J. Agric. Sci. Mansoura Univ., 28 (7): 5115 - 5128, 2003

SOME CHEMICAL AND TECHNOLOGICAL CHARACTERISTICS OF SUGAR BEET (*Beta vulgaris* .L) AS AFFECTED BY PLANTING METHODS AND DIFFERENT HARVESTING DATES

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ABSTRACT

Two field trials were conducted at Sakha Research Station during the two successive seasons of 2000 / 2001 and 2001 / 2002 to study the influence of transplanting by using paper pots at 4 - leaf stage in addition to control (direct seed bed). And three harvesting dates 180, 195 and 210 days after sowing on yield and quality of sugar beet variety Gloria. The main results could be summarized as follows: Root dimension (length and diameter) significantly increased by direct seed sowing . Highest root length and root weight / plant were obtained in both seasons, when seeds were sowing directly compared with transplanting seedling at 4 - leaf stage which recorded the lowest root length. On the other hand the sugar beet plants recorded the biggest value of root diameter in the first season when seeds was sown directly in the permanent field while in the second season transplanted one obtained the highest value. In addition, transplanting seedling at 4 – leaf stage significantly increased top weight / plant, root and sugar yield / fed, reducing sugar percentage, branched root percentage ,T.S.S., sucrose and juice purity percentages in both seasons.

Results indicated that harvesting dates were significantly affected root length, root diameter, root weight / plant, top weight / plant, root and sugar yield / fed, reducing sugar, branched root , T.S.S., sucrose and juice purity percentages in both seasons. Highest root length, root diameter, root weight / plant, root and sugar yield / fed, reducing sugar percentage, branched root percentage as well as T.S.S., sucrose, purity percentages were produced from treatments that harvested after 210 days from sowing in both seasons. While, highest top weight / plant produced from harvesting sugar beet after 180 days from sowing in both seasons.

Transplanting of sugar beet significantly effected juice impurities which expressed as Na , K and alpha amino - N, where it recorded the highest value of Na and K in the two seasons , while it recorded the lowest value of alpha amino - N compared with the direct sown plants Sugar loss to molasses and recoverable sugar percentages significantly increased in transplanting plants.

The interaction between planting system and harvesting dates had a significant effect on all studied traials in the both seasons. Maximum root and sugar yields and percentages of reducing soluble sugars, branched roots, T. S. S., sucrose, juice purity and juice impurities were produced from transplanting plants at 4 – leaf stage and harvesting it after 210 days. While, highest values of root dimension (length and diameter) were produced from sown with direct seed and harvesting plants after 210 days from sowing in the two seasons.

INTRODUCTION

The importance of sugar beet (*Beta vulgaris* .L) is conferred to sugar production and its by products which are used for alcohol production and feed for livestock. In Egypt sugar beet could be cultivated in the newly reclaimed soils. According to the agricultural view, sugar beet plants grow well in the

period from 1st October till the third week of November and still in the field 6 - 7 months. On the other hand, the manufacturing interval for sugar beet factory extends not less than 120 days, hence prolonging the agriculture season for continuous supplying by sugar beet roots become needed. However, starting the sowing date in August till 15th November will save appropriate chance for continuous delivery as long as possible during the industrial season. On the other hand, the earliest sowing season, i.e. August till September, the summer crops are still under harvest and consequently land preparation for sugar beet earlier season will be delayed. In addition, earlier sowing dates for sugar beet will increase the chance for pests and diseases to attack sugar beet plants and the sugar beet fields will be suffered from low plant density. Based on the available information in respect to the problem, this work was conducted to face and solve delaying land preparation as well as pest management of the early sowing dates and to increase the plant density of sugar beet fields. Using paper pots in a small nurseries in the field will keep sugar beet plants under aseptic conditions and save enough time for land preparation after harvesting the summer crops . For shortening the period from planting to maturity of sugar beet many investigators used transplanting of seedling in this respect, Duchatelet (1986) confirmed that transplanting sugar beet increased sugar production by 20 % improved production security. Hollowell (1986) reported that sugar beet transplantation at 4 - true leaf stage gave the highest quality of sugar beet than direct sowing. Uchino and Kanzawa (1986) studied effect of paper pots at transplanting system on Rhizoctonia root rot of sugar beet plants and the results showed that the percentage of infected roots and rot symptoms were much lower in transplanted sugar beet plants than in the directly sown plants and sugar content was 1.5 times higher. Vigoureux (1986) showed that sugar yield of transplanted sugar beet plants were 1.91 ton / ha greater than those of drilled crops (9.5 ton / ha). Yonts *et al.* (1986) showed that transplanted sugar beet by using paper pots increased sucrose yield over direct seed bed sugar beet plants. Narang and Bains (1987) reported that transplanting sugar beet gave the highest tonnage and led to a high incidence of branch to roots. Burcky (1988) observed that transplanting sugar beet gave higher plant population and increased sugar yield by 1.4 - 4 ton / ha. specially after late planting. Schollmeyer and Kastner (1990) reported that in trials on 65 farms sugar beet sown in early March, grown in a greenhouse for about 6 week and transplanted at 27 cm spacing yielded 52.9 ton root / ha compared with 41.21 ton from direct sown crops. Lunnan *et al.* (1991) pointed out that transplanting rather than sowing increased mean sugar yield from 4.92 to 7.62 ton / ha and increased sugar content of roots from 14.6 to 15.4 % . EL-Kassaby and Leilah (1992) reported that plant density significantly affected root diameter, root weight as well as root and sugar yield ton / fed. Ghonema and Sarhan (1994) reported that direct seedling method surpassed the other experimented transplanting ones in all studied characteristics. Pruning one third of top leaves i.e. transplanting seedling with cutting one third of the top leaves of seedling before transplanting was superior over pruning the complete seedling in all studied characters. EL- Geddawy *et al.* (1997) showed that transplanting of sugar beet gave the highest root and sugar

yields than direct sowing, the superiority due to the high density for transplantation.

This work study the effect of harvesting dates on yield and quality of sugar beet many investigators examined this effect. In this respect, Besheit and EL-Gharbawy (1991) showed that individual root weight, percentages of sucrose and purity increased as harvest date delayed. Root and sugar yields were highest at seven months after sowing. Malec (1992) pointed out that early sowing of sugar beet leads to higher crop yield but inferior quality and lower sugar content, late harvesting improves quality with little effect on crop yield. Shafi *et al.* (1992) reported that sugar beet sown on 10th Oct. and harvested on 1st May, 15th May, 31st May, and 15th June gave 63.4, 66.6, 67.7, 69.5 and 70.3 ton / ha, respectively. They added that the highest sugar yield (about 11.6 ton / ha.) were recorded in crop harvested on 30th June and the lowest yield (5.06 ton / ha) were found in crop harvested on 1st May. Gutmanski and Nowakowski (1994) showed that delaying harvesting increased root and sugar yield, leaf yield was reduced by later harvesting. They added that delaying harvesting increased sugar and amino nitrogen contents. Lauer (1995) reported that harvests were at regular intervals beginning 13th September and ending 25th October. They also found that delaying harvesting increased root yield,sucrose content and recoverable sucrose. Saif, Laila *et al.* (1997) found that delaying harvesting date up to 200 days reduced top yield, but increased root and sugar yields, juice purity and sucrose percentages.

The main object of this investigation was to study the effect of planting methods i.e. direct seedling and transplanting sugar beet seedling at 4 – leaf stage for shortening the period from planting to maturity and to study the effect of harvesting dates on growth root and sugar yields and quality of sugar beet c.v. Gloria.

MATERIALS AND METHODS

Two filed experiments were carried out during the two seasons of 2000 and 2001at Sakha Agricultural Research Station, Kafr EL-Sheikh Governorate. The experiments were laid out in a split plot design with four replicates. The two sowing methods (transplanting and direct seed bed) were occupied in the main plots and the three harvesting dates were allocated in the subplots. The experimental unit area included 10 ridges, 60 cm apart and 3.5 m long occupying an area of 21 m2 (i.e. 1 / 200 fed) . The sowing dates were 5th and 10th October, in both seasons, respectively. Plants were thinned or transplanted in hills 20 cm apart. The cultivar Gloria was used. Nitrogen in the form of urea (46.5 % N) was applied at rate of 90 kg N / fed as side – dressing 40 days after sowing or 10 days from transplanting. Phosphorus in the form of super phosphate (15.5 %) and Potassium in form of potassium sulfate (48% K_2O)at a rate of 31 kg P_2O_5 / fed and 48 kg K_2O / fed, respectively were incorporated directly before sowing. Other agricultural practices were carried in the same manner prevailing in the region except for the factor under study.

At harvest a random sample of ten plants was taken at from each plot to determine the following data:

1-Root length, root diameter, root and top fresh weight / plant.

2 - The percentage of the branched roots.

3–Percentage of total soluble solids (T. S. S. %) was determined by using hand refractometer

4-Percentage of sucrose was determined according to Carruthers and Oldfield (1960).

5-Percentage of reducing soluble sugars was determined as described in A. O.A.C. (1990)

6-Percentage of juice purity was calculated by dividing sucrose % by total soluble solids % according to Carruthers and Oldfield (1960).

7-Impurities in roots such as Sodium (Na), Potassium (K) and alpha amino nitrogen (α - amino - N) (Milliequivalents / 100 g. beet) were determined according to the method described by William (1984

8-Percentage of sucrose loss to molasses (S. L. %) and recoverable sugar percentage (R. S. %) were determined according to the following equations which described by (Reinfeld *et al.*, 1974).

(S. L.%) = 0.343 (K + Na) + 0.094 (α - amino - N) - 0.31

(R. S.%) = Pol - [0.343 (K + Na) + 0.094 (α - amino - N) + 0.29]

Where:- Pol = Sucrose %

K = Potassium, Na = Sodium and (α - amino - N) = alpha amino nitrogen in milliequivalent / 100 g beet.

9 -Root yield (ton / fed) : Root yield of the two central ridges of each plot were estimated in kilograms and converted to record root yield in ton/ fed .

10 - Sugar yield (ton / fed) was calculated by multiplying root yield / fed by sucrose %

Data were statistically analyzed according to procedures out hand by Snedecor and Cochran (1981) and the treatment means were compared by using LSD as given by Waller and Duncan (1969) at 5% level of probability .

RESULTS AND DISCUSSION

Data presented in Table 1 revealed significant differences among the direct seed sown and transplanting at 4 - leaf stage system on root length , root diameter, root weight and top weight of sugar beet plants. Also, the table recorded the effect of harvesting dates after 180,195 and 210 days from sowing on the same traits and the interaction between the previous planting systems and harvesting dates.

Table(1): **Means of root length, root diameter, root weight / plant and top weight / plant as affected by transplanting and harvest dates and their interaction in both 2000 /2001 and 2001 / 2002 seasons .**

Treatments			Root Length (Cm)		Root Diameter (Cm)		Root Weight (Kg / plant)		Top weight (g / plant)	
			2000/2001	2001/2002	2000/2001	2001/2002	2000/2001	2001/2002	2000/2001	2001/2002
Direct Seed Sown			28.79	28.73	11.36	11.31	1.170	1.170	403.97	425.75
Transplanting at 4 – leaf stage			16.86	16.83	11.15	11.97	1.110	1.110	618.46	631.29
F - test			*	*	*	*	**	**	**	**
Harvest Dates	180 Days		19.72	19.91	10.17	10.46	0.930	0.990	658.27	677.37
	195 Days		22.86	22.91	11.05	11.00334	1.120	1.080	478.76	502.53
	210 Days		25.95	25.52	12.55	12.13	1.370	1.300	396.62	405.67
	L . S . D. at 0.05		1.40	1.39	0.81	0.79	0.25	0.23	65.042	63.750
Interaction	Direct seed Sown	180 Days	25.04	25.44	10.12	9.92	0.973	1.000	585.35	623.00
		195 Days	28.96	28.82	11.29	11.38	1.193	1.107	362.95	374.23
		210 Days	32.38	31.92	12.67	12.62	1.347	1.410	263.63	280.02
	Transplanting at 4 - leaf stage	180 Days	14.39	14.38	10.22	10.99	0.880	0.987	731.20	731.74
		195 Days	16.76	17.00	10.80	11.29	1.050	1.050	594.58	630.82
		210 Days	19.41	19.12	12.43	13.63	1.397	1.283	529.61	531.31
	L . S . D. at 0.05		1.98	1.97	1.59	1.56	0.354	0.321	91.98	90.15

1 -Root dimension (length and diameter): -

Data present in Table 1 showed that root dimension (length and diameter) significantly increased by direct sowing compared with those of transplanted in both seasons. The highest root length was obtained (28.79 and 28.73 cm) in both seasons, respectively, when seeds were sowing directly compared with transplanting seedling at 4 - leaf stage which recorded the lowest root length (16.86 and 16.83 cm) in both seasons, respectively . The tallest root were obtained (25.95 and 25.52 cm) when sugar beet harvested after 210 days from sowing, While harvesting after 180 days from sowing recorded the lowest one (19.72 and 19.91 cm) in the two seasons, respectively. On the other hand, the biggest of root diameter (11.36 cm) in the first season produced when the seeds was sown directly in the permanent field, while in the second season transplanted one obtained the highest root diameter (11.97 cm). Harvesting after 210 days from sowing produced the highest values in root diameter (12.67 and 12.62 cm) while, 180 days from sowing recorded the lowest one (10.17 and 10.46 cm) in both seasons, respectively. Regarding the interaction effect between planting methods and harvesting dates , the data revealed that the highest root length 32.38 and 31.92 cm resulted from direct seed sown which harvested after 210 days from sowing in the two seasons. Also the highest values of root diameter were obtained with seed sown directly and harvesting at 210 days from sowing in the first season but in the second season when the seedling was transplanted and harvested after 210 days from sowing. The lowest values of root diameter (10.12 and 9.92 cm) were obtained from the direct seed sown when harvested after 180 days from sowing in the two seasons. Similar results were reported by Besheit and EL-Gharbawy (1991), Malec (1992), Shafi *et al.* (1992), Mohamad (2000) and Zalat and Ibrahim (2002).

2 - Root and top weight / plant : -

Effect of planting methods and harvesting dates on fresh weight of both root and top are presented in Table 1. Both planting systems and harvesting dates significantly affected both fresh weight of root and top per plant in the two seasons The results indicated that highest fresh weight of root / plant produced from the direct sown of seed, however highest fresh weight of top / plant produced from the transplanting of seedling at 4 – leaf stage. The heavy roots (1.370 and 1.300 kg / plant) resulted when root harvested after 210 days from sowing. Whereas, harvest early after 180 days from sowing gave the highest top weight / plant (658.27 and 677.37 g / plant) in both seasons. Delaying the harvest up to 210 days from sowing gave the lowest top weight in both seasons (396.62 and 405.67 g / plant) . Also data in Table 1 showed that there is a significant interaction effect between sowing systems and harvesting dates on root and top weight per plant. The highest root weight per plant was recorded when sugar beet directly seed sown and harvested after 210 days from sowing. On the opposite direction, top weight recorded the highest values (731.20 and 731.74 g / plant) when sugar beet transplanted at 4 - leaf stage and harvested early after 180 days from sowing. The obtained results agree with those of Mousa (1990), Aboushady (1994), EL-Geddawy *et al.* (1997) and Zalat and Ibrahim (2002).

3 - Root yield ton / fed : -

Data presented in Table 2 showed significant differences among the two planting methods (direct seed sown and transplanting seedling at 4- leaf stage) of yield / fed. Also, the results revealed significant effect of harvesting dates after 180,195 and 210 days from sowing on root yield / fed and the interaction between the previous planting systems and harvesting dates in both seasons.

Table(2): Means of root yield (ton / fed), sugar yield (ton / fed), percentage of reducing sugar and percentage of branched root as affected by sowing methods and harvesting dates and their interaction during 2000 /2001and 2001 / 2002 seasons.

Treatments			Root yield (ton / fed.)		Sugar yield (ton / fed.)		Reducing sugars %		Branched root %	
			2000/2001	2001/2002	2000/2001	2001/2002	2000/2001	2001/2002	2000/2001	2001/2002
Direct Seed Sown			21.59	21.65	3.58	3.59	1.08	1.05	0.00	0.00
Transplanting at 4 - leaf stage			23.31	23.37	4.06	4.00	1.56	1.56	15.42	15.38
F - test			*	*	*	*	*	*	*	*
Harvest Dates	180 Days		19.00	19.17	3.03	2.94	1.16	1.18	5.43	5.59
	195 Days		23.05	22.67	3.86	3.82	1.33	1.30	7.96	7.92
	210 Days		25.29	25.69	4.54	4.62	1.47	1.44	9.74	9.57
	L . S . D. at 0.05		1.44	1.41	0.23	0.22	0.06	0.09	1.15	1.18
Interaction	Direct seed Sown	180 Days	17.17	17.44	2.61	2.62	0.91	0.94	0.00	0.00
		195 Days	22.58	21.91	3.69	3.61	1.08	1.03	0.00	0.00
		210 Days	25.02	25.60	4.38	4.52	1.26	1.20	0.00	0.00
	Transplanting at 4 - leaf stage	180 Days	20.84	20.89	3.44	3.26	1.42	1.43	10.85	11.17
		195 Days	23.52	23.44	4.02	4.03	1.57	1.57	15.92	15.83
		210 Days	25.55	25.78	4.70	4.73	1.68	1.68	19.48	19.14
	L . S . D. at 0.05		2.04	1.97	0.33	0.34	0.09	0.12	1.64	1.68

Yield of roots attained the lowest values under direct seed sown method, where this method recorded 21.59 and 21.65 ton / fed, while the transplanted seedling method recorded the highest one (23.31 and 23.37 ton / fed) in the two seasons, respectively. Although fresh root weight / plant decreased with seedlings transplanting but root yield / fed was increased this may be due to increases in number of plants per unit area. EL-Geddawy *et al.* (1997) reported that transplanting sugar beet recorded highest root yield / fed than direct seed sown may be due to the high density of the transplanting. Also it's obviously clear that delaying of harvesting dates until 210 days from sowing significantly affected yield of roots (25.29 and 25.69 ton / fed) in the first and second seasons, respectively. The interaction effect between planting methods and harvesting dates had a significant effect on root yield / fed which increased to maximum with increasing harvest date to 210 days with both planting methods without significant differences. Similar results were reported by Besheit and EL-Gharbawy (1991) , Malec (1992) , Shafi *et al.* (1992) , Mohamad (2000) and Zalat and Ibrahim (2002).

4- Sugar yield ton / fed : -

Data presented in Table 2 show the influence of sowing methods and harvesting dates on sugar yield / fed. Sowing methods significantly affected sugar yield / fed in both seasons. Transplanting of seedling at 4 – leaf stage surpassed those of directly seed sown method in sugar yield / fed in both seasons. It clear that harvesting roots at 210 days from sowing recorded highest sugar yield / fed (4.54 and 4.62 ton / fed). The lowest sugar yield / fed produced from harvesting at 180 days from sowing. The interaction between planting methods and harvesting dates significantly affected sugar yield in both seasons. It obviously clear that sugar yield significantly increased to maximum by transplanting method at 4 - leaf stage and harvesting date at 210 days after sowing in both seasons. Similar results were reported by Besheit and EL-Gharbawy (1991), Malec (1992), Shafi *et al.* (1992), Abou EL-Magd (1998), Mohamad (2000) and Zalat and Ibrahim (2002).

5 - Reducing sugars percentage : -

The equimolar mixture of glucose and fructose , referred to as " invert sugar ", is obtained from sucrose by acid or enzyme (invertase) hydrolysis :-

$$\underset{342\ g}{\text{Sucrose}} + \underset{18\ g}{\text{water}} \xrightarrow{\text{Acid or enzyme}} \underset{180\ g}{\text{glucose}} + \underset{180\ g}{\text{fructose}}$$

As reported by many investigators glucose and fructose are not principal reducing sugar in sugar beet but the reducing sugar galactose is also present. Whilst sucrose is quit stable under normal processing conditions, glucose, fructose and galactose having reactive free carbonyl groups, are not . For that , reducing sugar is an undesirable quality parameter because :-

1- At the basal level in beet it breaks down in carbonatation to yield acids and some colour .

2- At higher level, it represents sugar lost and greater acid and colour production.

From this point of view , determination of reducing sugar in sugar beet roots represents an important factor for acceptance or rejection. The results in table 2 showed that highly significant differences were found among reducing sugars percentage due to methods of planting and harvesting dates in both seasons. Transplanting seedlings at 4 - leaf stage gave the highest percentage (1.56 %) compared with the direct seed sown which recorded (1.08 and 1.05 %) the lowest percentages in both seasons, respectively. Highest percentages produced from harvesting after 210 days from sowing (1.47 and 1.44 %) in the two seasons, respectively. The interaction between methods of planting and harvesting dates significantly effected reducing sugars percentage in both seasons. The results indicated that transplanted seedling and harvesting root after 210 days recorded the highest percentage (1.68 %) in both seasons. These results in agreement with those of Mousa (1990), Aboushady (1994), EL-Geddawy *et al.* (1997),Abou EL-Magd (1998), EL-Sharnouby *et al.* (1999) and Zalat and Ibrahim (2002).

6 – Branched root percentage :-

Data presented in Table 2 revealed that branched root percentage significantly affected by sowing methods and harvesting dates in both seasons. Transplanting seedlings at 4 - leaf stage caused to high ratio of side roots (15.42 and 15.38 %) in both seasons. This ratio increased significantly with increasing harvesting date from 180 to 210 days compared to the direct sowing which recorded zero branched in the two seasons. Similar results were reported by EL-Geddawy *et al.* (1997), Mohamad (2000) and Zalat and Ibrahim (2002).

Table(3): Means percentages of T.S.S., Sucrose and purity as affected by sowing methods and harvesting dates in both seasons.

Treatments			T.S.S. (%)		Sucrose (%)		Purity (%)	
			2000/2001	2001/2002	2000/2001	2001/2002	2000/2001	2001/2002
Direct seed Sown			19.89	20.16	16.36	16.32	82.11	81.32
Transplanting at 4 - leaf stage			20.47	20.40	17.00	17.04	83.01	83.44
F – test			*	*	*	*	*	*
Harvest Dates	180 Days		19.23	19.07	15.37	15.32	79.73	80.35
	195 Days		20.30	20.53	16.74	16.85	82.44	82.04
	210 Days		21.00	21.23	17.95	17.87	85.51	84.75
	L . S . D. at 0.05		1.19	1.23	0.47	0.50	2.29	2.27
Interaction	Direct seed Sown	180 Days	19.13	19.00	15.23	15.05	79.26	79.20
		195 Days	20.00	20.53	16.37	16.51	81.83	80.38
		210 Days	20.53	20.93	17.49	17.40	85.23	84.38
	Transplanting At 4 - leaf stage	180 Days	19.33	19.13	15.50	15.59	80.19	81.50
		195 Days	20.60	20.53	17.10	17.19	83.04	83.70
		210 Days	21.47	21.53	18.41	18.33	85.78	85.12
	L . S . D. at 0.05		1.67	1.62	0.67	0.68	4.46	4.48

7 - Total Soluble Solids percentage (T.S.S. %): -

Data presented in Table 3 revealed significant differences between sowing methods and harvesting dates on some technological and chemical characteristic (total soluble solids, sucrose and juice purity percentages) of sugar beet.

The results showed that transplanting seedling at 4 – leaf stage recorded highest percentage(20.47 and 20.40 %) of T.S.S., However, direct seed sown recorded the lowest T.S.S. percentage (19.89 and 20.19 %) in both seasons, respectively. Also, T.S.S. percentage significantly increased with delaying harvesting dates. Highest percentage of T.S.S. was recorded from the latest harvesting dates i.e. 210 days from sowing. Regarding the interaction effect between planting methods and harvesting dates, the data revealed that the highest percentage of T.S.S. (21.47and 21.53%) resulted from transplanted seedlings and harvesting after 210 days from sowing. These results in agreement with those of Mousa (1990), Aboushady (1994), EL-Geddawy *et al.* (1997) and Zalat and Ibrahim (2002).

8 - Sucrose percentage : -

The results in Table 3 clearly showed that sucrose percentage significantly increased by transplanting seedling at 4 – leaf stage (17.00 and 17.04 %) compared with direct seed sown (16.36 and 16.32 %) in the two seasons, respectively. This means that the sucrose percent in the direct seed sown was less than that of transplanted by 3.76 and 4.23 % in the two seasons respectively. Also, sucrose percentage recorded the highest percentages (17.95 and 17.87 %) with harvesting at 210 days from sowing. The lowest sucrose percentage was recorded with the early harvesting at 180 days from sowing (15.37 and 15.32 %) in the both seasons, respectively. The interaction between planting systems and harvesting dates had a significant effect on the percentage of sucrose in both seasons. The highest sucrose percentages (18.41 and 18.33 %) were obtained from transplanting seedlings at 4 – leaf stage and harvesting at 210 days in both seasons. Similar results were reported by Besheit and EL-Gharbawy (1991), Malec (1992), Shafi *et al.* (1992), Mohamad (2000) and Zalat and Ibrahim (2002).

9- Juice purity percentage :-

Juice purity is the ratio of sucrose to total soluble solids as a percentage in sugar beet roots. The results in Table 3 indicated that juice purity percentage significantly affected by sowing methods and harvesting dates in both seasons. The juice purity percentage significantly decreased in direct seeds sown (82.11 and 81.32 %), while increased with transplanted seedling was 83.01 and 83.44 % in the two seasons, respectively. This means that the purity in direct seed sown was less than that of transplanted seedling by 1.08 and 2.54 % in the two seasons, respectively. Also, delaying harvesting to 210 days after sowing gained full maturing roots, consequently obtained excess of the juice purity which averaged by 6.36 % in the two seasons. The interaction between planting systems and harvesting dates showed a significant effect on the juice purity percentage in both seasons. The highest percentages (85.78 and 85.2 %) were obtained from transplanting seedling and harvesting date 210 days. Similar results were

reported by Besheit and EL-Gharbawy (1991), Malec (1992), Shafi *et al.* (1992), EL-Geddawy *et al.* (1997), Mohamad (2000) and Zalat and Ibrahim (2002).

Table (4): Effect of planting methods and harvest dates on sugar beet Root Impurities expressed as Sodium, Potassium and α - mino -N (Milliequivalents / 100 g.beet),and the effect on Sugar Loss to Molasses and Recoverable sugar Percentages.

Treatments			Na		K		α– Amino-N		Sugar Loss to Molasses %		Recoverable sugar %	
			Meq / 100 gram beet									
			200/2001	200/2002	200/2001	200/2002	200/2001	200/2002	200/2001	200/2002	200/2001	200/2002
Direct seed sown			2.19	2.17	5.81	5.79	2.42	2.41	2.66	2.65	13.10	13.07
Transplanting at 4 - leaf stage			2.53	2.54	6.04	6.05	1.97	1.98	2.81	2.82	13.59	13.62
F – test			*	*	*	*	*	*	*	*	*	*
Harvest dates	180 days		2.39	2.37	6.38	6.34	2.27	2.26	2.91	2.89	11.86	11.83
	195 days		2.23	2.24	5.95	5.98	2.47	2.29	2.72	2.72	13.42	13.53
	210 days		2.05	2.02	5.46	5.44	2.65	2.64	2.52	2.49	14.83	14.78
	L. S. D. at 0.05		n.s	n.s	0.06	0.06	0.07	0.07	n.s	n.s	0.45	0.43
Interaction	Direct seed sown	180 days	2.33	2.31	6.05	6.02	2.25	2.23	2.77	2.75	11.86	11.70
		195 days	2.18	2.20	5.81	5.86	2.42	2.44	2.66	2.68	13.11	13.23
		210 days	2.03	2.00	5.41	5.34	2.58	2.57	2.48	2.45	14.41	14.35
	Transplanting at 4 leaf stage	180 days	2.66	2.65	6.52	6.49	2.29	2.31	3.05	3.04	11.85	11.95
		195 days	2.28	2.29	6.05	6.08	2.53	2.54	2.78	2.79	13.72	13.80
		210 days	2.06	2.07	5.48	5.52	2.72	2.70	2.53	2.55	15.28	15.18
	L. S. D. at 0.05		0.06	0.61	0.08	0.08	0.10	0.10	0.03	0.03	0.63	0.64

10 - Impurities of sugar beet :-

The results in Table 4showed significant differences among planting methods (direct seed sown and transplanting seedling at 4- leaf stage) on the main impurities in sugar beet juice especially Na, K and α - Amino-N also, on sugar loss to molasses and recoverable sugar percentages. Also, revealed the effect of harvesting dates at 180,195 and 210 days from sowing on the same traits and their interaction.

The cations, Na and K and the α - Amino - N are quantitatively and qualitatively important because they are the major non- sugar in sugar beet roots and expressed as juice impurities and they effected on the sugar beet roots quality. The results in Table 4 showed that transplanting seedlings significantly effected on juice impurities which expressed as Na, K and alpha amino – N. The highest juice impurities values of Na and K (2.53 and 2.54, 6.04 and 6.05) by transplanting seedling at 4 – leaf stage in the two seasons, respectively and the lowest value of alpha amino - N (1.97 and 1.98) However, the direct seed sown produced the lowest values of Na and K (2.19 and 2.17, 5.81 and 5.79) and for alpha amino - N (2.42 and 2.41) in the both seasons, respectively. Harvesting dates significantly affected juice impurities in both seasons. Delaying in harvesting dates up to 210 days after sowing significantly decreased the values of Na and K (2.05 and 2.02 , 5.46 and 5.44) in the two seasons, respectively. However, the early harvest date (180 days) recorded the highest one (2.39 and 2.37, 6.38 and 6.34) respectively. The interaction between methods of planting and harvesting dates had a significant

effect on impurities. Direct seed sown and harvesting at 210 days from sowing have the lowest impurities special Na and K (2.03 and 2.00, 5.41 and 5.34) in both seasons, respectively. While highest values of alpha amino – N (2.72 and 2.70) was found from transplanted seedling and harvested at 210 days from sowing. Similar results were reported by Besheit and EL-Gharbawy (1991), Malec (1992), Shafi *et al.* (1992), Mohamad (2000) and Zalat and Ibrahim (2002).

11 - Sugar loss to molasses and recoverable sugar percentage : -

Sugar loss to molasses and recoverable sugar percentages significantly increased by transplanting seedling was 2.81 and 2.82 % for sugar loss to molasses percentage and 13.59 and 13.62 % for recoverable sugar percentage. While in direct seed sown was 2.66 and 2.65 % for sugar loss to molasses percentage and 13.10 and 13.07 % for recoverable sugar percentage in the two seasons, respectively. This means that sugar loss to molasses in the direct seed sown was less than that of the transplanted seedling by 5.34 and 6.02 % and the recoverable percent in the direct seed sown was less than that of the transplanted seedling by 3.60 and 4.04 % in the two seasons, respectively. Also, harvesting sugar beet after 210 days from sowing gave the lowest percentage of sugar loss to molasses (2.52 and 2.49 %) but the recoverable sugar percentage gave the highest (14.83 and 14.78 %) in both seasons. While, the highest values of sugar loss to molasses was recorded with the early harvest date at 180 days from sowing (2.91 and 2.89 %) but the lowest values of recoverable sugar percentage was recorded with the early harvest date at 180 days from sowing (11.86 and 11.83 %) in the both seasons, respectively .Such effect of late harvest was due to increased sucrose and purity percentages as well as to reduction of impurities in terms of Na, K and α - Amino – N.

The interaction between planting systems and harvesting dates showed a significant effect on the percentages of sugar loss to molasses and recoverable sugar in both seasons .The lowest percentage of sugar loss to molasses was 2.53 and 2.55 % by transplanting seedling and harvesting at 210 days. While the highest percentage of recoverable sugar 15.28 and 15.18 % was produced with transplanting seedling and harvesting at 210 days from sowing. These results are in harmony with those reported by Besheit and EL-Gharbawy (1991), Malec (1992), Nassar (1992), Shafi *et al.* (1992), Lauer (1995), Ramadan (1999), Mohamad (2000) and Zalat and Ibrahim (2002).

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تأثر بعض الصفات الكيميائية والتكنولوجية لمحصول بنجر السكر بطرق الزراعة ومواعيد الحصاد المختلفة

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أقيمت تجربتان حقليتان بمزرعة محطة بحوث سخا – محافظة كفر الشيخ خلال موسمي الزراعة ٢٠٠٠ / ٢٠٠١ و ٢٠٠١ / ٢٠٠٢ بهدف دراسة تأثير طرق الزراعة (الزراعة المباشرة والزراعة بشتلات في عمر ٤ أوراق باستخدام الأطباق الورقية) وكذلك تأثير ثلاثة مواعيد حصاد (١٨٠ و ١٩٥ و ٢١٠ يوم) من الزراعة علي المحصول وصفات الجودة لبنجر السكر صنف جلوريا تم تنفيذ التجارب بتصميم القطع المنشقة مرة واحدة في أربع مكررات .

١- أوضحت النتائج أن الزراعة المباشرة بالبذرة سجلت أعلي القيم لكل من طول الجذر وقطر الجذر مقارنة بمعاملة الشتل في كلا موسمي الزراعة . بينما أشارت النتائج إلي ميعاد الحصاد عند ٢١٠ يوم من الزراعة قد سجل أعلي القيم لكل من طول الجذر وقطر الجذر في كلا موسمي الزراعة.

٢- أوضحت النتائج أن الزراعة بالشتلات في أطباق ورقية في عمر أربع أوراق قد سجلت أعلي القيم لكل من وزن العرش / نبات ، محصول الجذور / فدان ، محصول السكر / فدان ، نسبة السكريات المختزلة ، نسبة تفرع الجذور ، نسبة المواد الصلبة الكلية ، نسبة السكروز ، نسبة النقاوة ، تركيز الصوديوم و البوتاسيوم ، نسبة السكر المفقود في المولاس والسكر الأبيض الناتج مقارنة بالزراعة المباشرة بالبذرة في كلا موسمي الزراعة. بينما أعطت الزراعة المباشرة بالبذرة أعلي القيم في الوزن الغض للجذور / نبات وتركيز الأحماض الأمينية المرتبطة بالنيتروجين مقارنة بالزراعة بالشتل وذلك كلا موسمي الزراعة.

٣- أشارت النتائج إلي أن الحصاد عند ٢١٠ يوم من الزراعة قد سجل أعلي قيم لكل من الوزن الغض للجذر / نبات ، محصول الجذور والسكر / فدان ، نسبة السكريات المختزلة ، نسبة التفريع ، نسبة المواد الصلبة الكلية ، نسبة السكروز ودرجة النقاوة ، تركيز البوتاسيوم والأحماض الأمينية المرتبطة بالنيتروجين ونسبة السكر الأبيض الناتج مقارنة بمواعيد الحصاد الأخرى.

٤- لقد سجل التفاعل بين طرق الزراعة المستخدمة ومواعيد الحصاد تأثيرا معنويا علي جميع الصفات تحت الدراسة حيث سجلت معاملة زراعة شتلات بنجر السكر في عمر أربع أوراق والحصاد المتأخر عند ٢١٠ يوم من الزراعة للحصول علي أعلي القيم لكل من محصول الجذور للفدان والسكريات المختزلة ، نسبة التفريع للجذر وصفات نسبة المواد الصلبة الكلية ونسبة السكروز ودرجة النقاوة وتركيز البوتاسيوم وتركيز الأحماض الأمينية المرتبطة بالنيتروجين ونسبة السكر المفقود في المولاس ونسبة السكر الأبيض الناتج مقارنة بالزراعة المباشرة بالبذرة بينما سجلت الزراعة المباشرة بالبذرة والحصاد عند ٢١٠ يوم أعلي القيم في صفات الوزن الغض للجذور و العرش وتركيز البوتاسيوم دون تأثير معنوي مع تلك التي زرعت بالشتل وتم حصادها بعد ٢١٠يوم من الزراعة وذلك في كلا موسمي الزراعة.