruthers *et al* (1962).

Purity, sugar lost in molasses, sugar extractable, extractability % were calculated according to the following formulas:

Purity% = 99.36 – [14.27 $(V_1+V_2+V_3)/V_4$] (Devillers, 1988).

Sugar lost in molasses (SM) = (V_1+V_2) 0.14 + V_1 x 0.25 + 0.50 and alkalinity cofficient = $V_1 + V_2/V_3$ Devillers, 1988).

Sugar extraction% = V_4 – SM – 0.6 (Dexter *et al* 1967).

Extractability % = Sugar extraction % / pol%.

Where: V_1= Sodium. V_2= Potassium. V_3=alfa amino N. V_4= Pol%.

Analysis of variance was computed for each character in each year and combined analysis for both seasons was also done. Treatments were compared using L.S.D at 5% level of probability.

RESULTS AND DISCUSSION

1-Root yield (t/f):

Average data over the two seasons Table (1) indicated that prolonging the period between last irrigation and harvest (ceasing period)
from 10 days to 20 and 30 days decreased insignificantly root yield (t/f) by 0.53 (1.57%) and 0.6 (1.77%) t/f, respectively.

This trend have been recorded in the separate seasons (not presented) except that the reduction in root yield with the delay in harvest after the last irrigation was significant in the second season.

The reduction in root yield accompanied the delay in harvest after last irrigation may be attributed to the increase in root maturity and hence, the increase in the rate of assimilates could not compensated the reduction in root moisture content (Besheit *et al*, 1996). These results are in line with those of, Ruzsanyi (1990), Emara *et al* (2000) and Ferweez *et al* (2004) who reported that root yield was reduced with the decrease in available irrigation water.

Average of the two seasons date Table (1) and the not presented separate years data showed that beet root yield loss was increased gradually and significantly as time elapsed between harvesting and processing to reach its maximum value 17.54% (from 33.46 to 27.59 t/f) after 8 days (Table 1).

Meantime, covering stored root by tops decreased significantly root yield loss by 5.56% (from 33.46 to 31.60 t/f) as compared with root yield processed immediately after harvest, while, the magnitude of root yield loss was much higher 9.68% (from 33.46 to 30.22 t/f) in beet root stored under open air conditions. Such effect may be due to the effect of high temperature prevailing during beet harvest in May under El-Minia Governorate conditions on water evaporation loss and/or the increase in root respiration rate and various metabolic changes in roots tissue (Gibriel *et al*, 2003). Therefore, these results are in accordance with those of Mousa (1990) and Ferweez (2002) who pointed out that minimal losses were recorded in fast processed beet.

Worth to mention, prolonged the period between last irrigation and harvest up to 30 days minimized deterioration percentage in root yield stored for 8 days before processing to reach (14.20%) as compared with ceasing period of 10 and 20 days, where, deterioration percentage recorded 20.83 and 17.59, respectively. Such effect give evidence that delaying harvest after last irrigation enhanced root maturity and decrease the rate of root weight deterioration.

2- Beet quality parameters:

Combined data of beet quality parameters (over both seasons) i.e. sucrose% (Pol), purity and extracted% sugar (sugar recovery) are summarized in Table (1). Date of the measured traits in the same days of harvest (before storge)within and over seasons indicated that delaying the ceasing period after last irrigation from 10 dats to 20 and 30 days gradually and significantly increased sucrose% (Pol%) and extracted% sugar (sugar recovery), while, the increase in purity trait was too small to reach the level of significance. Pooled data Table (1) cleared that the percent of increase in sucrose % accompanied the dealyed of harvest after last irrigation from 10 to 20 and 30 5days were 9.29 (from 15.07 to 16.47)and 13.54 (from 15.07 to 17.11), respectively and for extracted %sugar 11.23 (from 12.47 to 13.87) and 16.52 (from 12.47 to 14.53), while , the precent of increase in purity percentage recorded 0.72 (from 90.57 to 91.22)and 1.08 (from 90.57 to 91.55) corresponding to the delay in ceasing period from 10 days to 20 'and 30 days, respectively. These results give evidence that thirstiness of beet before harvest more than 10 days enhanced greatly sugar accumulation in beet root. Therefore, the problem of sucorce reduction in beet root under EL-Minia Governorate could be easy eliminated during the increase in plant ceasing. These results were conifermed those reported by, Emara *et al* (2000) and Ferweez *et al* (2004).

Table 1. Effect of ceasing period, storage period, and storage conditions on root yield and quality parameters (Combined data).

Ceasing period	Storage Days(B)	Root yield (t/f)			Sucrose %			Purity%			Extracted% sugar		
		I	II	Mean	I	II	Mean	I	II	Mean	I	II	Mean
10 days	0	33.84	33.84	33.84	15.67	15.67	15.67	90.57	90.57	90.57	12.47	12.47	12.47
	2	32.29	32.94	32.62	15.25	15.19	15.22	89.77	90.30	90.04	12.50	12.53	12.52
	4	30.60	32.00	31.30	15.71	15.51	15.61	89.43	90.25	89.84	12.85	12.80	12.83
	6	28.65	31.06	29.86	16.11	15.78	15.95	89.09	90.15	89.62	13.15	13.03	13.09
	8	25.40	28.18	26.79	16.89	16.06	16.48	88.99	89.79	89.39	13.83	13.22	13.53
Mean		30.16	31.60	30.88	15.81	15.52	15.67	89.57	90.21	89.89	12.96	12.81	12.89
20 days	0	33.31	33.31	33.31	16.47	16.47	16.47	91.22	91.22	91.22	13.87	1387	13.87
	2	31.77	32.45	32.11	16.99	16.70	16.85	90.91	91.11	91.01	14.27	14.06	14.17
	4	30.27	31.26	30.77	17.76	17.21	17.49	90.63	91.08	90.86	14.93	14.52	14.73
	6	28.23	30.47	29.35	18.02	17.35	17.67	90.52	90.84	90.68	15.16	14.60	14.88
	8	26.04	28.86	27.45	18.18	17.57	17.89	90.06	90.68	90.37	15.19	14.78	14.99
Mean		29.92	31.27	30.60	17.47	17.06	17.27	90.67	90.99	90.83	14.68	14.37	14.53
30 days	0	33.24	33.24	33.24	17.11	17.11	17.11	91.55	91.55	91.55	14.53	14.53	1453
	2	32.19	33.03	32.61	17.36	17.24	17.30	91.03	91.39	91.21	14.68	14.62	14.65
	4	30.98	32.65	31.82	17.58	17.37	17.48	90.62	91.22	90.92	14.81	14.71	14.76
	6	29.06	31.15	30.11	18.07	17.62	17.85	90.44	91.68	90.76	15.24	14.91	15.08
	8	27.39	29.65	28.52	18.48	17.96	18.22	90.25	90.91	90.52	15.59	15.20	15.40
Mean		30.57	31.94	31.26	17.72	17.46	17.59	90.78	91.23	91.01	14.97	14.79	14.88
Averages of delaying days	0	33.46	33.46	33.46	16.22	16.22	16.22	91.11	91.11	91.11	13.62	13.62	13.62
	2	32.08	32.81	32.44	16.53	16.38	16.46	90.57	90.84	90.71	13.82	13.74	13.78
	4	30.62	31.97	31.30	17.02	16.70	16.86	90.23	90.85	90.54	14.16	14.04	14.09
	6	28.65	30.89	29.77	17.40	16.92	17.16	90.02	90.69	90.36	14.52	14.18	14.35
	8	26.28	28.90	27.59	17.85	17.20	17.53	89.77	90.46	90.12	14.87	14.29	14.58
Grand mean		30.22	31.60	30.91	17.00	16.68	16.84	90.34	90.79	90.57	14.26	13.97	14.08
L.S.D at 0.05													
A				N.S			0.27			0.51			0.26
B				0.35			0.25			0.55			0.22
C				0.29			0.25			N.S			0.18
AxB				0.76			0.42			N.S			0.32
AxC				0.69			0.30			0.48			0.28
CxB				0.65			0.24			0.59			0.28
AxBxC				1.03			0.48			N.S			0.36

Average values over both seasons of sucrose% (Pol%) and extracted% sugar were inreased gradually and significantly as time elapsed after harvest and perior to process to attain its maximum level after 8 days from harvest. In addition the perecent of increase in Pol% trait recorded 8.08 (from 16.22 to 17.53), while, its was 7.05 (from 13.62 to 14.58) for extracted% sugar (Table1). The observed increase in sucrose% is apparent increase and not true increase and this due to the incease in sucrose concentration as a results of root dryness (which, caused obvious reduction in root yield mentioned before), meantime, overcome both sucrose used in respiration and/or conversion to reducing to sugars. Likewise, the increase in extracted% sugar may be due to the apparent increase in Pol% which overcome the increase in the impurities such as Na , K and reflected positively on suger loss in molasses.

On the other hand, insignificant decrease in purity with time elapsed after harvest had been observed (Table 1), the percent of reduction 0.44, 0.63, 0.83 and 1.10 as beet processing delayed for 2, 4, 6 and 8 days as compared with beet processed immediatly. Such effect may be due to the increase in pol% and juice impurities, where, purity is caculated from both variables . Similar results were reviewed by Abou Shady (1994), Ferweez (2002) and Ferweez *et al* (2004).

Dealing with storage condition effect, date in Table (1) demonstrated that stored beet under open air condition significantly increased both sucrose% (Pol%) and extracted% suger than those stored after covering by tops, while, slight increased (statistically insignificant) for purity trait between the two storge treatments. Such effect may be due to that beet storage under open air conditions suffer more moisture loss than those covered with beet tops as mentioned before. In this connection, Abou Shady (1994) and Ferweez (2002) demonstrated that the relative increase in quality traits were the lowest under coverning root by tops.

With respest to the intreaction between ceasing period and root storage days after harvest and perior to processing, data in Table (1) showed that harvest beet after 10 days from the last irrigation exhibited the highest deterioration rate for the three quality traits of beet stored 8 days, thereafter, gradual and asignificant reduction in deterioration rate in both sucrose% and extracted% sugar have been observed as delay harvest for 20 and 30 days after the last irrigation, meantime, nearly, the same trend was observed for purity trait but the reduction in deterioration rate as ceasing period increased was too slight to reach the level of significance.

3- Juice impurities parameter:

Pooled data of juice impurities which comprises reducing sugars, Sodium, Potassium and α Amino-N percentages are presented in Table (2) showed that delaying harvest after last irrigation from 10 days to 20 and 30 days decreased gradually and significantly juice content of reducing sugars, Na and α Amino-N. On the contrary juice K content increased significantly with the increase in ceasing period (Table2) similar findings in the separate seasons (not presented) were also detected.

Table 2. Effect of ceasing period,storage period, and storage conditions on juice impurities parameters (Combined data).

Ceasing peirod	Storage Days(B)	Storage conditions											
		Reducing sugars%			Na%			K%			α A.N %		
		I	II	Mean	I	II	Mean	I	II	Mean	I	II	Mean
10 days	0	0.25	0.25	0.25	2.02	2.02	2.02	5.40	5.40	5.40	1.86	1.86	1.86
	2	0.31	0.28	0.30	2.29	2.13	2.21	6.03	5.61	5.82	1.93	1.90	1.92
	4	0.36	0.31	0.34	2.42	2.20	2.31	6.47	5.75	6.11	2.04	1.95	2.00
	6	0.48	0.37	0.43	2.57	2.29	2.43	6.88	5.90	6.39	2.14	2.00	2.07
	8	0.53	0.41	0.47	2.75	2.39	2.57	7.28	6.29	6.79	2.24	2.09	2.12
Mean		0.39	0.32	0.36	2.41	2.21	2.31	6.41	5.79	6.10	2.04	1.96	2.00
20 days	0	0.16	0.16	0.16	1.86	1.86	1.86	5.85	5.85	5.85	168	1.68	1.68
	2	0.22	0.19	0.21	2.08	1.95	2.02	6.30	5.98	6.14	1.78	1.72	1.75
	4	0.29	0.23	0.26	2.32	2.04	2.18	6.65	6.18	6.42	1.89	1.77	1.83
	6	0.37	0.26	0.32	2.48	2.17	2.33	6.90	6.36	6.63	1.78	1.83	1.81
	8	0.41	0.29	0.35	2.66	2.30	2.48	7.08	6.52	6.80	2.11	1.88	2.00
Mean		0.29	0.23	0.26	2.28	2.06	2.17	6.56	6.18	6.37	1.85	1.78	1.81
30 days	0	0.10	0.10	0.10	1.78	1.78	1.78	6.02	6.02	6.02	1.56	1.56	1.56
	2	0.16	0.13	0.15	1.94	1.87	1.91	6.41	6.14	6.28	1.66	1.61	1.64
	4	0.23	0.16	0.20	2.09	1.95	2.02	6.68	6.26	6.47	1.75	1.66	1.71
	6	0.26	0.19	0.23	2.24	2.05	2.15	6.86	6.40	6.63	1.81	1.70	1.76
	8	0.31	0.22	0.27	2.43	2.16	2.30	6.96	6.53	6.75	1.89	1.76	1.83
Mean		0.21	0.16	0.19	2.10	1.96	2.03	6.59	6.27	6.43	1.73	1.66	1.70
Averages of delaying days	0	0.17	0.17	0.17	1.89	1.89	1.89	5.76	5.76	5.76	1.70	1.70	1.70
	2	0.23	0.20	0.22	2.10	1.98	2.04	6.25	5.91	6.08	1.79	1.74	1.77
	4	0.29	0.23	0.26	2.28	2.06	2.17	6.60	6.06	6.33	1.89	1.79	1.84
	6	0.37	0.27	0.32	2.43	2.17	2.30	6.88	6.22	6.55	1.98	1.84	1.91
	8	0.41	0.31	0.36	2.61	2.28	2.45	7.11	6.44	6.78	2.08	1.91	2.00
Grand mean		0.29	0.24	0.27	2.26	2.08	2.17	6.52	6.08	6.30	1.89	1.80	1.84
L.S.D at 0.05													
A				0.08			0.12			0.15			0.12
B				0.06			0.09			0.13			0.06
C				0.04			0.08			0.12			0.08
AxB				0.04			0.12			0.21			0.13
AxC				0.05			0.15			0.35			N.S
CxB				0.12			0.21			0.20			0.11
AxBxC				0.17			0.24			0.40			0.28

Such effect may be due to that increasing ceasing period induced beet plants to maturity and hence a decrease in juice impurities and increase in sugar accumulation were takeplace. These findings are full agreement with those of Ferweez *et al* (2004). Combined data, (Table2) cleared that, juice impurities increased gradually and significantly as time elapsed between harvest and processing to reach its maximum value after 8 days as compared with beet processed immediately after harvest. Where, the increase in reducing sugars counted 111.76% (from 0.17 to 0.36), in Na content 29.63% (from 1.89 to 2.45), in K 17.71% (from 5.76 to 6.78) and in α Amino-N 17.65% (from 1.70 to 2.00). Average date also manifested that covering stored roots by tops decreased significantly the increase in juice impurities as compared with stored roots under open air conditions. The magnitude of reduction in juice impurities recored 17.24%, 7.97%, 6.75% and 4.76% for reducing sugars, Na, K and α Amino-N, respectively.

The apparent increase in reducing sugars may be due to sucrose conversion and/or with other impurities due to water loss (dryness) caused by high temperature prevailing during storage. Similar results are reported by Sobkowick and Lisinska (1979), El-Geddawi (1988) and Gouda (1988).

Perusal of data (Table2) it is clear that beet harvest after 20 days from last irrigation exhibited the highest deterioration rate expressed as the percantage of increase in the studied impurities in beet stored for 8 days as compared with beet processed in the same day of harvest (zero time) recorded 118.75% (from 0.16 to 35), 33.33% (from 1.86 to 2.48), 16.24% (from 5.85 to 6.86) and 19.05% (from 1.68 to 2.00) for reducing sugars, Na, K and α Amino-N, respectively, followed by ceasing period of 30 days, while, the lowest deterioration rate was of harvest carried out after 10 days from the last irrigation. Such effect may be due to that lessen the period between harvest and last irrigation increased greatly water loss and hence may be decrease the activity of sucrose degradation enzymes.

4- Beet technological parameters:

Combined data (Table3) and separate data of both 2003/2004 and 2004/2005 seasons (not presanted) clarified that prolonging ceasing period before harvest from 10 to 20 and 30 days decreased gradually but insignificantly sugar loss in molasses by 1.38% and 3.21%, respectively (Table3).

The reduction in sugar loss in molasses is greatly correlated with the montioned formerly reduction in juice impurities which used in the formula of estimating sugar loss in molasses . Furthermore, the reduction in sugar loss in molasses accompanied the delay in harvest for 30 days after the last irrigation had a positive and beneficial importance on extracted % sugar and hence on sugar yield.

Table 3. Effect of ceasing period, storage period and storage conditions on technological parameters (Combined data).

Ceasing Period	Storage Days(B)	Storage conditions											
		Sugar loss% in molass			Alkalinity coefficient			Extractability. %			Sugar Yield (t/f)		
		I	II	Mean	I	II	Mean	I	II	Mean	I	II	Mean
10 days	0	2.00	2.00	2.00	3.99	3.99	3.99	82.75	82.75	82.75	4.22	4.22	4.22
	2	2.15	2.06	2.11	4.31	4.07	4.19	81.97	82.49	82.23	4.04	4.13	4.09
	4	2.26	2.10	2.18	4.36	4.08	4.22	81.80	62.59	82.20	3.93	4.10	4.02
	6	2.36	2.15	2.26	4.42	4.10	4.26	81.63	82.57	82.10	3.87	4.05	3.96
	8	2.46	2.24	2.35	4.48	4.15	4.32	81.88	82.32	82.10	3.51	3.73	3.62
Mean		2.25	2.11	2.18	4.31	4.08	4.20	82.01	82.54	82.28	3.91	4.05	3.98
20 days	0	2.00	2.00	2.00	4.59	4.59	4.59	84.34	84.34	84.34	4.62	4.62	4.62
	2	2.12	2.04	2.08	4.71	4.61	4.66	83.99	84.19	84.09	4.53	4.56	4.55
	4	2.23	2.09	2.16	4.75	4.64	4.70	84.07	84.37	84.22	4.52	4.54	4.53
	6	2.26	2.15	2.21	5.27	4.66	4.97	84.13	84.15	84.14	4.28	4.45	4.37
	8	2.39	2.21	2.30	4.62	4.69	4.66	83.55	84.03	83.79	3.96	4.27	4.12
Mean		2.20	2.10	2.15	4.79	4.64	4.72	84.02	84.22	84.12	4.36	4.49	4.43
30 days	0	1.98	1.98	1.98	5.00	5.00	5.00	84.92	84.92	84.92	4.83	4.83	4.83
	2	2.08	2.02	2.05	5.03	4.98	5.01	84.56	84.80	84.68	4.73	4.83	4.78
	4	2.17	2.06	2.12	5.01	4.95	4.98	84.24	84.69	84.47	4.59	4.80	4.70
	6	2.23	2.11	2.17	5.03	4.97	5.00	84.34	84.62	84.48	4.43	4.65	4.54
	8	2.29	2.16	2.23	4.97	4.94	4.96	84.36	84.63	84.50	4.27	4.51	4.39
Mean		2.15	2.07	2.11	5.01	4.97	4.99	84.48	84.73	84.61	4.57	4.72	4.65
Averages of delaying days	0	1.99	1.99	1.99	4.53	4.53	4.53	84.00	84.00	84.00	4.56	4.56	4.56
	2	2.12	2.04	2.08	4.68	4.55	4.62	83.51	83.55	83.53	4.43	4.51	4.47
	4	2.22	2.08	2.15	4.71	4.56	4.64	83.37	83.88	83.63	4.35	4.48	4.42
	6	2.28	2.14	2.21	4.91	4.58	4.75	83.37	83.78	83.60	4.19	4.38	4.29
	8	2.38	2.20	2.29	4.69	4.59	4.64	83.26	83.72	83.49	3.91	4.17	4.04
Grand mean		2.20	2.09	2.14	4.70	4.56	4.64	83.50	83.79	83.65	4.29	4.42	4.35
L.S.D at 0.05													
A				N.S			0.15			0.45			0.20
B				0.10			N.S			N.S			0.11
C				0.06			N.S			N.S			0.09
AxB				0.07			N.S			N.S			0.15
AxC				0.07			N.S			N.S			0.09
CxB				0.08			N.S			N.S			0.11
AxBxC				0.14			N.S			N.S			0.38

On the other hand, increasing ceasing period from the last irrigation to harvest from 10 to 20 and 30 days asscociated with a significant increase in alkalinity coefficint (AC) by 12.38 and 18.81% and sugar extractibility percentage (quality index) by 2.24 % and 2.83 %,

where, alkalinity coefficient (AC) was determined from the major non sugars K, Na and α Amino-N as follows AC = K + Na/ α Amino-N, whereas, early in Germeny, Brieghel-Müller and Brüniche-Olsen (1953)

reported that AC is of importance to the buffer capacity of the juice and to the carbon dioxide obsorption and hence calcium elimination in the second carboration stage. Morevor, Wieninger and Kubadinow (1971) stated that AC should not fall below 1.8 to prevent evaporator corrosion at the high temperature of evaboration process. Furthermore, the increase in sugar extractibility% greatly associated with the quantity of sugar extracted from beet juice. These results are partely agreement with those reported by Ferweez *et al* (2004) who stated that sugar losses and quality index increased with the dealy in harvest after the last irrigation.

Dealing to storage period effect, combined data Table (3) and separate data in both seasons (not presented) revealed that delayed the time elapsed between harvest and processing increased gradually and significantly sugar loss in molasses to reach its maximum value (15.08%) after 8 days as compared with beet processed immediatly after harvest. However, the differences in AC and sugar extractibility% as beet stored for 2, 4, 6 and 8 days after harvest were too small to reach the level of significance.

Dealing with the effect of storage conditions, averaged data Table (3) clarified that covering stored roots by tops decreased sugar loss in molasses by 5% (from2.20 to 2.09%) as compared by roots stored under open air conditions, reflecting the same effect of storage conditions on juice impurities (K, Na and α amino-N), while, storage conditions had aslight effect on AC and sugar extractability% (Table3).

With regard to the effect of interaction between ceasing period and root storage after harvest and perior to processing, data Table (3) revealed that ceasing period of 10 days and processed after 8 days from harvest exhibited the highest deterioration rate in the three technological characteristics, thereafter, the rate of deterioration was decreased gradually and significantly for sugar loss in molasses and insignificantly for AC and quality index (Sugar extractability%) with prolonging ceasing period to 20 and 30 days after the last irrigation. These findings give avidence that delayed the period between last irrigation and harvest enhanced greatly the technological criterions and reflected positively on sugar production even the used of deteriorate beet.

5- Sugar yield (t/f):

Pooled data over the two seasons Table (3) indicated that proloning ceasing period before beet harvest up to 20 and 30 days increased gradually and signifiantly sugar yield by 9.48% (from 4.22 to 4.62 t/f) and 14.45% (from 4.22 to 4.83 t/f), respectively, as compared with ceasing period of 10 days, the same trend was also detected in the separate years (data not presented). Such effect may be due to the positive effect of delaying harvest after last irrigation on main component of sugar yield, i.e. root yield and extracted% sugar (sugar recovery) and other component which also positively affected sucrose% (Pol), purity and sugar% extractibility and negatively affected juice impurities and sugar loss in molasses as mentioned previously. In this connection, the ultimate aim of beet cultivation is to produce maximum sugar yield which affected greatly by many factors such as crop management, quality of roots and efficiency of processing, therefore, those results had paramount evidence to the importance of delaying harvest after the last irrigation up for 20 to 30 days on the sugar productivity specially under El-Minia Governorate, which, suffer reduction of root quality. These findings are in harmany with those found by Giovanardi and Ceccon (1989), Ruzsanyi (1990), Emara *et al* (2000) and Ferweez *et al* (2004) who found that sugar yield increased with the decrease in available water.

Average data (Table 3)indicated that delaying beet processing for two days after harvest insignificantly reduced the sugar yield (t/f) thereafter, continue delay in beet delivery increased gradually and significantly the reduction in sugar yield (t/f). The percent of reduction recorded 1.97, 3.07, 5.92 and 11.40 of the initial value at zero time as beet delayed for 2, 4, 6 and 8 days perior to processing. Furthermore, covering stored beet by tops decreased significantly the loss in sugar yield as compared with beet stored under open air conditions, whereas, the relative decrease in sugar yield loss attained 3.07 and 5.92% for both storage conditions as compared with beet processed in the same harvest day. These findings may be due to the reduction in root yield quality and technological criteria accompanied the delay in beet processing as mentiond before. These results are affirmed by those of Mousa (1990) and Ferweez (2002) and Ferweez *et al* (2004).

Dealing with the relationship between ceasing period and storage period, combined data in Table (3) indicated that the percent of reduction in sugar yield for beet stored 8 days reached 14.22, 10.83 and 9.11 corresponding to beet harvest after 10, 20 and 30 days from the last irrigation. These finding give evidence to the beneficial effect of delay harvest under EL-Minia condition for 20 or 30 days after the last irrigation.

6-Interactions effect :

Summary for the significance of year, ceasing period, storage period, storage conditions and their interactions are presented in Table (4), data showed that root and sugar yield and sucrose% (Pol) were significantly differed between the two seasons indicating that these traits did not perform consistently across the two seasons or in other words these traits were affected greatly by environmental conditions and crop managment. On the contrary, other traits including some quality traits, juice impurities, technological characteristics were insignificantly differed in both seasons. Such effect may be due to that the most of these traits were estimated from arthimetic equations of some measured data such as Pol% and juice impurities which were not affected by the used treatment and may be affected by other treatments not studied in this work. Furtheremore, various interaction degrees showed different degrees of significance and insignificance (Table4).

CONCLUSION

Under El-Mina environments high temperature during beet harvest and processing affected negatively on beet root quality. Therefore, delaying harvest after the last irrigation for 30 days enhanced apparently root quality and technological criteria and hence sugar yield per unit area. Meantime beet harvest after 30 days from the last irrigation decreased obviously stored beet deterioration.

Furthermore, results obtained revealed that beet must be processed as soon as possible after harvest. It could be delayed for two days only after covering stored beet by tops to avoid the deterioration in both productivity and quality in addition to overcome processing difficulties.

Table 4. Summary for the significance of years , ceasing period , storage period and storage conditions and the interactions (Combined data).

Factor	Root yield (t/f))	Quality parameters			Juice impurities parameters				Technological parameters			Sugar yield (T/F)
		Sucrose %	Purity %	Extracted % Sugar	Reducing Sugar %	Na	K%	α-A.N	Sugar loss % in Molass	Alkalinity coefficient	Extract ability	
Years(Y)2003-04	29.64	16.92	90.73	14.19	0.26	2.15	6.27	1.81	2.13	4.65	83.87	4.21
2004-2005	31.18	16.76	90.51	14.00	0.28	2.19	6.33	1.87	2.16	4.63	83.53	4.51
Significance	**	*	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	*
Ceasing period(A)	N.S	**	N.S	**	*	*	*	*	N.S	**	**	**
Storage(days) (B)	**	**	N.S	**	**	**	**	*	**	N.S	N.S	**
Storage treat. (C)	**	*	N.S	*	*	**	**	*	*	N.S	N.S	*
Interaction												
YxA	N.S	*	N.S	*	N.S	N.S	N.S	N.S	N.S	N.S	*	N.S
YxB	*	**	N.S	*	N.S	N.S	N.S	N.S	N.S	N.S	N.S	**
YxC	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S
AxB	*	**	N.S	**	**	**	**	N.S	**	N.S	N.S	**
YxAxB	*	**	N.S	**	N.S	N.S	N.S	N.S	N.S	N.S	N.S	**
AxC	**	**	N.S	**	**	**	**	N.S	*	N.S.	**	**
YxAxC	*	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S
BC	**	*	N.S	**	**	**	**	N.S	**	N.S	N.S	**
YxBxC	**	N.S	N.S	N.S	*	*	N.S	N.S	N.S	N.S	N.S	N.S
AxBxC	**	**	N.S	**	*	**	**	N.S	**	N.S	N.S	**
YxAxBxC	**	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	**s

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تأثير المعاملات الزراعية والتصنيعية على الصفات التكنوكيميائية والمحصولية لبنجر السكر تحت الظروف البيئية لمحافظة المنيا

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أجرى هذا البحث بمحطة البحوث الزراعية بملوى –محافظةالمنيا–مصر الوسطى خلال موسمى ٢٠٠٣/٢٠٠٤ و٢٠٠٤/٢٠٠٥بهدف دراسة تأثير ميعاد الفطام على الإنتاجية والصفات التكنوكيميائية لجذور البنجر المخزنة تحت ظروف الجو المفتوح والجذور النظيفة المغطاة بالعروش لمدة ٢، ٤، ٦، ٨ ايام بعد الحصاد وقبل التصنيع وتشير نتائج التحليل الإحصائى التجميعى للموسمين معا إلى ما يلى :

إطالة المدة بين آخر رية والحصاد و(ميعاد الفطام)من ١٠ يوما إلى ٢٠ أو٣٠ يوم أدت إلى زيادة تدريجية فىمعظم الصفات التكنوكيميائية ومحصول السكر بالطن للفدان بينما اظهر محتوى الشوائب بالعصير (فيما عدا عنصر البوتاسيوم) ومحصول الجذور بالطن للفدان إتجاها مغايرا.

أدى تأخير تصنيع البنجر بعد الحصاد إلى زيادة تدريجية فى معدل الفقد فى الصفات الإنتاجية (محصو الجذور والسكرباطن/ف) والصفات التكنوكيميائية (صفات الجودة –الصفات التكنولوجية– والشوائب) ويلاحظ انخفاض فى معدل التدهور عند تغطية البنجر المخزن بالعروش مقارنة بالبنجر المتروك تحت ظروف الجو المفتوح.

وعلى ذلك توصى الدراسة تحت الظروف البيئية لمحافظة المنيا بإطالة المدة بين آخر رية والحصاد (ميعاد الفطام)الى٣٠يوما لتاثيرها الإيجابى على صفات الجودة والصفات التكنولوجية وكذا لزيادة إنتاج السكر لوحدة المساحة وفى نفس الوقت تقليل التأثير المعاكس لفعل درجات الحرارة المرتفعة والسائدة وقت الحصاد والتصنيع .