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REDUCING THE LOSSES IN YIELD, QUALITY AND PROFITABILITY OF SUGAR BEET ROOTS RESULTED FROM PROCESSING DELAY USING POTASSIUM FERTILIZATION

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ABSTRACT

Under El-Minia Governorate conditions sugar beet is processed in Abou Korkas factory after the end of cane milling season during last week of April and beginning of May. Whenever, high temperature and low humidity are prevailing during beet maturity period. So, therefore, this trail was conducted at Mallawi Agric. Res. Station, El-Minia, Egypt, during 2008/2009 and 2009/2010 seasons to study the losses in yield and quality of sugar beet as affected by various potassium fertilizer levels and post-harvest delaying of crop delivery to the factory. Potassium fertilizer levels, i.e. zero, 24 and 48 kg K_2O/fed. and post harvest delaying periods were zero (at harvest time), two, four, six and eight days after-harvest.

The obtained results revealed that the highest values of pol% (18.13%), rendement (14.97%), roots yield (29.06 tons/fed) and recoverable sugar yield (4.33 tons/fed.)of sugar beet could be achieved at 24 kg K_2O /fed.compared with levels of zero and 48 kg K_2O/fed. Data also showed that the increase in time elapse between harvesting and processing (from 0 to 8 days) exhibited to gradual increase in pol%, α-N, Na and K contents as well as sugar recovery% of sugar beet. On the contrary, roots and recoverable sugar yields were contrary decreased.

Therefore, fertilization of sugar beet with 24 kg K_2O/fed. and delivered in the day are recommended under Middle Egypt conditions (El-Minia Governorate conditions) for increasing beet grower income because it minimized lowest value in the loss of total return per fed as compared with the other potassium fertilizer levels, i.e. zero and 48 kg K_2O/fed.

Keywords: Sugar beet, K_2O level, sugar recovery%, pol, % and LE.

INTRODUCTION

Sugar beet (*Beta vulgaris* L.) was introduced to Egypt to overlap the vast gap between sugar consumption and production, it is represented the second sugar crop after sugar cane. Egyptian policy is pushing hardly to grow and develop sugar beet crop by establish new beet factories. The sugar produced from sugar beet increased from 7.36% in 1990 to about 49.70% of the total local sugar production (1.99 million ton) in 2010 (CCSC, 2011).

A quality reduction of sugar beet roots percent as serious problems face expanding of sugar beet plantation in middle Egypt, especially under El-Minia conditions where high temperature and low humidity preneling during beet maturity. Potassium is known for its role in sucrose transportation and accumulation in storage tissues of plants. Potassium is one of the major elements needed for vegetative growth of plant and sugar synthesis. Optimal rate of potassium is required to ensure high roots yield as well as high quality of roots (Kamel, *et al.*1979; Ali, 1985; Edris, *et al*.1992 and Abou-salama, 1995). Root, top and sugar yields of sugar beet was significantly increased with increasing K-fertilizer rate up to 48 kg K_2O/fed (Salah, *et al*. 1984; Zalat, 1986; Genaidy, 1988 and El-Kassaby, *et al.*1991).In addition, Edris, *et al*. (1992) revealed that the highest value of roots yield was obtained when potassium fertilizer was added at the highest level (96 kg K_2O/fed). However, Hegazy, *et al*. (1992) and Shalaby, *et al*. (2002) indicated that the aforementioned characters were not affected by potassium fertilization. Applying 48 kg K_2O/fed led to a significantly increase in TSS% (Salah, *et al*. 1984 and Genaidy, 1988), while El-Kassaby *et al*. (1991); Sobh, *et al*. (1992) and Abou-Amou, *et al*. (1996); Sorour, *et al*. (2002); revealed that potassium fertilizer levels had insignificant effect on TSS% of beet roots. In contrast, El-Kammah and Ali, (1996) demonstrated that white sugar-percentage (Rendement) of sugar beet was a significantly increased with increasing potassium fertilization rate. Here too, El-Ramady (1997) noted that the highest value of rendement were obtained at the rate of 48 kg K_2O/fed.

It is well known that harvested beet roots lose sugar and weight continuously post-harvest because of chemical and microbiological deterioration (El-Geddawy, 1988). Some factors are reported to affect the losses in yield and quality of sugar beet post-harvest such as variety, agriculture practices i.e. nitrogen fertilizer and delaying the crop delivery to factory (Ferweez and Khalifa 2004, and Ferweez, *et al.* 2006).

The objective of this work was to find out the optimal potassium level needed to obtain the highest yield and quality of sugar beet and influence of potassium fertilizer level on the deterioration of sugar beet root delaying before processing.

MATERIALS AND METHODS

The present work was conducted at Mallawi Agric. Res. Station El-Minia Governorate, Egypt, during 2008/2009 and 2009/2010 seasons. Sugar beet variety namely Montebianco was used and sown on 15^{th} and 18^{th} October in both seasons. Potassium fertilizer levels (first experiment), i.e. zero, 24 and 48 kg/fed. with four replications were arranged in randomized complete block design (RCBD). Delaying periods (second experiment) of beet delivery to factory were zero (at harvest), two, four, six and eight days after harvest allocated in randomized complete blocks design (RCBD). The combined analysis between the two experiments was used.

Nitrogen fertilizer was added at the recommended rate of 70 kgs N /fed in two equal doses (the first one after 25 days from sowing and the second one after 30 days later) as well as phosphorus fertilizer was added at recommended rate of 30 kgs /fed. at planting. Chemical and physical properties of the experimental soil before soil preparation were estimated according to the procedures outlined by Jackson (1967) are shown in Table (1_a) :

On the harvest day (after 195 days from sowing date), a sample of approximately half ton was obtained from the healthy vegetative homogenous beet roots of sugar beet cultivar in four replicated times. The sample of each treatment was topped, cleaned and thoroughly mixed into a pile. Beet roots piles were left under open field conditions in order to study the changes in quality. Temperatures and relative humidity during the storage of beet roots period, were recorded (Table 1_b).

Table 1_a: Some physical and chemical characteristics of the experimental soils*.

Properties	2008/2009 Season	2009/2010 Season
Texture analysis:		
Clay %	44.10	47.40
Silt%	31.50	28.60
Sand%	24.40	24.00
Texture grade:	Clay	Clay
pH (1:1 suspention)	7.50	7.50
Ec m.mohs (1:1)	1.32	1.15
Organic matter%	1.17	1.24
Soluble cations:		
Ca^{++} + Mg^{++} meq/100g soil	0.96	0.84
Na^{+} meq/100g soil	0.37	0.44
K^{+} meq/100g soil	0.09	0.11
Soluble anions:		
CO_3+ HCO_3 meq/100g soil	0.33	0.36
Cl^{-} meq/100g soil	0.84	0.91
Total N, %	0.09	0.10
Available P (ppm)	17.8	18.4
Exchangeable K (meq/100g soil)	0.64	0.71

*** Each value represents the mean of 5 soil samples**

Table 1_b: Meteorological data * during delaying delivery period (8days) before beet processing of beet roots post-harvest.

Storage period (day)	2008/2009				2009/2010			
	Temperature °C			Relative Humidity, %	Temperature °C			Relative Humidity, %
	Max.	Min.	Mean		Max.	Min.	Mean	
0	32.7	14.0	23.4	53.0	45.0	18.6	31.8	42.0
1	30.8	16.2	23.5	45.6	31.0	18.0	24.4	60.0
2	26.2	13.6	19.9	47.8	33.0	19.0	26.0	53.0
3	28.4	14.4	21.4	47.2	33.0	19.0	26.0	52.0
4	33.5	15.4	24.5	45.8	36.0	17.0	26.5	48.0
5	29.0	15.0	22.0	45.0	36.0	17.5	26.8	31.0
6	31.9	14.0	22.6	48.6	29.0	19.0	24.0	52.0
7	30.1	18.0	24.1	45.6	28.0	16.0	22.0	54.0
8	28.7	14.2	21.5	50.8	30.0	16.0	23.0	49.0
Average	30.1	15.0	22.6	47.7	33.4	17.8	25.6	49.0

*** From Mallawi Meteorological Station, El-Minia, Egypt.**

On the day of analysis, a sample of twenty roots were sent to the laboratory, cleaned with running tap water, dried and grated with grater into cossettes, then mixed thoroughly to determine the quality characteristics according to Mohamed, (2002).

Data recorded:

A- Qualitative characteristics:

1. Pol% was estimated in fresh of sugar beet roots samples, using saccharometer according to the method described in AOAC, (2005).
2. Alpha amino nitrogen, sodium and potassium contents: were estimated according to the procedure described by the sugar company using auto Analyzer (Cooke and Scott, 1993). The results were calculated as milliequivalent per 100 gm beet.
3. Sugar recovery% was calculated according to Cooke and Scott (1993) using the following equation: Sugar recovery% = Pol, %- [0.29 + 0.343 (K + Na) + α - N (0.094)], Where, K, Na and α - N were determined as milliequivalent/100 g beet.

B- Productivity parameters:

1. Roots yield and top yield (ton /fed): After 195 days from sowing, plants of sugar beet from each plot were harvested to determine roots yield and top yield as ton /fed on fresh weight basis.
2. Recoverable sugar yield (ton/fed.) was calculated from the following equation: Recoverable sugar yield (ton/fed.) = Roots yield (ton/fed.) X Sugar recovery%. as reported by Mohamed, (2002).

Data collected were subjected to the proper analysis of variance (ANOVA). The proper statistical of all data was carried out according to lined by Gomez & Gomez (1984). Homogeneity of variance and differences among treatments were evaluated by the least significant difference test (LSD) at 5%.

RESULTS AND DISCUSSION

I- Qualitative characteristics:

Tables 2 to 6 revealed that potassium fertilizer level had a significant effect on pol%, alpha amino nitrogen (α-N), sodium content, potassium content of beet roots and rendement or sugar recovery% of sugar beet in the two growing seasons and the combined except potassium content was insignificant in the 2nd season. It could be noted from combined analysis that adding K_2O at 24 or 48 kg/ fed caused an increase in pol% by 20.90 and 11.19%, sugar recovery% by 28.47 and 16.60% and potassium element of beet roots by 0.30 and 3.90% compared with the control (zero portion), respectively. This increase might be due to the role of K_2O which encourage carbohydrates to translocate to store in roots, hence transformed to sucrose and reflected on the increase in of root pol, %, where potassium used as Co-Enzyme with phosphorase to form sucrose (El-Harriri and Gobarh, 2001 and Shalaby, *et al*. 2002). In this subject, they noticed similar data. But, the increase in pol, % of beet roots with applying K_2O at 24 kg/fed was higher than 48 kg/fed. This might be attributed that increase in applying K_2O at 48 kg/fed led to that potassium attack ion malat from malic acid (K^+ react with malic acid to form potassium malat) thus decrease of sucrose, % or pol% and may be attributed that to the so called dilution effect (Shalaby, *et al.* 2002). Potassium is one of the major elements needed for vegetative growth of plant and sugar synthesis. They added that the best level of potassium fertilization was 24 kg/fed. In this subject, adding K_2O at 24 or 48 kg/fed. caused decrease in alpha amino nitrogen (α-N) content of beet roots by 12.32 and 14.00% and sodium element of beet roots by 35.92 and 47.33% compared with the control, respectively. This decrease might be due to the increase in pol% of beet roots. Here too, Sobh, *et al*. (1992); Khalifa, (1995) and Soltan, (1999) reported that K content of fresh roots were increased with increasing K levels till 48 kgs K_2O/fed. Similar conclusion was reported by Pardo & Guadalix (1993) and El-Harriri and Gobarh, (2001) who indicated that increasing potassium level increased K content of beet roots with decrease in both of α–N and sodium content of beet roots. In this subject, Shalaby, *et al*. (2002) indicated that the increase in K content of fresh roots with increasing the potassium application may be due to the increase in soil salt.

Increasing the time elapsed between harvesting and processing or delaying the crop delivery to factory had a significant effect on pol%, alpha amino nitrogen (α-N), Na, K contents and sugar recovery% in the two growing seasons and the combined as shown in Tables (2 to 8). It could be also notice that the increase in the period between harvesting and processing from zero time (at harvest) to eight days led to a gradual increase in pol% α-N , Na and K contents as well as sugar recovery%. These increases might be due to the decrease in the moisture content in beet roots. Such results are in accordance with those obtained by Mohamed (2002) and Ferweez and Khalifa (2004) and Ferweez *et al*. (2006).

Table 2 : Effect of delaying the beet roots delivery to the factory on pol% of sugar beet under different potassium fertilizer levels.

Delaying days (B)	2008/2009 season				2009/2010 season				Combined			
	Potassium fertilizer levels (kg K_2O/fed) (A)											
	0.0	24.0	48.0	Mean	0.0	24.0	48.0	Mean	0.0	24.0	48.0	Mean
Zero	14.25	17.86	16.35	16.15	14.89	18.40	17.20	16.83	14.57	18.13	16.78	16.49
2	14.66	18.17	16.70	16.51	15.41	18.77	17.56	17.25	15.04	18.47	17.13	16.88
4	15.05	18.43	16.99	16.82	15.69	19.18	17.92	17.60	15.37	18.81	17.45	17.21
6	15.66	18.67	17.21	17.18	16.39	19.40	18.12	17.97	16.03	19.03	17.67	17.57
8	16.07	18.96	17.30	17.44	16.96	19.54	18.20	18.23	16.51	19.25	17.75	17.84
Mean	15.14	18.42	16.91	16.82	15.87	19.06	17.80	17.58	15.50	18.74	17.35	17.20
F test	**	**	**	**	**	**	**	**	**	**	**	**
LSD0.05	A=1.34	B=0.06	AB=0.11		A=0.55	B=0.05	AB=0.09		A=0.60	B=0.04	AB=0.07	

The relationships or interactions between potassium fertilizer level and the period between harvesting and processing (AB) show a significant increases in the contents of pol%, rendement or sugar recovery%, K and Na, while insignificant interactions were found for α-N of sugar beet roots (Tables 2-6). It could be concluded that potassium fertilizer level (24 kg K_2O/fed.) at zero delaying day (at harvest day) recorded the highest values of pol%, rendement or sugar recovery%, , as well as the lowest values of α-N, Na and K contents of sugar beet. Similar results were obtained by Kandil *et al*. (2002) and Badawi *et al.* (2004); Ferweez & Khalifa (2004) and Ferweez *et al*. (2006).

Table 3 : Effect of delaying the delivery to the factory on α-amino nitrogen content * of sugar beet at different potassium fertilizer levels.

Delaying days (B)	2008/2009 season				2009/2010 season				Combined			
	Potassium fertilizer levels (kg K_2O/fed) (A)											
	0.0	24.0	48.0	Mean	0.0	24.0	48.0	Mean	0.0	24.0	48.0	Mean
Zero	2.11	1.97	1.84	1.97	2.03	1.78	1.85	1.89	2.07	1.88	1.85	1.93
2	2.30	2.05	1.91	2.09	2.14	1.84	1.92	1.97	2.22	1.95	1.92	2.03
4	2.36	2.12	2.00	2.16	2.23	1.91	1.99	2.04	2.29	2.02	1.99	2.10
6	2.44	2.21	2.07	2.24	2.29	1.99	2.07	2.12	2.37	2.10	2.07	2.18
8	2.51	2.30	2.16	2.33	2.36	2.09	2.17	2.21	2.44	2.20	2.17	2.27
Mean	2.35	2.13	2.00	2.16	1.92	1.92	2.00	2.04	2.28	2.03	2.00	2.10
F test	**	**	Ns		**	**	Ns		**	**	Ns	
LSD0.05	A=0.19	B=0.06	AB=-		A=0.09	B=0.19	AB=-		A=0.09	B=0.03	AB=-	

***= Alpha amino nitrogen as milliequavalents/100 gm beet.**

Table 4 : Effect of delaying the beet roots delivery to the factory on sodium content * of sugar beet at different potassium fertilizer levels.

Delaying days (B)	2008/2009 season				2009/2010 season				Combined			
	Potassium fertilizer levels (kg K_2O/fed) (A)											
	0.0	24.0	48.0	Mean	0.0	24.0	48.0	Mean	0.0	24.0	48.0	Mean
Zero	1.77	1.35	1.16	1.43	1.74	1.21	1.11	1.35	1.76	1.28	1.14	1.39
2	1.83	1.42	1.27	1.51	1.85	1.27	1.21	1.44	1.84	1.35	1.24	1.47
4	1.93	1.48	1.34	1.58	1.92	1.34	1.29	1.52	1.93	1.41	1.32	1.55
6	2.01	1.57	1.42	1.67	2.01	1.41	1.36	1.60	2.01	1.49	1.39	1.63
8	2.12	1.65	1.47	1.75	2.12	1.50	1.43	1.68	2.12	1.58	1.45	1.72
Mean	1.93	1.50	1.33	1.59	1.93	1.35	1.28	1.52	1.93	1.42	1.31	1.55
F test	**	**	Ns		**	**	**		**	**	**	
LSD0.05	A=0.12	B=0.02	AB=-		A=0.11	B=0.02	AB=0.03		A=0.07	B=0.01	AB=0.03	

***= Sodium content as milliequavalents/100 gm beet.**

Table 5 : Effect of delaying the beet roots delivery to the factory on potassium content * under at different potassium fertilizer levels.

Delaying days (B)	2008/2009 season				2009/2010 season				Combined			
	Potassium fertilizer levels (kg K_2O/fed) (A)											
	0.0	24.0	48.0	Mean	0.0	24.0	48.0	Mean	0.0	24.0	48.0	Mean
Zero	6.39	6.60	6.76	6.58	6.32	6.55	6.72	6.53	6.36	6.58	6.74	6.56
2	6.55	6.66	6.83	6.68	6.50	6.62	6.84	6.65	6.53	6.64	6.84	6.67
4	6.71	6.70	6.90	6.77	6.67	6.69	6.94	6.77	6.69	6.70	6.92	6.77
6	6.85	6.73	6.98	6.85	6.74	6.73	7.02	6.83	6.80	6.73	7.00	6.84
8	6.97	6.79	7.05	6.94	6.87	6.76	7.15	6.93	6.92	6.78	7.10	6.93
Mean	6.69	6.70	6.91	6.77	6.62	6.67	6.94	6.74	6.66	6.68	6.92	6.75
F test	**	**	**		Ns	**	**		**	**	**	
LSD0.05	A=0.18	B=0.02	AB=0.04		A=-	B=0.02	AB=0.04		A=0.20	B=0.01	AB=0.03	

***= Potassium content as milliequavalents/100 gm beet.**

Table 6 : Effect of delaying the beet roots delivery to the factory on rendement under different potassium fertilizer levels.

Delaying days (B)	2008/2009 season				2009/2010 season				Combined			
	Potassium fertilizer levels (kg K_2O/fed) (A)											
	0.0	24.0	48.0	Mean	0.0	24.0	48.0	Mean	0.0	24.0	48.0	Mean
Zero	10.96	14.66	13.17	12.93	11.64	15.28	14.05	13.66	11.30	14.97	13.61	13.29
2	11.28	14.92	13.45	13.22	12.06	15.59	14.34	14.00	11.67	15.26	13.89	13.61
4	11.57	15.13	13.68	13.46	12.24	15.96	14.62	14.27	11.90	15.55	14.15	13.87
6	12.10	15.32	13.84	13.75	12.88	16.13	14.76	14.59	12.49	15.72	14.30	14.17
8	12.43	15.56	13.88	13.96	13.36	16.22	14.76	14.78	12.90	15.89	14.32	14.37
Mean	11.67	15.12	13.61	13.46	12.44	15.84	14.50	14.26	12.05	15.48	14.05	13.86
F test	**	**	**		**	**	**		**	**	**	
LSD0.05	A=0.32	B=0.22	AB=0.37		A=0.57	B=0.19	AB=0.33		A=0.54	B=0.14	AB=0.24	

Rendement= Sugar recovery%

II- Yield parameters:

Results in Tables (7 and 8) indicated that potassium fertilizer level had a significant effect on roots and recoverable sugar yields (ton/fed.) of sugar beet in the two growing seasons and the combined as well. It could be noticed from combined analysis that the highest values of roots and recoverable sugar yields (29.06 and 4.33 tons/fed.) was recorded at level of 24 kg K_2O/fed., while the lowest values of roots and recoverable sugar yields (26.73 and3.02 tons/fed.) was zero kg K_2O/fed. level, respectively. The increase in recoverable sugar yield (ton/fed)of sugar beet might be due to the increase in both of roots yield (ton/fed) and pol, % (Mohamed, 2002). But, the maximum value of recoverable sugar percent of sugar beet was achieved by applying K_2O at 24 kg/fed than 48 kg/fed. This result might be mainly due to that the high levels of potassium fertilization increased the impurities contents in juice of beet roots and consequently reduced the rendement or sugar recovery, % of sugar beet. These findings are in good accordance with those published Zalat, (1986); Salah, *et al*. (1984); Genaidy, (1988)and El-Kassaby, *et al (*1991).They demonstrated that root yield of sugar beet was significantly increased with increasing K-fertilizer level up to 48 kg K_2O /fed.The present results contracticted with those obtained by Hegazy, *et al.* (1992)and Shalaby, *et al*. (2002)who indicated that the aforementioned character were not affected by potassium application. These differences might be due to the variations in the studied environmental conditions, variety and soil type. Also, losses% in recoverable sugar yield (ton/fed.) of sugar beet post harvest were 6.67, 10.55 and 15.35% of the initial value with nitrogen fertilizer levels 70, 90 and 110 kg /fed., respectively. Consequently, deterioration rates or losses% in roots yield and recoverable sugar yield (ton/fed.) increased with increasing nitrogen fertilizer level.

The deterioration rates or losses% post harvest of sugar beet were 19.90, 11.56 and 18.98% in roots yield (ton/fed.) and 17.97, 7.71 and 15.68% of the initial value at harvest in recoverable sugar yield (ton/fed.) with potassium fertilizer levels, zero, 24 and 48 kg K_2O/fed., respectively (Tables, 7 and 8).

Table 7: Effect of delaying the beet roots delivery to the factory on roots yield (ton/fed.) under different potassium fertilizer levels.

Delaying days (B)	2008/2009 season				2009/2010 season				Combined			
	Potassium fertilizer levels (kg K_2O/fed) (A)											
	0.0	24.0	48.0	Mean	0.0	24.0	48.0	Mean	0.0	24.0	48.0	Mean
Zero	26.66	28.60	29.00	28.09	26.80	29.52	28.42	28.25	26.73	29.06	28.71	28.17
2	23.86	27.24	26.92	26.01	23.85	28.00	26.22	26.02	23.86	27.62	26.57	26.02
4	21.15	25.69	24.70	23.84	20.95	26.47	23.78	23.73	21.05	26.08	24.24	23.79
6	18.89	23.89	21.75	21.51	18.63	24.90	21.41	21.65	18.76	24.40	21.58	21.58
8	16.64	22.84	19.72	19.73	16.70	23.32	19.33	19.78	16.67	23.08	19.53	19.76
Mean	23.86	24.03	23.62	23.84	21.39	26.44	23.83	23.89	21.41	26.05	24.13	23.86
F test	**	**	**		**	**	**		**	**	**	
LSD0.05	A=1.83	B=0.23	AB=0.40		A=1.39	B=0.15	AB=0.25		A=0.73	B=0.13	AB=0.23	

Table 8: Effect of delaying the beet roots delivery to the factory on recoverable sugar yield (ton/fed.) under different potassium fertilizer levels.

Delaying days (B)	2008/2009 season				2009/2010 season				Combined			
	Potassium fertilizer levels (kg K_2O/fed) (A)											
	0.0	**24.0**	**48.0**	**Mean**	**0.0**	**24.0**	**48.0**	**Mean**	**0.0**	**24.0**	**48.0**	**Mean**
Zero	2.92	4.14	3.82	3.63	3.12	4.51	3.99	3.87	3.02	4.33	3.91	3.75
2	2.69	4.07	3.62	3.46	2.88	4.36	3.76	3.67	2.79	4.21	3.69	3.56
4	2.45	3.89	3.38	3.24	2.57	5.22	3.48	3.42	2.51	4.06	3.43	3.33
6	2.27	3.66	3.01	2.98	2.40	4.01	3.16	3.19	2.34	3.84	3.09	3.09
8	2.07	3.53	2.74	2.78	2.23	3.78	2.85	2.96	2.15	3.66	2.80	2.87
Mean	2.48	3.86	3.32	3.22	2.64	4.18	3.45	3.42	2.56	4.02	3.38	3.32
F test	**	**	**Ns**		**	**	**Ns**		**	**	**Ns**	
LSD0.05	**A=0.55**	**B=0.22**	**AB=-**		**A=0.20**	**B=0.13**	**AB=-**		**A=0.25**	**B=0.12**	**AB=-**	

Increasing the time elapsed between harvesting and processing had a significant effect on roots and recoverable sugar yields (ton/fed.) (Tables 7 and 8). It could be noted that the increase in the delaying period from zero to 2, 4, 6 and 8 days led to an increase in the deterioration rates or losses being 8.26, 18.41, 30.54 and 42.56% in roots yield and 5.34, 12.61, 21.36 and 30.66% recoverable sugar yield, respectively as compared with zero time, respectively. This deterioration or losses rates in roots and recoverable sugar yields (ton/fed.) might be due to the decrease in moisture% of beet roots (Table 9) and sucrose consumption during respiration process of roots. Such results are in accordance with those obtained by Mohamed (2002); Ferweez and Khalifa (2004) and Ferweez *et al*. (2006).

Also data in Tables 7 and 8 indicate a significant interactions between potassium fertilizer level and the period between harvesting and processing (AB) with regard to roots yield (ton/fed.) and insignificant interaction for recoverable sugar yield (ton/fed.) of sugar beet in the two growing seasons and their combined data. So, the growers will suffer more due to beet roots deterioration than factory. It could be concluded that applying potassium fertilizer at 24 kg K_2O/fed. reduced the deterioration or losses rates in both of roots and recoverable sugar yields (ton/fed.) of sugar beet and with time elapsed between harvesting and processing for any reason.

III- Economics of sugar beet productivity per feddan at the studied delaying days and nitrogen fertilizer levels :

Data in Table 9 show that the level of 24 kg K_2O/fed. gave the lowest value in the loss of productivity/fed, i.e. root and sugar yields post -harvest, while the highest value in the loss of productivity/fed. was found with the level of zero kg K_2O/fed. But, potassium fertilizer level at 24 kg K_2O/fed. gave the highest value of total return and net profit per fed because it resulted in the highest value of root yield (ton/fed.) at harvest (Table, 7) and consequently after delaying.

Table 9 : Some economical parameters* of sugar beet productivity per feddan at studied potassium fertilizer levels and delaying days.

Items	Potassium fertilizer (Kg K_2O/ fed.)			Delaying days				
	Zero	24	48	Zero	2	4	6	8
Costs (LE) :**								
Variable costs :								
i.e. irrig., etc.	2400	2550	2700	2400				
Fixed costs								
Overhead	100							
Rental value	2000							
Total costs	4500	4650	4800	4650				
Productivity (in ton)								
Roots yield	26.73	29.06	28.71	28.17	26.02	23.79	21.58	19.76
Sugar yield	3.02	4.33	3.91	3.75	3.56	3.33	3.09	2.87
Loss in Productivity as means (in ton) :								
Roots yield	2.33	0.00	0.35	0.00	2.15	4.38	6.59	8.41
Sugar yield	1.31	0.00	0.42	0.00	0.19	0.42	0.66	0.88
Prices (LE /ton)**								
Root	220	270	260	250	260	260	260	270
Total return (LE)	5880.6	7846.2	7464.6	7042.5	6765.2	6185.4	5610.8	5335.2
Net profit (LE)	1380.6	3196.2	2664.6	2392.5	2115.2	1535.4	960.8	685.2
Loss in (L E*) :**								
Total return (LE)	1965.6	0.00	381.6	00.00	277.3	857.1	1454.4	1707.3

***According to Garg & Azad, (1975). ** Sources of CCSC (2010). *** L.E. = Egyptian pound**

In addition the data demonstrated that the increase in the period between harvesting and processing was coincided with an increase in the loss of productivity/fed, i.e. root and sugar yields, and the loss of total return/fed.

Therefore, fertilization of sugar beet with 24 kg K_2O/fed. is recommended under Middle Egypt conditions (El-Minia Governorate conditions)for increasing income value of grower because it gave the lowest value in the loss of total return/fed post-harvest compared with the other potassium fertilizer levels, i.e. zero and 48 kg K_2O/fed.. This led to an increase in the delivered roots quantity to the factory, consequently increasing the rendement or sugar recovery% in Abou Kourkas factory and helping in solving the factory problem, i.e. reduction of rendement or sugar recovery%.

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خفض الفواقد في إنتاجية ، جودة وربحية جذور بنجر السكر الناتجة عن تأخير التصنيع تحت مستويات مختلفة من السماد البوتاسى

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معهد بحوث المحاصيل السكرية - مركز البحوث الزراعية ، مصر

تحت ظروف محافظة المنيا يصنع بنجر السكر فى مصنع ابوقرقاص بعد نهاية موسم عصير القصب اثناء الاسبوع الاخير من شهر ابريل وأوائل مايو ، حيث تسود درجات الحرارة العالية ودرجات الرطوبة المنخفضة متاحة ،لذا أجرى هذا البحث في مزرعة محطة البحوث الزراعية بملوي ،محافظة المنيا ،مصر خلال موسمى٢٠٠٨ /٢٠٠٩، ٢٠٠٩/٢٠١٠ لدراسة خفض الفواقد في إنتاجية ، جودة وربحية بنجر السكر بعد الحصاد كنتيجة تأخير التوريد للمصنع باستخدام مستويات مختلفة من السماد البوتاسى. وفى هذا الصدد استخدمت ثلاث مستويات من السماد البوتاسى هي صفر ،٢٤ و ٤٨ كجم/ف وخمس فترات تأخير عن التصنيع هي صفر ، ٢ ، ٤ ، ٦ و ٨ أيام في تصميم التحليل المشترك لتحديد المستوى الامثل من السماد البوتاسى الذي يحقق أعلى إنتاجيه وجودة من محصول بنجر السكر ويخفض الفاقد في السكر الناتج عن تأخير التصنيع بعد الحصاد.

أوضحت النتائج المتحصل عليها الأتي :

١ــ حقق مستوى٢٤ وحدة من السماد البوتاسى/ فدان القيم الأعلى في نسبة الحلاوة في جذور البنجر ، ،نسبة استخراج السكر ، وحاصل الجذور والسكر (٢٩,٠٦ و ٤,٣٣ طن/ف على التوالى).

٢ــ أشارت النتائج أن زيادة الفترة بين الحصاد وتأخير توريد الجذور إلى المصنع من يوم الحصاد حتى ثمانية أيام أدت إلى زيادة تدريجية في نسبة السكر في جذور البنجر، كميات ألفا امينو نيتروجين ، الصوديوم والبوتاسيوم وبالعكس نقص تدريجي فى حاصل الجذور والسكر بالطن/فدان.

٣- أدى مستوى٢٤ وحدة من السماد البوتاسى /فدان تحت ظروف هذة التجربة الى خفض التدهور ا و معدل الفواقد في كلا من نواتج الجذور والسكر القابل للاستخراج طن/فدان بعد الحصاد مع إطالة او تأخير فترة توريد المحصول إلى المصنع لاى سبب. لذا نلاحظ أن التأثير الأكبر لمعدلات التدهور او الخسارة لجذور بنجر السكر بعد الحصاد تقع على عاتق الزراع بدرجة اكبر من المصنع.

٤- بناء على ذلك وجد إن مستوى٢٤ وحدة من السماد البوتاسى /فدان يوصى به لخفض التدهور او معدل الفواقد في كلا من الجذور والسكر القابل للاستخراج و الفاقد في العائد الكلى للفدان تحت ظروف مصر الوسطي (ظروف محافظة المنيا) لأنة خفض معدلات التدهور ا و الفواقد مقارنة مع مستويات السماد البوتاسى الأخرى (الصفر و ٤٨ وحدة من السماد البوتاسى/فدان).

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