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Botanical Characteristics of Some Sugar Beet Varieties (*Beta vulgaris* L): Comparative Study

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ABSTRACT

Two pots experimentsin were carried out at the experimental farm of Sakha Agricultural Research Station, North Delta, Egypt, during the two winter seasons of 2014/2015 and 2015/2016 to study certain botanical characteristics(25) varieties (*Betavulgaris* L).. The obtained results indicated that:(root length, root diameter, root size, root fresh weight, root dry weight, number of leave, fresh and dry weight leaves)showedvarieties highest values withCharlston, Lamiaa, Nefertitis, Salma and Beta 398 Charlstonwas the better one for leaf and root characters. While, the lowest values were recorded with Cawamera, Milaspoly, DEO32-705, HM16584 and OscarpolyIn addition, it was the found that chlorophylls and macro elements content in the leaf, were recorded highest values forthe varieties Maximus and Charlston, but, the lowest value were cleared with the varieties Alauda , Cawamera and Milaspoly. At the same time, yield total as well as (sugar, quality, potassium, sodium, α amino nitrogen and TSS showed the maximum values with Charlston, Beta 394, Lamiaa, Salma, Samba and HM586 compared with,Pleno, HM16584, Cawamera, and Milaspoly which gave the lowest values. The anatomical studies of roots showed that diameter of root, thickness vascular of bundle, layer of paranchyma, diameter of vessels and number of growth rings, , recorded the highest values with Charlston variety compared Cawamera variety.Moreover , it was found apossitive correlation between root dry weight, fresh and dry weight of leaves, chlorophyll A, phosphorus , sugar %, quality%, sodium content,diameter of xylem vessels and thickness of parenchyma layer and growth rings, these resultspropsed to classified sugar beet varieties to three groups, the first one include the varieties charlston, Lamiaa, Nefertitis, Salma, Beta 398, Beta 394, Samba and HM586 as earlier varieties .The second onewereMaximus, Steel, Nansy,Mona,Lagon, Mimona, Drena, Glorius, Athospolyand HM16101as medium, and the third onewereCawamera, Milaspoly, DEO32-705, HM16584, Oscarpoly, Alauda, and Pleno, as later for sowing date and may be useful for understanding the mechanisms of sugar content with dry weight, thickness of parenchyma layer, growth rings of the root and date of sowing and maturity of these varieties under the same condition.

Keywords: Sugar beet, varieties, morphology, physiology, yield and its quality

INTRODUCTION

Sugar beet (*Beta vulgaris L.*) is a member of the Chenopodiaceae and like many others in the family is a halophyte. It is a highly variable species containing four main groups of agricultural significance, *gardin beets*, *fodder beets* and sugar beet. Sugar beet is a biennial plant. In the first year, epigeal germination leads to the development of a rosette of glabrous. Dark green, glossy leaves with prominent midribs and strong petioles. Leaf production continues through the first season, while the root swells and accumulates sucrose. Root crops are usually harvested before the onset of winter frosts and May yield up to 15 ton of sugar / ha from 83 t of roots (Elliott and Weston 1993).

Sugar beet crop has an important position in Egyptian crop rotation as winter crop not only in the fertile soils, but also in poor, saline alkaline and calcareous soils. Whereas, it could be economically grown in the newly reclaimed soils such as at the Northern parts of Egypt as one of the most tolerant crops to salinity and wide range of climates, so, there were multiple of varieties and their botanical characteristics.

Many workers found that late harvesting of sugar beet crop increased growth traits, quality%, yields/fed and decreased impurities i.e. nitrogen (N), sodium (Na) and potassium (K%), (Abou El-Maged *et al* 2003), (Aly 2006) , (Azzazy *et al* 2007)and(El-Sheikh *et al* 2009) harvested sugar beet varieties at 210 days from sowing and showed significant effect on root weight, sucrose%, impurities, i.e. Na% and K%, as well as root and sugar yields/fed, than the other two harvest dates 180 and 195 days from sowing in both seasons.(Enan *et al* 2009) in Egypt, showed that sugar beet varieties differed significantly in root length, diameter, fresh weight/plant, TSS% and root yields/fed in both seasons and sugar yield in the 1st season. Farida variety significant increase of total soluble solids%, sucrose%, purity% and sugar yields/fed, while, it recorded the lowest values for impurities%, i.e. N, Na and K% in both seasons. fdxz(Dewy and Lu 1959) found that positive linear correlation for components of shoot and dry weight as well as sugar production.

To increase the relationship between sugar content and botanical characters in roots must be given to the development of new high shoot and root characteristicsof genotypes or hybrids for growers through breeding programs. Before this, it is necessary to investigate the anatomical, morphophysilogical characters of sugar beet varieties . No available data was found concerning the anatomical differences between the tested sugar beet varieties. Therefore, the main objective of this study was to copmpare anatomical, the morphological, physiological parameter as well as yield and its quality among the studied sugar beet varieties, to understanding the mechanisms of sugar content in the root and related to sowing date and maturity of these varieties.

MATERIALS AND METHODS

Two pots experiment in a randomized complete block design system with five replications were carried out at the experimental farm of Sakha Agricultural Research Station in North Delta Egypt, during the two winter seasons of 2014/2015 and 2015/2016 (25) varieties of Beta vulgaris L were examined denoted 1-MAXIMUS,2-STEEL, 3-NANSY, 4-MONA, 5-LAGON, 6-BETA398, 7-CHARLSTON, 8-MIMONA, 9-BETA394, 10-DRENA, 11-LAMIAA, 12-PLENO,

13-ALAUDA, 14-NEFERTITIS, 15-SALMA 16-MILASPOLY, 17-CAWAMERA, 18-SAMBA, 19-GLORIUS, 20-ATHOSPOLY, 21-OSCARPOLY, 22-HM16101, 23-HM16584, 24-HM586,25-DEO32-705.2-Anatomical studies of roots in somevarieties was evaluated. The seeds of multigerm sugar beet (Beta vulgaris, L.Chenopodiaceae)" were sown under normal field condition on 30thSeptember during the two growing seasons.Pots ,30 cm Ø were filled withthe soil of experimental farm. Soil analysis were done according to (El-Sawy *et al*. 2000) and presented in Table (1).

Table 1. Soil analysis of the experimental soil .

Seasons	pH	O.M%	EC Mmohos/cm	Available nutrients (ppm)			meq/ L
				N	P	K	Na
2014/2015	8.05	1.80	4.00	27	7.5	389	8.7
2015/2016	8.20	1.75	4.15	26.5	8.7	395	7.99

Normal cultural practices as recommended by ARC Egypt were done and disease control was carried out whenever it was necessary. Samples were takenfrom ten guarded plants and selected at random from each replications and evaluated : as follow:-

Morphological characters i.e, root length (cm), root diameter (cm), root size (cm^3), root fresh and dry weight (g/plant),number of leaves, fresh and dry leaves weight (g/ plant). The data were taken at 80 days from sseding during two seasons.

Physiological characteristics i.e. chlorophyll A, B, and carotenoids (mg/cm2) according to Inskeep and Blom, (1985),macroelements content in the leaves (N, Pand K)are reported by(Snell and Snell1977)were taken at (80 days) during two seasons.

Yield and quality:Sucrose (%), quality (%), sodium, potassium, α amino nitrogen and TSS (%) were determined according to McGinnur (1971)at harvesting date (200 days)from sowing in both seasons.

Anatomical characteristics:

For preparing sections, the root specimens were taken after 25, 40 and 55 days from seed planting. Root pieces of 4-5 mmlength were taken 2 cm far from the tip of the main fleshy roots. Specimens were fixed in Formalin Alcohol Acetic acid mixture (FAA, 1:18:1 v/v), washed and dehydrated in alcohol series. The dehydrated specimens were infiltrated and embedded in paraffin wax (52-54 °C m. p.). The embedded specimens were sectioned on a rotary microtome at a thickness of 10 – 12 µm. Sections were mounted on slides and deparaffinised. Staining was accomplished with safranine and light green, cleared in xylol and mounted in Canada balsam (Gerlach, 1977). Slides were microscopically examined and measurements and counts were taken and averages of 10 readings from 3 slides were calculated.

Transverse section of the fleshy root for three sugar beet varieties(Charlstone, Glorius and cawamera) i. e. root diameter, thickness of bundle thickness parenchyma layer, Ø of big xylem, thickness of epidermis, cortex tissues, Ø of V.C vessels and number of growth rings were measured during (2015 and 2016) season.

Statistical analysis:

The obtained data were subjected to the proper statistical procedures for analysis of variance according to that outlined by Gomez and Gomez (1984).Also, simple correlation coefficients and linear regression were computed among studied traits according to Steel and Torrie (1980).

RESULTS AND DISCUSSION

The results in Table (2) showed highly differences among the studied varieties for root characters, where the highest values were 34.11, 4.90, 62.58, 224.45 and 50.87 recorded of the varieties No. 9,1,2,7 and 7 for root length, diameter, size, fresh and dry weight respectively, while, the lowest values were 12.77, 1.97, 22.82, 20.61 and 3.30 of the varieties No. 17, 17, 17, 25 and 13 for the root characters, length, diameter, size, fresh weight and dry weight respectively, indicated to the genetic background for the studied varieties.

The results in Table (3) showed that, there were highly significant among the sugar beet varieties for the studied characters, the highest values for number of leaves, fresh weight and leaves dry weight were

26,204 and 56.38 recorded of varieties No. 7,7and 7 during the two seasons respectively, while the lowest values were 13.33, 45.49, 7.44 recorded of varieties 24, 25 and 25 during the two seasons respectively, indicated to the varieties No. 7 and 11 highly response to nutrition elements then increasing the growth rate comparing to other varieties, as well as, could be used as donor for these traits in breeding program or using for cultivation on large scale in early sowing date, but for the varieties No. 17, 17 and 25.

The results in Table (4) showed highly differences among some sugar beet varieties for physiological characters, where the varieties No. 7,7,4,7,1 and 7 recorded the highest values 2.83, 2.40, 1.83, 45.90, 3.17 and 48.11 for chlorophyll A, chlorophyll B, charotain, nitrogen, phosphorous and potassium respectively, but, the varieties No. 17, 17, 15, 3, 17, (9,17) recorded the lowest values 2.00, 1.27, 1.25, 23.09, 2.00, (31.09, 32.09) for mention traits respectively, indicated to these characters were under genetic control and could be used the highest values of these traits as indicator to early maturing of some sugar beet genotypes. these results harmony with those obtained by Abdelaal (2015) he found the root length and diameter, shoot and root fresh weights, TSS, sucrose and purity percentages as well as root and sugar yield/fed were highly response to high concentration of NPK contain.

Table 2. Morphological characters of root for some sugar beet varieties during 2014/2015 and 2015/2016 season.

Treatment	Root length		Root diameter		Root size		Root fresh		Root dry	
	2015 season	2016 season	2015 season	2016 season	2015 season	2016 season	2015 season	2016 season	2015 season	2016 season
1-MAXIMUS	19.03	18.81	4.50	4.90	60.16	60.94	129.37	129.71	26.88	27.08
2-STEEL	30.20	31.62	2.82	2.99	62.29	62.58	94.32	97.21	18.34	19.24
3-NANSY	19.75	22.13	4.06	4.07	41.84	41.81	99.49	126.22	24.31	24.61
4-MONA	18.67	18.71	3.53	3.18	35.14	39.12	85.31	89.63	11.56	12.31
5-LAGON	20.13	20.51	3.89	4.08	59.60	58.87	63.40	80.17	14.37	15.40
6-BETA398	24.76	24.57	4.08	4.70	60.35	62.17	95.47	103.41	16.19	16.73
7-CHARLSTON	20.10	22.41	4.35	4.50	50.44	50.39	200.12	224.45	46.42	50.87
8-MIMONA	18.05	19.02	2.52	2.64	35.52	34.41	43.42	65.51	22.58	20.87
9-BETA394	33.15	34.11	3.48	3.69	41.14	46.15	77.26	81.57	15.72	15.88
10-DRENA	21.70	25.83	4.17	4.29	53.17	54.88	83.70	100.15	16.44	15.99
11-LAMIAA	16.00	14.23	4.17	4.28	32.97	33.31	157.96	160.41	35.70	33.29
12-PLENO	22.82	23.55	3.00	3.28	56.13	57.16	33.76	38.14	6.69	7.41
13-ALAUDA	10.90	11.31	2.55	2.62	40.15	41.74	31.26	31.95	3.86	3.30
14-NEFERTITIS	20.60	23.37	3.32	3.36	58.51	59.01	81.18	84.04	12.55	12.67
15-SALMA	20.38	20.77	4.06	4.07	56.56	57.21	126.21	128.79	21.30	25.22
16-MILASPOLY	16.96	18.20	2.10	2.12	40.29	41.79	80.18	83.88	17.70	18.08
17-CAWAMERA	12.77	13.68	1.97	1.99	22.82	23.31	33.12	35.33	3.39	3.45
18-SAMBA	19.44	21.75	2.36	2.33	45.03	43.64	79.04	89.15	10.75	13.08
19-GLORIUS	19.82	19.92	2.13	2.12	36.81	36.90	152.42	156.18	34.55	32.82
20-ATHOSPOLY	17.29	17.62	2.55	2.52	34.27	34.53	69.76	65.41	8.26	8.87
21-OSCARPOLY	17.20	19.02	2.17	2.15	30.84	36.41	74.24	4.18	11.44	11.23
22-HM16101	20.40	21.80	2.05	2.07	43.70	42.70	59.43	60.14	9.30	9.90
23-HM16584	17.53	18.46	2.08	2.07	25.42	27.33	52.48	51.33	9.57	9.92
24-HM586	24.47	25.06	2.87	2.85	57.48	58.85	60.41	65.81	5.41	5.90
25-DEO32-705	13.99	14.04	3.29	3.25	38.47	40.69	20.61	20.89	4.63	4.00
Means	20.138	20.941	3.123	3.206	45.03	45.581	83.240	89.752	16.318	16.726
LSD 0.05	0.809	1.484	0.331	0.236	3.300	2.171	1.663	1.554	1.021	1.201

Table 3. Morphological characters of leaves for some sugar beet varieties during 2014/2015 and 2015/2016 season.

Treatment	No. of leaves		Fresh weight of leaves		Dry weight of leaves	
	2015 season	2016 season	2015 season	2016 season	2015 season	2016 season
1-MAXIMUS	25.00		164.22	164.24	20.51	21.09
2-STEEL	16.00	24.33	93.14	93.82	16.41	16.40
3-NANSY	17.00	15.33	170.29	170.46	35.39	35.12
4-MONA	16.00	17.00	109.75	109.28	17.16	17.14
5-LAGON	17.66	16.00	103.69	105.63	38.66	38.11
6-BETA398	18.00	17.00	161.69	158.26	23.48	23.36
7-CHARLSTON	25.00	19.00	204.08	200.22	56.38	56.18
8-MIMONA	15.67	26.00	102.96	100.75	15.78	15.15
9-BETA394	24.33	15.00	154.49	152.22	28.21	28.80
10-DRENA	18.00	24.00	131.28	140.19	19.31	19.31
11-LAMIAA	19.00	18.00	188.48	185.28	46.60	46.16
12-PLENO	23.00	19.00	108.16	108.35	16.23	16.68
13-ALAUDA	16.00	22.00	76.27	77.33	9.24	9.59
14-NEFERTITIS	18.33	16.67	125.57	124.83	27.33	28.30
15-SALMA	15.67	18.00	163.09	163.60	20.57	30.26
16-MILASPOLY	17.33	16.00	135.38	139.29	24.42	24.08
17-CAWAMERA	13.33	13.67	71.18	73.79	9.35	9.98
18-SAMBA	14.00	15.00	98.20	100.20	20.56	21.07
19-GLORIUS	15.00	14.67	80.40	83.92	13.71	14.74
20-ATHOSPOLY	14.00	14.00	99.54	100.19	17.58	17.58
21-OSCARPOLY	14.00	14.00	109.24	111.24	20.63	20.47
22-HM16101	15.00	15.00	80.39	84.29	13.90	14.34
23-HM16584	15.33	15.33	85.19	81.36	13.19	13.53
24-HM586	13.33	13.67	122.19	125.79	20.12	20.86
25-DEO32-705	19.00	18.67	45.49	46.15	7.78	7.44
Means	17.413	17.397	119.074	120.027	22.451	22.696
LSD 0.05	2.373	1.420	11.836	1.784	1.500	1.560

Table 4. Phsiological characters of leaves for some sugar beet varieties during 2014/2015 and 2015/2016 season.

Treatment	Cholorophell A		Cholorophell B		Charotain		Nitrogen		Phosphorus		Potassium	
	2015 season	2016 season	2015 season	2016 season	2015 season	2016 season	2015 season	2016 season	2015 season	2016 season	2015 season	2016 season
1-MAXIMUS	2.64	2.68	1.40	1.43	1.35	1.36	30.78	30.91	3.04	3.17	41.09	41.19
2-STEEL	2.21	2.20	1.64	1.70	1.63	1.65	30.69	30.76	2.65	2.68	42.01	42.15
3-NANSY	2.28	2.33	1.33	1.39	1.68	1.66	21.74	21.86	2.70	2.74	46.01	46.18
4-MONA	2.35	2.38	1.88	1.82	1.73	1.83	23.64	23.70	2.29	2.35	42.00	42.14
5-LAGON	2.09	2.20	1.58	1.65	1.31	1.39	24.24	24.29	2.05	2.15	33.00	33.13
6-BETA398	2.26	2.29	1.60	1.68	1.60	1.60	26.01	26.16	2.69	2.75	35.25	35.35
7-CHARLSTON	2.83	2.80	2.37	2.40	1.74	1.78	45.84	45.90	2.89	2.95	47.89	48.11
8-MIMONA	2.30	2.25	1.69	1.73	1.32	1.38	27.09	27.20	2.80	2.83	43.06	43.15
9-BETA394	2.15	2.13	1.65	1.68	1.50	1.59	30.75	30.83	2.15	2.19	31.09	31.16
10-DRENA	2.03	2.16	1.71	1.75	1.61	1.65	29.59	29.69	2.40	2.47	32.15	32.24
11-LAMIAA	2.29	2.34	1.89	1.90	1.73	1.78	31.09	31.15	2.60	2.65	33.75	33.80
12-PLENO	2.05	2.07	1.35	1.40	1.29	1.35	32.30	32.35	2.59	2.64	42.99	42.08
13-ALAUDA	2.25	2.33	1.61	1.65	1.28	1.30	27.09	27.20	2.69	2.75	46.04	46.15
14-NEFERTITIS	2.12	2.15	1.79	1.84	1.46	1.45	36.07	36.19	3.06	3.14	43.65	43.74
15-SALMA	2.25	2.24	1.50	1.56	1.20	1.25	38.20	38.27	3.00	3.09	42.84	42.90
16-MILASPOLY	2.95	2.99	1.64	1.65	1.27	1.34	24.84	24.89	2.05	2.14	39.16	39.25
17-CAWAMERA	2.00	2.09	1.27	1.29	1.25	1.31	23.09	23.16	2.00	2.09	32.09	32.15
18-SAMBA	2.70	2.69	1.38	1.40	1.35	1.39	25.10	25.20	2.57	2.62	45.07	45.25
19-GLORIUS	2.00	2.09	1.65	1.69	1.35	1.39	28.65	28.75	2.89	2.51	36.69	36.74
20-ATHOSPOLY	2.08	2.15	1.27	1.29	1.42	1.45	29.79	29.86	2.85	2.89	35.16	35.25
21-OSCARPOLY	2.35	2.39	1.35	1.39	1.25	1.28	24.07	24.17	2.70	2.75	38.74	38.89
22-HM16101	2.33	2.32	1.72	1.73	1.56	1.62	30.10	30.20	3.02	3.10	33.09	33.21
23-HM16584	2.18	2.16	1.51	1.55	1.31	1.34	24.09	24.87	2.10	2.17	40.06	40.20
24-HM586	2.21	2.21	1.68	1.74	1.37	1.45	27.24	27.29	2.81	2.87	42.72	42.78
25-DEO32-705	2.02	2.11	1.68	1.78	1.49	1.54	28.09	28.20	2.25	2.29	38.23	38.30
Means	2.318	2.336	1.625	1.661	1.421	1.464	28.808	28.094	2.594	2.651	38.832	38.94
LSD 0.05	0.265	0.060	0.038	0.070	0.033	0.156	11.379	0.071	0.035	0.058	0.331	0.049

The data in Table (5) showed, the highly differences among sugar beet genotypes were found for yield and quality characters where, the highest values were 21.05, 86.17, 6.17, (2.96,2.93), 5.55, and 26.20 recorded for sugar, quality, potassium, sodium α amino nitrogen and T. S. S of the varieties No. 7, (7, 11), 7,, (7, 16), 10 and 7respectively as shown in Table (5), while, the lowest values were 18.2, 79.49, 4.53, 1.84, 3.07 and 19.23 recorded for the mention traits of the varieties No. 25, 25, 17, 17, 7 and 17 respectively, indicated to the sugar value ranged from 18.2 to 21.05 % and could be classification, first one, high sugar concentration more than 20 %, second one which ranged from 19-20 %, the third one less than 18 %, for T S S, could be classifications these genotypes to, first one highest value which more than 24 % for example No. 7 Charleston variety , second one which ranged from 20-24% for example No. 19 Glorious variety and third one was less than 20 % for example No. 17 Cawamera variety. The adversely relationship between α amino nitrogen coefficient alkalinity may be due to the decreasing of (K+Na) content in the root juice results are in line with those obtained by (El-Maghraby 1981), (Abo Elghait 1993), (Attia 1999) and (El Emery2004)on sugar beet plants,

Table 5. Yield and quality characters of roots for some sugar beet varieties during 2014/2015 and 2015/2016 season.

Treatment	Sugar (%)		Quality (%)		Potassium (%)		Sodium (%)		α Amino nitrogen		T.S.S (%)	
	2015 season	2016 season	2015 season	2016 season	2015 season	2016 season	2015 season	2016 season	2015 season	2016 season	2015 season	2016 season
1-MAXIMUS	19.49	19.78	84.98	84.65	5.92	5.97	2.76	2.78	4.35	4.36	23.10	22.35
2-STEEL	19.02	19.52	84.10	83.00	5.49	5.58	1.90	2.44	4.58	4.67	24.52	24.09
3-NANSY	20.51	20.64	83.63	85.74	5.55	5.71	2.19	2.17	4.47	4.46	23.71	23.27
4-MONA	20.75	20.04	84.00	85.43	5.62	5.52	2.20	1.98	3.46	3.58	20.60	20.89
5-LAGON	20.57	20.04	83.54	85.75	5.72	5.85	2.46	2.30	4.30	4.12	19.71	21.00
6-BETA398	19.90	19.80	81.65	83.16	5.97	5.87	2.19	2.08	4.86	4.73	21.02	20.16
7-CHARLSTON	21.02	21.05	85.74	86.17	6.17	6.12	2.96	2.63	3.13	3.07	26.13	26.20
8-MIMONA	19.47	20.29	83.62	82.67	5.66	5.78	2.27	2.04	4.01	4.17	24.51	24.00
9-BETA394	20.01	19.68	85.43	85.69	5.16	4.99	2.20	1.97	3.85	3.12	20.28	19.69
10-DRENA	19.87	19.60	82.67	83.62	5.41	5.42	2.30	2.48	5.50	5.55	23.74	23.90
11-LAMIAA	20.33	20.43	85.57	86.17	5.50	5.36	2.44	1.86	4.62	4.66	23.27	23.70
12-PLENO	18.49	18.60	81.17	83.71	5.60	5.49	2.43	1.93	5.15	5.27	20.32	21.22
13-ALAUDA	19.33	19.26	85.69	85.07	5.14	5.19	2.01	2.20	3.56	3.64	23.56	23.83
14-NEFERTITIS	18.53	18.96	83.71	83.17	5.66	5.59	2.16	2.65	4.38	4.93	19.68	20.23
15-SALMA	20.17	20.29	85.67	85.75	5.82	5.92	2.28	2.20	3.77	3.71	21.87	20.53
16-MILASPOLY	18.03	18.95	83.82	84.12	5.69	5.61	2.93	1.96	4.92	4.74	23.96	24.84
17-CAWAMERA	18.36	19.48	80.77	79.82	4.53	4.65	2.05	1.84	5.28	5.18	19.88	19.23
18-SAMBA	20.14	18.55	86.06	85.57	4.79	5.63	2.68	2.51	3.47	3.68	24.95	24.10
19-GLORIUS	19.05	19.90	83.67	83.54	5.21	5.27	2.19	2.46	3.63	3.83	23.42	23.03
20-ATHOSPOLY	19.10	19.57	84.80	85.31	5.15	5.11	2.16	1.93	3.24	3.02	24.01	23.83
21-OSCARPOLY	20.55	20.70	80.80	81.17	4.89	4.84	2.00	1.97	5.30	5.00	22.75	23.90
22-HM16101	20.53	20.86	83.17	83.63	5.67	5.82	2.09	2.30	4.43	4.68	23.43	24.25
23-HM16584	19.78	19.87	84.31	85.10	5.32	5.29	1.90	2.10	4.68	4.30	24.04	24.32
24-HM586	20.15	20.77	86.75	85.76	5.37	5.47	2.19	2.05	3.44	3.71	22.10	22.40
25-DEO32-705	18.20	18.24	79.49	79.87	5.18	5.89	1.89	2.23	4.64	4.99	23.98	23.33
Means	19.654	19.795	84.153	84.166	5.454	5.527	2.269	2.202	4.210	4.303	22.773	22.785
LSD 0.05	0.463	0.454	1.611	1.461	0.351	0.250	0.180	0.101	0.673	0.767	1.292	0.724

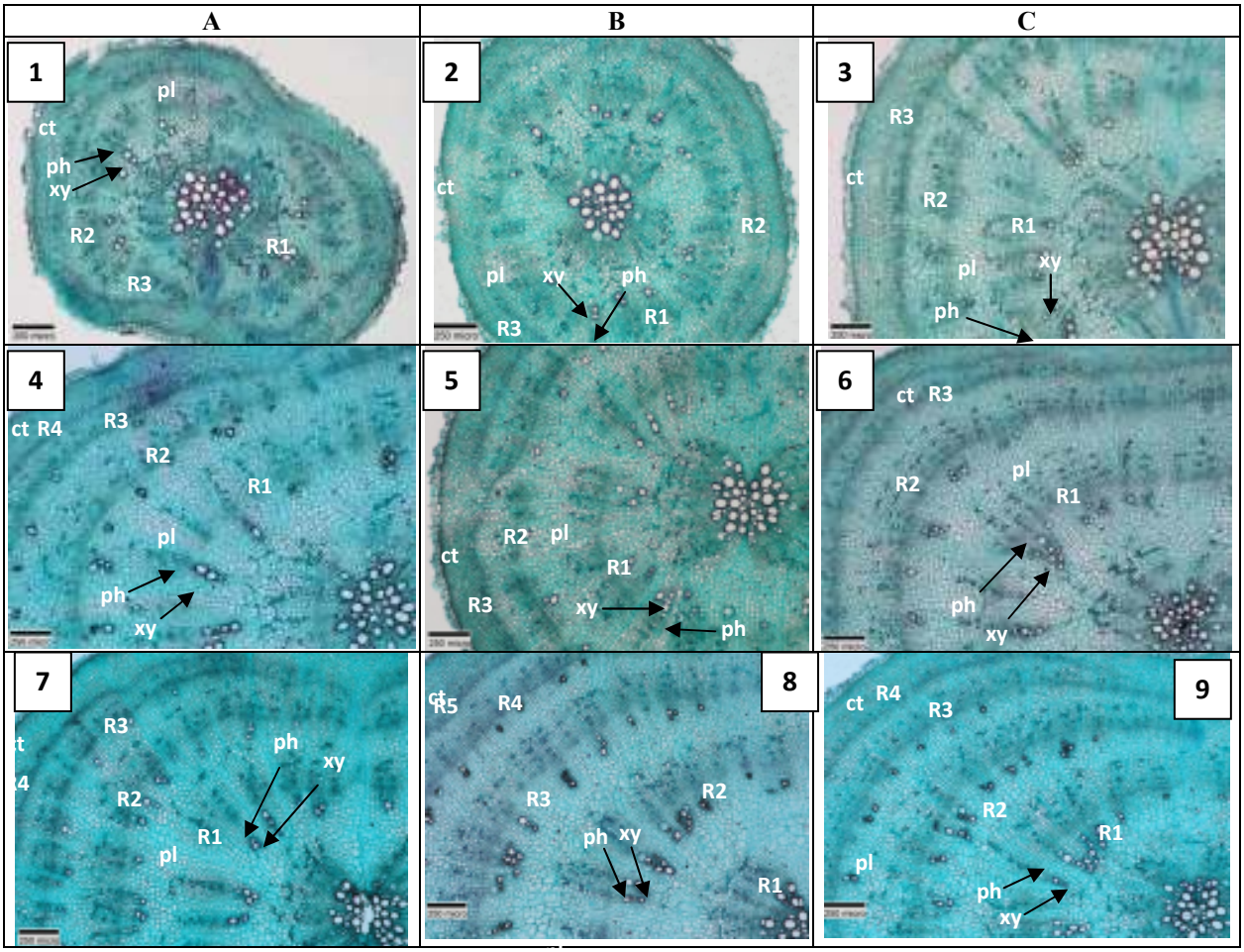

Fig. 1. Root cross sections of three sugar beet varieties; A (Glorious), B (charlestn) and C (cawamera) during 1-2-3 (25 days from swing), 4-5-6 (40 days from swing) and 7-8-9 (55 days from swing), (ct: cortex tissue, vb: vascular bundles, pl: parenchyma layer, R1: supernumerary cambium ring No. 1, R2: supernumerary cambium ring No. 2, R3: supernumerary cambium ring No. 3, R4: supernumerary cambium ring No. 4, R5: supernumerary cambium ring No. 5, ph: phloem tissue, xy: xylem tissue).

The data in Table (6) and fig (1) showed that the desirable values for Ø of root, thickness of bundles, parenchyma layer, vessels and growth rings were recorded of variety Charleston, respectively, undesirable values for the mention characters were recorded of the variety Cawamera respectively. At the same time, the data in (Table 6 and fig 1) recorded moderate values with Glorius variety for the mention characters of root with, indicated to there were are highly differences among the sugar beet varieties and could be classification the studied genotypes to three classes on the basis the anatomical characters to categories in three sowing dates. Moreover the parenchyma tous zone(layer) have been considered to be derived from proliferating phloem and ray parenchyma (Hayward 1988). The diameter increased as the results of increase in number of ring s and thickness of parenchyma zone of root, (El Emery 2004) and (Abdelaal 2015) showed that anatomical characters of root such as root diameter,

Table 6. Anatomical characters of roots for some sugar beet Glorious, Charleston and Cawamera varieties during 2015 season.

Treatments	Anatomical characters								
	Ø of root	Thickness of bundle	Parenchyma layer	Ø of big xylem vessels	Epidermis	Cortex	Ø of V. C	Vessels	No. of growth rings
Cawamera	1956.72c	424.14 b	516.99 c	39.98 a	30.14 c	131.2 a	97.55 a	65.18b	4.00b
Charlston	3125.1 a	545.44 a	806.58 a	28.18 b	40.42 b	100.4 b	49.52 b	77.23a	5.00a
Glorius	2298.6 b	573.57 a	611.46 b	22.69 b	54.42 a	72.03 c	22.14 c	72.53ab	4.00b
Means	2460.19	514.38	645.01	71.65	41.66	101.24	56.41	30.28	4.33
LSD 0.05	153.17	40.21	54.12	6.07	2.74	10.73	6.02	7.54	0.52

For correlation coefficient, there were positive and significant correlation between root length and each of No. of leaves and weight of fresh leaves, as well as there were highly positive and significant correlation between root diameter and each of No. of leaves, fresh leaves and fresh leaves weight. For root size was positively correlated with no leaves and dry weight, moreover the correlation coefficient between root fresh and dry weight were positively and significant with each of No. of leaves, fresh and dry weight for leaves indicated to the fresh and dry leavesweight were highly affected on root characters that referred to the role of

leaves in photosynthesis and accumulated minerals elements in the root as shown in Table (7).

The data in Table (8) showed there were positively correlation for root length anddiameter with charotain and nitrogen content, moreover, root size was positively correlated with each of nitrogen, phosphorus and potassium, as well as,their were positive correlation between root fresh and dry with chlorophyll A, Nitrogen and phosphorus content, indicated to the chlorophyll A and phosphorus played important role in increase the growth rate for root sugar beet.

Table 7. Simple correlation coefficient between root characters and morphological characters of the combined data for the two seasons.

Characters	No of leaves	Fresh leaves weight	Dry leaves weight
Root length	0.297**	0.313**	0.219
Root diameter	0.478**	0.525**	0.389**
Root size	0.300**	0.310**	0.217
Root fresh	0.479**	0.729**	0.726**
Root dry	0.509**	0.691**	0.708**

Table 8. Simple correlation coefficient between root characters and physiological characters of the combined data for the two seasons.

Characters	Chlorophyll A	Chlorophyll B	Charotain	Nitrogen (N)	Phosphorus (P)	Potassium (K)
Root length	-0.113	0.107	0.443**	0.339**	0.088	-0.147
Root diameter	-0.063	-0.015	0.345**	0.126	0.212	-0.027
Root size	-0.555	-0.075	0.212	0.363**	0.320**	0.231*
Root fresh	0.483	0.038	0.263*	0.384**	0.346**	0.090
Root dry	0.484	0.049	0.211	0.396**	0.315**	-0.077

The root length and diameter positively correlated with sugar % , potassium and sodium %, on the other side, negatively correlated with T S S, also, The root size was positively correlated with potassium % and sodium %, moreover, the root fresh and dry weight were positively correlated with sugar %, potassium, sodium and quality %, on the other hand, negatively and significant correlated with T.S.S., indicated to the increase root fresh and dry weight was consider as indicator to increase the sugar accumulation.These results are confirm with (Benati and Bentini 1990) who recorded that the proportion of roots of larger diameter tended to be greater in the high yielding of root and sugar. The proportion of root collar increased with increasing root diameter, as shown in Table (9).

Table 9. Simple correlation coefficient between root characters and yield and quality characters of the combined data for the two seasons.

Characters	Sugar (%)	Quality (%)	Potassium(%)	Sodium (%)	α amino nitrogen	T.S.S (%)
Root length	0.132	0.124	0.118	0.123	-0.076	-0.320**
Root diameter	0.270*	-0.008	0.406**	0.340**	0.056	-0.407**
Root size	-0.031	0.157	0.497**	0.452**	0.089	-0.211
Root fresh	0.452**	0.420**	0.322**	0.574**	-0.254*	-0.352**
Root dry	0.305**	0.236*	0.374**	0.572**	-0.195	-0.247*

The data in Table (10) showed positive correlations coefficient between root length and each of Epidermis and cortex, also, there were positive and significant correlation between root diameter and size with diameter of root, parenchyma and diameter of big xylem and number of growth rings. Moreover the correlation between root fresh and dry weight were positively and significant with parenchyma layer and number growth rings, indicated to the important role of parenchyma layer and number of growth rings for increase the size and weight of sugar beet root. Similar results was obtained with those of (El-Emery 2004)on sugar beet.

Table 10. Simple correlation coefficient between root characters and anatomical characters ofrootduring 205/2016 season.

Characters	Ø of root(µ)	Thickness of bundle (µ)	Paranchyma layer (µ)	Ø of big xylem vessels	Epidermis (µ)	Cortex (µ)	Ø of V. C (µ)	Ø of Vessels (µ)	No. of growth rings
Root length	0.379	-0.580	0.345	0.029	0.819**	0.74*	0.663	0.606	0.631
Root diameter	0.959**	0.345	0.941**	0.698*	-0.076	-0.035	-0.169	-0.212	0.999**
Root size	0.925**	0.329	0.901**	0.699*	-0.090	0.040	-0.153	-0.220	0.954**
Root fresh	0.615	-0.263	0.582	0.264	-0.644	0.553	0.443	0.384	0.816**
Root dry	0.597	-0.283	0.566	0.243	-0.660	0.570	0.462	0.450	0.803**

CONCLUSION

The relationships between root dry weight with fresh and dry weight of leaves, chlorophyll A, phosphorus , sugar %, quality%, sodium content, diameter of xylem vessels and thickness of parenchyma layer in the root and growth rings were positively correlated .So, these results are important as taxonomic evidences of sugar beet varieties.It proposed to classified them to three groups, the first one include the varieties charlston, Lamiaa, Nefertitis, Salma, Beta 398, Beta 394, Samba and HM586 as earlier.The second one are MAXIMUS, STEEL, NANSY ,MONA ,LAGON , MIMONA , DRENA, GLORIUS, ATHOSPOLY and HM16101 as medium, and the third one were Cawamera, Milaspoly, DEO32-705, HM16584, Oscarpoly, Alauda, and Pleno, as later for sowing date .Moreover, it may be useful for understanding the mechanisms of sugar content with dry weight, thickness of parenchyma layer, growth rings of the root and sowing date and maturity of these varieties under the same conditions.

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الخصائص النباتية لبعض أصناف بنجر السكر (دراسة مقارنة)

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أجريت تجربة أصص فى قطاعات كاملة العشوائية فى خمس مكررات في المزرعة البحثية بمحطة البحوث الزراعية بسخا شمال الدلتا- مصر خلال موسمي شتاء 2015/2014 و 2016/2015 وذلك لدراسة الخصائص النباتية (المورفولوجية والفسيولوجية والمحصول والجودة لخمسة وعشرون صنف من بنجر السكر كما تم دراسة الخصائص التشريحية لبعض أصناف منها لتوضيح العلاقات المتبادلة بين الخصائص النباتية السابقة مع الخصائص التشريحية لتلك الأصناف. أظهرت النتائج المتحصل عليها من التجربة أن الصفات المورفولوجية والفسيولوجية للجذور والاوراق مثل (طول وقطر وحجم الجذور والوزن الطازج والجاف للجذور والاوراق وعدد الاوراق) قد سجلت أعلي القيم مع الأصناف Cawamera, Milaspoly, Charlston{وبخاصة الصنف Charlston, Lamiaa, Nefertitis, Salma and Beta 398 ، بينما أعطت الأصناف DEO32-705, HM16584 and Oscarpoly أقل القيم لتلك الصفات وبخاصة Cawamera, HM16584 and Milaspoly أما الخصائص الفسيولوجيةمثل (الكلوروفيلات والعناصر المعدنية الكبري بالاوراق) فقد تبين أن الأصناف Maximus and Charlston قد أعطت أعلي القيم المتحصل عليها في حين سجلت الأصناف , Alauda Charlston, Beta 394, Lamiaa, Salma, Samba and Cawamera and Milaspoly أقل القيم المدروسة لهذه الخصائص. في الوقت نفسه قد حققت الأصناف HM586 أعلي إنتاجية في المحصول والجودة للجذور لصفات (السكروز والجودة والبوتاسيوم والصوديوم والنيتروجين الأميني وكذلك المواد الصلبة الذائبة الكلية) وبخاصة الصنف Charlston وذلك مقارنة بالأصناف Pleno, HM16584, Cawamera, and Milaspoly قد سجلت أقل القيم في الانتاجية والجودة علي التوالي. ومن الدراسة التشريحيةلجذور الاصناف الثلاثة الاتية Charlston, Glorius and Cawamera وهي (قطر الجذر و سمك الحزمة الوعائية و سمك طبقة البارنشيما واتساع أوعية الخشب التالي و طبقة البشرة والقشرة والاوعية وكذلك حلقات النمو)فبأعلي القيم لهذه الصفات التشريحية قد سجل مع الصنف Charlston مقارنة بالصنف Cawamera الذي أظهر أقل الخصائص التشريحية لتلك الصفات. وأخيرا ومن خلال الدراسة تؤكد العلاقات المتبادلة بين الوزن الجاف للجذور مع الوزن الطازج والجاف للأوراق وكذلك محتوها من الكلوروفيل أ والفوسفور ومحتوي الجذور من السكروز والجودة والصوديوم وسمك طبقة البارنشيما وعدد حلقات النمو للجذور أنها كانت علاقات موجبة، لذلك فأن أهمية هذة النتائج تكمن فى أنة يمكن الأستفادة بها كدلائل تصنيفية لأصناف بنجر السكر الى ثلاث مجموعات :-المجموعة الاوليتضم أصناف charlston, Lamiaa, Nefertitis, Salma, MAXIMUS, STEEL, NANSY ,MONA ,LAGON المجموعة الثانية تضم أصناف (علي أنها أصناف مبكرة)، Beta 398, Beta 394, Samba and HM586 Cawamera, Milaspoly, (علي أنها متوسطة) المجموعة الثالثة تضم أصناف , MIMONA , DRENA, GLORIUS, ATHOSPOLY and HM16101 DEO32-705, HM16584, Oscarpoly, Alauda, and Pleno(علي أنها متأخرة)،وكذلك فهم ميكانيكية الربط بين تخزين السكر والوزن الجاف وسمك طبقة البارنشيما وعدد حلقات النمو فى الجذور مع مواعيد الزراعة والحصاد لتلك الأصناف تحت نفس ظروف الدراسة