Zagazig J. Agric. Res., Vol. 37 No. (3) 2010

BIOCHEMICAL CHANGES FOR SOME SUGAR BEET GENOTYPES IN RELATION TO YIELD AND YIELD COMPONENTS UNDER RAS SUDR CONDITIONS

Mohamed, H. Hendawey[1*] and A.E. Atia[2]

1. Biochemistry Unit-Plant Genetic Resources Department. Desert Research Center, Matarya, Cairo, Egypt.

2. Sugar Crops Research Institute. Agriculture Research Center, Giza, Egypt.

ABSTRACT

Biochemical changes for fifteen sugar beet genotypes (Pleno, Gazela, H-Poly1, Oscar poly, Toro , Kawemera, Disprerez PolyN, Demapoly, Farida, Karola, Negma, Baraka, Gloria, Top and Chems) in relation to yield and its components were studied during 2007/2008 and 2008/2009 seasons under saline conditions at Ras Sudr, Sourth Sinai. Sugar beet genotypes greatly varied in their ability to grow and subsequently to assimilate and translocate biochemical components. Pleno and Gazela surpassed the other genotypes in root diameter, root weight and root yield. Oscar poly and Pleno genotypes recorded the highest mean values for sugar yield, followed by Gazela genotype in a descending order. These findings associated with the highest values of some biochemical constituents such as photosynthetic pigments, proline, soluble protein, RNA and decreased in malondialdehyde content as compared with the other genotypes. Impurities content and sucrose% were affected by genotypes and salinity. This study is showing that sugar beet genotypes such as Pleno, Gazela as well as Oscar poly were highest in their productivity and salt tolerance, also studied biomarkers are benefit to determine best inducers against sensitivity to salinity.

Key words: Sugar beet genotypes, salt tolerance, yield, biochemical constituents, impurities, quality.

[*] Corresponding author : Mohamed H. Hendawey , Te.: +20102684666
E-mail address: mhhendawey@yahoo.com

INTRODUCTION

Sugar beet has been introduced in Egypt as a new sugar crop where considered as one of two important sugar crops in the world. Sugar beet plays an important role in decreasing the gab between sugar consumption and production. So, there has been an urgent need to raise sugar beet in newly reclaimed lands out of the Nile Valley and Delta, such as Wadi Sudr in south of Sinai. While, irrigation in this region depends mostly on under ground water. Also, the soil of Wadi Sudr showed to be saline and highly calcareous.

Salinity affects almost all aspects of plant development, including germination, vegetative growth and reproductive development. Salinity affects photosynthesis mainly through a reduction in leaf areas, chlorophyll content and stomatal conductance, and to a lesser extent through a decrease in photosystem II efficiency (Netondo *et al*., 2004). Soil salinity imposes ion toxicity, osmotic stress, nutrient (Na, Ca, K, P, Fe and Zn) deficiency and oxidative stress on plants as well as indirectly limits plant productivity through its adverse effects on the growth of beneficial and symbiotic microbes. High salt concentrations in soil impose osmotic stress and thus limit water uptake from soil. Sodium accumulation in cell walls can rapidly lead to osmotic stress and cell death (Munns 2002). Ion toxicity is the result of replacement of K by Na in biochemical reactions, and Na and Cl induced conformational changes in proteins. For several enzymes, K acts as cofactor and cannot be substituted by Na. High concentration of K is also required for binding tRNA to ribosomes and thus protein synthesis (Zhu 2004 and Tester and Davenport 2003). Ion toxicity and osmotic stress cause metabolic imbalance, which in turn leads to oxidative stress (Hernandez *et al*., 2001). The trends and magnitude of these changes varied according to salinity level as well as the cultivated variety. In this regard, Marschner (1995) indicated that sugar beet is highly tolerant to salinity during most of its cycle but sensitive during germination. Also, Hajiboland and Joudmand (2009) reported that sugar beet is one crop species grown mainly on salinity-affected soils.

This work was carried out to investigate the biochemical changes for some sugar beet

genotypes in relation to yield and yield components under saline conditions at Ras Sudr, South Sinai.

MATERIALS AND METHODS

Field Experiments

Two field experiments were carried out during 2007/2008 and 2008/2009 seasons at Agricultural Experimental Station of Desert Research Center (DRC) located in Ras Sudr, South Sinai Governorate, to study the biochemical changes for some sugar beet genotypes in relation to yield and yield components. Table 1 shows some mechanical and chemical properties of the experimental soil and chemical analysis of underground irrigation water at Ras Sudr, South Sinai. Seeds of all sugar beet genotypes (Pleno, Gazela, H-Poly1, Oscar poly, Toro, Kawemera, Disprerez PolyN, Demapoly, Farida, Karola, Negma, Baraka, Gloria, Top and Chems) were obtained from Agricultural Research Center and planted in hills distanced at 20 cm apart. Sowing dates were on November. Calcium superphosphate (15.5% P_2O_5) at the rate of 100 kg/fad was applied during tillage operations. Potassium sulphate (48% K_2O) at rate of 50 kg/fad was added before the first irrigation, while ammonium nitrate (33.5% N) at the rate of 70 kg N/fad was added in two equal doses at 45 and 60 days from sowing date, respectively. Two samples were taken; the first one was at 85 days after sowing to determine photosynthetic pigments, malondialdehyde, free proline, soluble protein and ribonucleic acids (RNA) in fresh materials. While, minerals content was determined in oven dry materials. The second sample was taken at harvesting (after 180 days from sowing) to determine the yield and yield components such as root length (cm.), root diameter (cm.), root weight (kg), top weight (Kg), root yield (ton/fad.), sugar yield (ton/fad.) and quality of sugar beet roots.

Methods of Analysis

Photosynthetic Pigments

Chlorophyll a, chlorophyll b and carotenoids were determined according to A.O.A.C. (1990).

Free Proline Content

Free proline concentration was measured colorimetrically in the extraction of fresh materials according to Bates *et al*. (1973).

Table 1. Mechanical and chemical analysis of the experimental soil and chemical analysis of irrigation water at Ras Sudr, South Sinai

a) Mechanical analysis of the experimental soil.	
Characters	Values
Total sand (%)	85.17
Clay (%)	8.11
Silt (%)	6.72
Texture class	Sandy loam
b) Chemical analysis of the experimental soil.	
Characters	Values
pH	7.81
E.C. (mmhos/cm)	7.12
Soluble cations (meq/L)	
Ca^{++}	34.06
Mg^{++}	14.18
Na^{+}	60.33
K^{+}	1.02
Soluble anions (meq/L)	
$CO_3^{=}$	-----
HCO_3^{-}	1.74
Cl^{-}	57.88
$SO_4^{=}$	49.97
c) Chemical analysis of irrigation water.	
Characters	Values
pH	7.1
E.C. (mmhos/cm)	7.00
Soluble cations (meq/L)	
Ca^{++}	12.51
Mg^{++}	8.19
Na^{+}	45.46
K^{+}	0.201
Soluble anions (meq/L)	
$CO_3^{=}$	------
HCO_3^{-}	2.02
Cl^{-}	36.58
$SO_4^{=}$	27.14

Soluble Protein Content

Soluble protein content of sugar beet was determined according to Lowry *et al.* (1951).

Malondialdehyde Content (MDA)

Malondialdehyde content was determined as outlined by Zhao *et al*. (1994).

Nucleic Acids Content

Ribonucleic acids (RNA) were extracted from fresh leaves and roots of sugar beet genotypes. RNA was separated and determined according to Cherry (1973).

Minerals Content

Sodium and potassium were measured by using the flame photometer model Perkin Elmer PEP7 according to Allen (1974) and Brown and Lilliand (1964). Phosphorus was determined according to Murphy and Riley (1962).

Alpha Amino Nitrogen

Alpha amino nitrogen was determined using hydrogenation method according to Carruthers *et al.* (1962).

Soluble Sugars Content

The concentration of reducing sugars was determined according to Bernfeld (1955) and Miller (1959).

Sucrose Percentage

Sucrose percentage was determined using saccarimeter according to the procedure outlined by Le-Docte (1927).

Purity Percentage

Purity percentage [Purity **%** = 99.36 - 14.27 (Na + K + α amino N) / Sucrose %] was calculated according to Devillers (1988).

Sugar Lost to Molasses Percentage (S.M. %.)

Sugar lost to molasses was calculated using the following equation: [S.M.% =0.14 (Na + K) + 0.25 (α amino N) + 0.50] according to Devillers (1988).

Extractable Sugar Percentage

Extractable sugar percentage (Sugar extraction % = Sucrose % - SM – 0.6) was calculated according to Dexter *et al*. (1967).

Extractability Percentage

Extractability percentage was calculated using the following equation: (Extractability % = Sugar extraction / Sucrose %) according to Dexter *et al*. (1967).

Statistical Analysis

Data were analyzed statistically according to the procedure

outlined by Snedecor and Cochran (1967). Combined analysis over growing seasons was done when the homogeneity test was insignificant according to Gomez and Gomez (1984). Duncan's multiple range test was used for the comparison between means (Duncan 1955).

RESULTS AND DISCUSSION

Yield and Yield Components

From the data presented in Table 2 it's clear that the differences between sugar beet genotypes in root length (cm.) are not significant. However, Pleno and Gazela genotypes have a higher root diameter (cm.) and root weight (kg) than other sugar beet genotypes. While, the lowest value of root diameter and root weight was produced from Gloria and Negma, respectively. It is quite clear from data that Gazela and Demapoly exceeded the other genotypes in top weight (Kg), while Disprerez PolyN genotype recorded the minimum value under the same conditions. In addition, Pleno and Gazela were the best genotypes and recorded the maximum values for root yield (ton/fad.) which reached 30.61 and 29.90 (ton/fad.), respectively. On the other hand, the lowest value of such parameter was achieved by Chems followed by Top genotype. Generally, the economic value of sugar beet genotypes is dependent on its sucrose content or sugar yield. In this respect, Oscar poly and Pleno genotypes recorded the highest mean values for sugar yield which reached 5.21 and 5.19 (ton/fad.), respectively, followed by Gazela (5.04 ton/fad.) in a descending order. Meanwhile, Chems and Top genotypes showed an opposite trend. It could be concluded that the superiority of Pleno and Gazela in yield and yield components may be due to the increase in some biochemical constituents under saline stress such as photosynthetic pigments (Table 3).

The effect of salinity on yield and yield components was noticed by many investigators such as Mekki and El-Gazzar (1999) they showed that moderate salt concentration (2500 ppm) gave the highest fresh root yield, root diameter and whole plant dry weight. However, Kandil *et al*. (2001) found that root yield, root length and diameter, top height, dry weights of top and root, as well as the total dry weight of whole sugarbeet were significantly decreased

Table 2. Yield and yield components of some sugar beet genotypes as affected by saline conditions at Ras Sudr, South Sinai (at harvesting 180 days from sowing)

Genotypes	Root length (cm.)	Root diameter (cm.)	Root weight (kg)	Top weight (Kg)	Root yield (ton/fad.)	*Sugar yield (ton/fad.)
Gazela	31.15 a	16.00 ab	1.208 ab	0.336 a	29.90 ab	5.04 ab
Pleno	27.73 a	16.35 a	1.296 a	0.324 ab	30.61 a	5.19 a
Negma	27.60 a	12.67 gh	0.653 g	0.284 cd	22.45 de	4.12 de
Farida	27.75 a	12.75 gh	0.738 fg	0.299 bc	22.99 de	4.09 de
Chems	27.83 a	13.57 e-h	0.669 g	0.276 cd	18.73 f	3.33 f
Top	28.50 a	15.18 a-d	0.796 e-g	0.259 de	19.66 f	3.59 f
Oscar poly	28.92 a	14.10 d-g	0.986 cd	0.231 e	28.49 a-c	5.21 a
H-Poly1	30.08 a	15.27 a-d	1.060 bc	0.233 e	28.76 a-c	4.71 bc
Baraka	30.50 a	14.27 c-f	0.957 c-e	0.321 ab	21.93 de	4.05 de
Karola	28.08 a	13.20 f-h	0.808 d-g	0.287 cd	22.52 de	4.13 de
Disprerez PolyN	28.08 a	14.75 b-e	0.908 c-f	0.201 f	24.15 d	4.29 cd
Kawemera	29.58 a	14.48 c-f	0.974 c-e	0.241 e	27.40 c	4.81 ab
Gloria	29.75 a	12.37 h	0.810 d-g	0.300 bc	20.80 ef	3.78 ef
Demapoly	29.08 a	13.38 e-h	0.955 c-e	0.336 a	23.01 de	4.29 cd
Toro	29.25 a	15.65 a-c	0.948 c-e	0.240 e	28.30 bc	4.60 bc

Values followed by the same letter (s) are not significantly different at $p < 0.05$.

*Theoretical sugar yield = root yield x sucrose%

Table 3. Concentration of photosynthetic pigments in leaves of some sugar beet genotypes as affected by saline conditions at Ras Sudr, South Sinai (at 85 days from sowing)

Genotypes	Photosynthetic pigments (mg/100 g fresh wt.)						
	Chlorophyll (a)	Chlorophyll (b)	Chlorophyll (a+b)	Chlorophyll (a/b)	Carotenoids	(a+b) /car	Total pigments
Gazela	70.11 a	27.43 bc	97.54 ab	2.55 c-e	23.09 bc	4.22 ab	120.63 a
Pleno	75.31 a	26.70 cd	102.01 a	2.82 bc	23.30 bc	4.37 a	125.31 a
Negma	49.43 d-f	25.99 c-e	75.42 d-f	1.90 ij	24.91 a-c	3.02 e-g	100.33 cd
Farida	51.93 c-e	18.08 g	70.01 e-h	2.87 b	24.83 a-c	2.81 f-h	94.84 d
Chems	40.07 g	14.59 h	54.66 i	2.74 b-d	22.88 c	2.38 h	77.54 e
Top	44.20 fg	21.38 f	65.58 gh	2.06 g-i	26.70 a	2.45 h	92.28 d
Oscar poly	58.78 bc	36.18 a	94.96 a-c	1.62 j	24.69 a-c	3.84 b-d	119.65 a
H-Poly1	59.61 b	36.09 a	95.70 a-c	1.65 j	24.54 a-c	3.89 a-d	120.24 a
Baraka	50.45 d-f	22.56 f	73.01 d-g	2.23 f-h	23.36 bc	3.12 ef	96.37 d
Karola	49.68 d-f	18.32 g	68.00 f-h	2.71 b-d	23.68 bc	2.87 f-h	91.68 d
Disprerez PolyN	59.63 b	29.82 b	89.45 c	1.99 hi	24.53 a-c	3.64 cd	113.98 a-c
Kawemera	61.03 b	18.14 g	79.17 d	3.36 a	23.06 bc	3.43 de	102.23 b-d
Gloria	45.79 e-g	18.36 g	64.15 h	2.49 d-f	24.87 a-c	2.57 gh	89.02 de
Demapoly	53.93 b-d	23.32 ef	77.25 de	2.31 e-g	25.43 ab	3.03 e-g	102.68 b-d
Toro	68.79 a	23.60 d-f	92.39 bc	2.91 b	23.22 bc	3.97 a-c	115.61 ab

Values followed by the same letter (s) are not significantly different at $p < 0.05$.

by increasing the level of chloride salinization in irrigation water up to 6000 ppm. Also, Fotouhi *et al*. (2006) reported that salinity stress caused 77 and 36% decrease in root yield and white sugar yield, respectively. In addition, Orabi and Mekki (2008) indicated that increasing of salt concentration in irrigation water decreased the root length, diameter and fresh and dry weight of sugar beet. In another study, Ebrahimian *et al.* (2008) found that the most proper level for evaluating sugar beet genotypes in field conditions was 12 ds/m.

The reduction of sugar beet root yield under salinization is caused by inhibition of photosynthesis or nutrient deficiency or by mineral toxicity. In this regard, Brugnoli and Bjorkman (1992) reported that the lowering of conductance to CO_2 diffusion caused by stomatal closure accounts for much of the reduction in photosynthesis under moderate salt stress. Also, Delfine *et al*. (1998) found that salt accumulation caused a drop of the Ca and Mg content in leaves which might have decreased membrane stability and chlorophyll content respectively. Moreover, they concluded that salinity reduced photosynthesis primarily by reducing the diffusion of CO_2 to the chloroplast both by stomatal closure and changes in mesophyll structure, which decreased the conductance to CO_2 diffusion within the leaf. Also, Ghoulam *et al*. (2002) showed that high NaCl concentrations caused a great reduction in growth parameters.

Chemical Composition

Photosynthetic Pigments

It was obviously clear from Table 3 that the studied sugar beet genotypes grown under Ras Sudr conditions greatly varied in their ability to grow and subsequently to assimilate and translocate biochemical components from source to sink. Data for photosynthetic pigments in leaves varied significantly in most tested cultivars. The greatest chlorophyll (a), chlorophyll (a+b) and chlorophyll (a+b)/carotenoids were produced from genotypes Pleno and Gazela, respectively. While, the lowest amounts were produced from genotype Chems. However, the genotypes Oscar poly and H-Poly1 followed by Disprerez PolyN, Gazela and Pleno had higher concentration of chlorophyll (b) than other genotypes. The lowest value of such content was recorded in

leaves of Chems genotype. In addition, Kawemera significantly exceeded the other genotypes in Chlorophyll (a/b) under the same conditions. The greatest carotenoids with insignificantly was produced from genotypes Top, Demapoly, Negma, Gloira, Farida, Oscar poly, H-Poly1 and Disprerez PolyN in a descending order. Data listed in the same table showed that significant differences were recorded in total pigments in most tested genotypes. It was found in high amounts reached 125.31, 120.63, 120.24, 119.65 and 115.61 for Pleno, Gazela, H-Poly1, Oscar poly and Toro, respectively. While, the lowest value of such content was produced from Chems followed by genotype Gloria. In this regard, the differences of photosynthetic pigments between sugar beet genotypes (*Beta vulgaris* L.) under saline conditions were noticed by many authors.i.e. Khafaga and Sallam (1999), Kandil *et al*. (2001), Jamil *et al*. (2007) and Hajiboland *et al*. (2009).

The reduction of photosynthetic pigments under salt stress conditions may be attributed to: 1) increased activity of chlorophyll degrading enzyme chlorophyllase (Rao and Rao 1981) 2) the destruction of chlorophyll a, which is more sensitive to salinity than chlorophyll b (Reddy and Vora 1986) 3) ion accumulation in leaves which lead to adversely affects on chlorophyll concentration (Yeo and Flowers 1983) 4) decreased contents of chlorophyll and carotenoids, PS2 and Hill reaction activities and fluorescence emission in sensitive plants (Singh and Dubey 1995) 5) induced changes in thylakoid pigment-protein complexes (Misra *et al*., 1999) 6) disturbing effects on structure, number and size of chloroplast which negatively affected chlorophyll biosynthesis (Hammad and Abou El-Khir 2005) and 7) the inhibitory effect of chloride on the activity of Fe containing enzymes, cytochrome oxidase which in turn may decrease the rate chlorophyll (Atta 2005).

Malondialdehyde, Proline, Soluble Protein and Ribonucleic Acids (RNA)

With regard to the different between sugar beet genotypes in malondialdehyde, proline, soluble protein and ribonucleic acids (RNA) under Ras Sudr conditions, Table 4 shows that Top and Chems genotypes recorded the highest

values of malondialdehyde content followed by Baraka and Gloria genotypes. While, the lowest values of such content were achieved by Oscar poly, Pleno, Gazela, Toro and H-Poly1 genotypes in a ascending order. In this connection, Nagesh Babu and Devaraj (2008) showed that salt stress induced reactive oxygen species (ROS) cause membrane damage in plants. A raise in malondialdehyde content (MDA) used as reliable criterion for membrane damage under salt stress.

Data in Table 4 showed that the highest values of proline were recorded in leaves of Pleno, Toro and Oscar poly. Such effect was obtained in roots of Pleno and Gazela .In this respect, Gzick (1996) and Kandil *et al*. (2001) concluded that higher proline level under salt stress is related to osmotic potential regulation in sugar beet. Also, Ranji *et al.* (1997) and Pakniyat and Armion (2007) showed that proline synthesis of tolerant sugar beet line was higher than the sensitive line under high concentration of saline stress. In this concern, Orabi and Mekki (2008) found that proline accumulation in leaves of sugar beet was gradually increased by increasing salinity level.

The interpretation of proline accumulation in stressed plants under saline conditions is that : 1) it acts as cytoplasmic osmotic solute (Ford and Wilson 1981), 2) mitigate or prevent the loss of several enzymes activity (Greenway and Munns 1980), 3) helping the plant to regulate the osmotic potential of root cells (Begum and Karmoker 1999), 4) stabilizing sub-cellular structures (e.g.membrances and proteins), scavenging free radicals and buffering cellular redox potential (Ashraf and Foolad 2007).

The obtained results in Table 4, also showed that soluble protein stimulative in leaves of Gazela and Oscar poly followed by Pleno and Toro than other sugar beet genotypes. While, Pleno genotype had the highest amount in roots followed by Oscar poly. Similar results were reported by Munns *et al.* (1979), Thakur and Rai (1982) and Khafaga and Sallam (1999) they observed that resistant varieties exposed to osmotic stress accumulated more protein than in susceptible ones. In the same manner, Ebrahim (2005) showed that irrigating plants of sugar beet with saline water increased the leaf concentration of soluble proteins and total free amino acids (TAA),

including proline. Moreover, protein synthesis may play an important role for increasing the osmotic pressure of cytoplasm and consequently enhance salt tolerance of plant.

Data for ribonucleic acids (RNA) in leaves varied significantly in most tested genotypes. The genotypes Gazela and Pleno followed by Oscar poly and H-Poly1 had higher concentration of RNA than other genotypes. In this concern, H-Poly1, Pleno and Gazela were the best genotypes for accumulated the highest values of RNA in roots. On the other hand, the lowest value of such content was produced from Negma and Gloria in leaves and roots, respectively. In this regard, Khafaga and Sallam (1999) found that RNA content in leaves and roots of sugar beet varieties were (0.62-0.69 mg/g) and (0.25-0.33 mg/g), respectively. The interpretation of increase ribonucleic acids (RNA) content for tested sugar beet genotypes may be attributed to inhibit the activity of RNase.

The results in Table 4 showed that the ratios between some biochemical constituents in leaves to the same content in roots ranged from 0.92 to 2.54 for proline, 1.53 to 3.33 for soluble protein and 2.24 to 3.49 for RNA. The later values simply means that the soluble protein in leaves is more than 1.53 folds that of the soluble protein in roots. Also, RNA content in leaves is more than 2.24 folds that of the RNA in roots.

Minerals and Reducing Sugars

The influence of salinity in irrigation water on minerals and reducing sugars in leaves and roots of sugar beet genotypes after 85 days from sowing under Ras Sudr conditions is present in Table 5. Data showed that H-Poly1 and Oscar poly exceeded the other genotypes in phosphorus of leaves plants, while Negma and Karola genotypes recorded the minimum values under the same conditions. In this respect, phosphorus content was accumulated in high amount in roots of Pleno genotype. In addition, Top and Farida were the highest genotypes where accumulated the highest values of sodium in leaves. Such effect was obtained in roots of Kawemera and Disprerez PolyN. On the other hand, the lowest value of such content was produced from leaves of Baraka genotype and roots of Pleno genotye. Regarding potassium content, Pleno genotype had a higher content in leaves than

Table 4. Concentration of malondialdehyde, proline, soluble protein and ribonucleic acids (RNA) in leaves and roots of some sugar beet genotypes as affected by saline conditions at Ras Sudr, South Sinai (at 85 days from sowing)

Genotypes	MDA nmole/g fresh wt.	Free proline μ mole/g fresh wt.		PL/PR	Soluble Protein mg/g fresh wt.		SPL/SPR	RNA μg/g fresh wt.		RL/RR
	Leaves	Leaves	Roots		Leaves	Roots		Leaves	Roots	
Gazela	33.51 f	2.29 b	1.28 a	1.78 cd	6.01 a	2.18 cd	2.75 b	314 a	94 ab	3.34 b-d
Pleno	31.76 f	2.52 a	1.29 a	1.95 bc	5.84 ab	2.56 a	2.28 cd	313 a	96 a	3.26 b-e
Negma	52.24 cd	1.15 h	0.86 f	1.33 ef	2.77 h	1.28 h	2.16 cd	184 f	79 d-f	2.32 gh
Farida	42.94 e	1.54 ef	1.08b-d	1.42 ef	5.19 b-e	2.37a-c	2.18 cd	249 cd	83 b-e	3.00 d-f
Chems	67.54 a	1.65 de	0.84 f	1.96 bc	3.52 fg	1.70 fg	2.07 d	215 d-f	71 f-h	3.02 d-f
Top	70.12 a	1.43 fg	0.60 g	2.38 a	4.52 e	1.85 fg	2.44 c	202 ef	64 gh	3.15 c-e
Oscar poly	29.21 f	2.36 ab	1.15a-d	2.05 b	5.97 a	2.44 ab	2.44 c	304 a	87 a-d	3.49 a
H-Poly1	35.24 f	2.05 c	1.03c-e	1.99 bc	5.05 c-e	2.29b-d	2.20 cd	288 ab	98 a	2.93 ef
Baraka	60.75 b	1.63 d-f	0.68 g	2.39 a	2.97 gh	1.29 h	2.30 cd	195 ef	87 a-d	2.24 h
Karola	56.16 bc	1.30 gh	1.02 de	1.27 f	5.37 a-d	1.61 g	3.33 a	268 bc	75 ef	3.57 b
Disprerez PolyN	50.67 cd	1.82 d	0.92 ef	1.97 bc	4.89 de	1.76 fg	2.77 b	245 cd	91 a-c	2.69 fg
Kawemera	47.82 de	2.06 c	0.81 f	2.54 a	4.64 e	1.90 f	2.44 c	221 de	88 a-d	2.51 gh
Gloria	58.54 b	1.11 h	1.20 ab	0.92 g	3.26 f-h	2.13 de	1.53 e	219 d-f	63 h	3.47 bc
Demapoly	44.23 e	1.73 de	1.10b-d	1.57 de	3.87 f	1.63 g	2.37 cd	199 ef	74 e-g	2.68 fg
Toro	34.13 f	2.43 ab	1.17a-c	2.07 b	5.59 a-c	1.94 ef	2.88 b	251 cd	80 c-f	3.13 c-e

RNA= Ribonucleic acids , MDA= Malondialdehyde , FAA=Total free amino acids
PL/PR=Ratio of proline in leaves to proline in roots, SPL/SPR= Ratio of soluble protein in leaves to soluble protein in roots,
RL/RR= Ratio of RNA in leaves to RNA in roots
Values followed by the same letter (s) are not significantly different at $p< 0.05$.

Table 5. Concentration of minerals and reducing sugars in leaves and roots of some sugar beet genotypes as affected by saline conditions at Ras Sudr, South Sinai (at 85 days from sowing)

Genotypes	Minerals content						Reducing sugars (RS) mg/ g dry wt.	
	Phosphorus (P) mg/g dry wt.		Sodium (Na) mg/g dry wt.		Potassium (K) mg/g dry wt.			
	Leaves	Roots	Leaves	Roots	Leaves	Roots	Leaves	Roots
Gazela	2.12 ab	1.68 ab	14.92 e	5.19 h-j	27.83 a-c	9.11 bc	16.64 ab	22.10 b
Pleno	2.09 ab	1.77 a	18.20 b-d	4.90 j	30.01 a	10.46 a	16.76 ab	24.22 a
Negma	1.44 f	1.54 c	18.64 b-d	6.51 a-c	23.83 d-f	7.86 d-f	15.24 cd	21.75 bc
Farida	2.12 ab	1.30 d-f	20.88 a	6.27 b-e	21.62 fg	7.77 ef	13.99 c-e	18.82 de
Chems	1.84 cd	1.23 e-g	19.32 a-c	5.88 d-g	26.33 b-d	8.12 c-f	14.47 cd	20.88 bc
Top	1.93 bc	1.28 d-f	21.08 a	6.05 c-g	23.11 e-g	8.62 b-e	12.84 e	17.24 e
Oscar poly	2.17 a	1.40 d	17.87 cd	5.75 e-h	28.76 ab	9.04 bc	17.01 a	22.17 b
H-Poly1	2.17 a	1.39 d	17.37 d	5.11 ij	28.47 ab	11.02 a	15.43 bc	22.08 b
Baraka	2.03 a-c	1.21 fg	14.88 e	6.37 b-d	25.43 c-e	8.65 b-e	13.88 de	19.89 cd
Karola	1.49 f	1.57 bc	20.09 ab	6.11 c-f	20.70 g	7.96 d-f	15.11 cd	21.62 bc
Disprerez PolyN	1.71 de	1.62 bc	20.19 ab	6.80 ab	25.36 c-e	6.51 g	13.94 c-e	18.74 de
Kawemera	2.00 a-c	1.39 d	19.43 a-c	7.07 a	27.05 bc	7.56 f	14.41 cd	20.67 bc
Gloria	2.05 a-c	1.12 g	18.30 b-d	6.75 ab	26.14 b-d	6.40 g	14.98 cd	21.34 bc
Demapoly	1.54 ef	1.35 de	19.75 a-c	5.43 g-j	21.49 fg	9.21 b	12.88 e	17.35 e
Toro	2.16 a	1.41 d	19.69 a-c	5.54 f-i	27.13 bc	8.86 b-d	14.85 cd	21.12 bc

Values followed by the same letter (s) are not significantly different at $p < 0.05$.

other sugar beet genotypes tested. The maximum value of such content in roots was achieved by H-Poly1 and Pleno. While, the minimum value of potassium content in leaves and roots were noticed by Karola and Gloria, respectively.

In general, two types of mechanism of salt tolerance have been identified in higher plants (Flowers *et al*., 1977, Greenway and Munns 1980 and Ashraf *et al*., 2001). In the first mechanism, the growth medium salinity causes specific ion effects on plants, and plants in turn respond by excluding toxic ions such as Na^+ and Cl^- from leaves by different ways. In the second mechanism, ions absorbed by cells are accumulated in the vacuoles. However, patterns of ion accumulation have been successfully used in discriminating between salt tolerant and salt sensitive species or cultivars.

On the other hand, Pakniyat and Armion (2007) found that the tolerant genotypes accumulated more Na^+ and Na^+/K^+ and less K^+ as compared to non-tolerant genotypes. However, Khafagi and El-Lawendy (1996) reported that salinity increased concentrations of ash, chloride, sodium and phosphate, and decreased nitrogen, potassium and calcium.

It is obvious from the data in Table 5 that, Oscar poly sugar beet genotype surpassed other genotypes in reducing sugar in leaves. However, Pleno and Gazela recorded the second order. Also, Pleno recorded the highest value in roots. In contrast, the lowest values of reducing sugars in leaves and roots were obtained by Top and Demapoly as compared with the other sugar beet genotypes. In this respect, Naguib *et al*. (1999) found that sugar beet grown in saline soil showed an increase in reducing and non-reducing sugar contents in the roots. Also, Ebrahim (2005) showed that irrigating plants of sugar beet with saline water increased the leaf content of soluble sugars.

Impurities (Na, K and Alpha Amino Nitrogen)

The differences between sugar beet genotypes in content of impurities, such as potassium, sodium and alpha amino nitrogen (at harvesting, 180 days from sowing) under conditions of Ras Sudr region is present in Table 6. Generally, the concentration of impurities present in beet roots influences the quality of the beet root. The high concentrations of impurities lead to decrease in

quality of beet and the process of sugar extraction. In this regard, Last *et al*. (1983) found that the concentrations of K and Na present as impurities in extracted root sap have been shown to be inversely related to the amount of extractable sugar**.**

Comparison between sugar beet genotypes data in Table 6 showed that sodium as impurities ranged from 1.773 for Disprerez PolyN genotype to 1.940 for Pleno genotype. However, the genotypes Top and Farida followed by Chems and Gloria had higher concentration of potassium as impurities than other genotypes. The lowest value of such content was recorded in roots of Toro genotype. Also, data revealed that significant differences were recorded in alpha amino nitrogen (%) in most tested genotypes. It was found in high amounts reached 2.751 for Farida. While, the lowest value of such content was noticed from Gazela genotype. In addition, Orabi and Mekki (2008) showed that Na and K contents in sugar beet juice were less affected by irrigation with saline water; however it was gradually decreased with high salt concentration.

Sucrose%, Sugar Lost to Molasses, Purity%, Sugar Extraction%, Extractability% and Recoverable Sugar Yield

Data in Table 7 point out the effect of salinity on sucrose, sugar lost to molasses, purity, sugar extraction, extractability and recoverable sugar yield in roots of sugar beet genotypes after 180 days from sowing. The genotypes Demapoly followed by Baraka, Karola, Negma and Oscar poly had higher concentration of sucrose% than other genotypes. However, the highest values of sugar lost to molasses were achieved by Farida, Chems, Karola and Top genotypes. While, Oscar poly and Disprerez PolyN genotypes recorded the highest values of purity as compared with the other genotypes. Data in the same table showed different between sugar beet genotypes in sugar extraction%, extractability%. In this respect, Demapoly recorded the highest value of such characters as compared with the other genotypes. Meanwhile, Oscar poly genotype was the best one in recoverable sugar yield followed by Pleno.

In this connection, the observed data in Table 7 were in harmony and

Table 6. Impurities (Na, K and alpha amino nitrogen) in roots of some sugar beet genotypes as affected by saline conditions at Ras Sudr, South Sinai (at harvesting 180 days from sowing)

Genotypes	Sodium (meq/100 beet)	Potassium (meq/100 beet)	Alpha amino nitrogen (meq/100 beet)
Gazela	1.826 b-d	3.955 cd	2.258 d
Pleno	1.940 a	3.706 de	2.581 bc
Negma	1.835 a-d	4.405 ab	2.711 ab
Farida	1.821 b-d	4.558 a	2.751 a
Chems	1.896 a-c	4.515 a	2.721 ab
Top	1.895 a-c	4.596 a	2.631 a-c
Oscar poly	1.873 a-d	3.503 e	2.536 c
H-Poly1	1.805 cd	3.815 c-e	2.38 d
Baraka	1.925 ab	4.486 a	2.378 d
Karola	1.866 a-d	4.418 ab	2.718 ab
Disprerez PolyN	1.773 d	3.755 c-e	2.273 d
Kawemera	1.821 b-d	3.768 c-e	2.531 c
Gloria	1.806 cd	4.511 a	2.575 bc
Demapoly	1.916 ab	4.103 bc	2.351 d
Toro	1.845 a-d	3.451 e	2.716 ab

Values followed by the same letter (s) are not significantly different at $p< 0.05$.

Table 7. Sucrose %, sugar lost to molasses, purity %, sugar extraction (%), extractability (%) and recoverable sugar yield of some sugar beet genotypes as affected by saline conditions at Ras Sudr, South Sinai (at harvesting 180 days from sowing)

Genotypes	Sucrose (%)	Sugar lost to molasses (S.M.%)	Purity (%)	Sugar extraction (%)	Extractability (%)	*Recoverable sugar yield
Gazela	16.87 cd	1.87 ef	92.58 a-d	14.40 bc	85.32 a-c	4.30 ab
Pleno	16.98 cd	1.93 a-f	92.45 a-d	14.45 bc	85.05 bc	4.42 a
Negma	18.38 ab	2.04 a-c	92.42 b-d	15.73 a	85.55 a-c	3.53 ef
Farida	17.80 a-c	2.08 a	92.07 d	15.12 ab	84.93 bc	3.47 ef
Chems	17.80 a-c	2.07 a	92.05 d	15.12 ab	84.93 bc	2.83 h
Top	18.28 ab	2.06 ab	92.23 cd	15.62 a	85.42 a-c	3.07 gh
Oscar poly	18.32 ab	1.88 d-f	93.20 a	15.83 a	86.40 a	4.51 a
H-Poly1	16.38 d	1.88 d-f	92.38 b-d	13.90 c	84.87 bc	3.99 b-d
Baraka	18.50 ab	1.99 a-e	92.58 a-d	15.90 a	85.98 ab	3.49 ef
Karola	18.38 ab	2.06 a-c	92.37 b-d	15.72 a	85.50 a-c	3.54 ef
Disprerez PolyN	17.77 a-c	1.84 f	93.10 ab	15.33 ab	86.27 a	3.69 de
Kawemera	17.56 bc	1.91 c-f	92.75 a-d	15.05 ab	85.67 a-c	4.12 a-c
Gloria	18.21 ab	2.02 a-d	92.40 b-d	15.59 a	85.57 a-c	3.23 fg
Demapoly	18.65 a	1.93 b-f	92.93 a-c	16.12 a	86.45 a	3.70 de
Toro	16.27 d	1.92 b-f	92.30 cd	13.76 c	84.48 c	3.89 c-e

Values followed by the same letter (s) are not significantly different at $p < 0.05$.

*Recoverable sugar yield = root yield x sugar extraction %

/or agreement with those reported by Mekki and El-Gazzar (1999), Shehata (1999), Shehata *et al*. (2000) and Kandil *et al*. (2001). However, Orabi and Mekki (2008) showed that sucrose % was less affected up to low salinity, whereas it was slightly increased with high salinity level. While the purity % was only increased with well irrigated plants.

According to the previous observed data, it could be recommended the use of salt tolerance genotypes such as Pleno, Gazela and Oscar poly, that associated with yield quality and biochemical constituents.

REFERENCES

Allen, E.S. 1974. Chemical analysis of ecological materials.Bluekuell Scientific Publications.Gany Mead. Oxford, pp. 563.

A.O.A.C. 1990. Official Methods of Analysis of Association of Official Analytical Chemists. Pub. By the Association of Official Analytical Chemists, Inc., Arling West Virginia, USA.

Ashraf, M. and M.R. Foolad. 2007. Roles of glycine betaine and proline in improving plant abiotic stress resistance. Environ. Exp. Bot., 59:206-216.

Ashraf, M., N. Nazir and T. Mcneily. 2001. Comparative salt tolerance of amphidiploid and diploid Brassica species. Plant Sci., 160: 683-689.

Atta, M.I. 2005. Influence of some growth substances on inducing salt tolerance of cotton seedling. Al-Azhar J. Agric. Res., 41:91-110.

Bates, L.S., P. Waldren and I.D. Teare. 1973. Rapid determination of free proline for water stress studied. Plant and Soil, 93: 205-216.

Begum, F. and J.L. Karmoker. 1999 . Effect of salinity stress on the accumulation and distribution of proline in wheat. Rachis, 18(1): 22-25.

Bernfeld, P. (1955). Methods in enzymology. Vol. I. 149-154. (Acad. Press, Inc., New york).In S.P. Colowick and N.O.Koplan (Eds.).

Brown, J.D. and O. Lilliand. 1964. Rapid determination of potassium and sodium in plant material and soil extracts by flamphotometry. Proc. Amer. Soc. Hort. Sci., 48: 341-346.

Brugnoli, E. and O. Bjorkman. 1992. Growth of cotton under continuous salinity stress:

influence on allocation pattern, stomatal and non-stomatal component of photosynthesis and dissipation of excess light energy. Planta, 187:335-347.

Carruthers, A., J.F.T. Oldfield and H.J. Teague. 1962. Assessment of beet quality. Paper presented to the 15th Annu. Tech. Conf. British Sugar Crporation LTD. 36 pp.

Cherry, J.H. 1973. Molecular biology of plants test-Manual.Clombia Univ. Press. New York and London. 68-71.

Delfine, S., A. Alvino, M. Zacchini and F. Loreto 1998. Consequences of salt stress on conductance to CO_2 diffusion Rubisco characteristics and anatomy of spinach leaves. J. Plant Physiol., 25: 395-902.

Devillers, P. 1988. Prevision du sucre melasse. Scuries francases, 129: 190-200. (C.F. The Sugar Beet Crop Book).

Dexter, S.T., M. Frankes and F.W. Snyder. 1967. A rapid of determining extractable white sugar as may be applied to the evaluation of agronomic practices and grower deliveries in the sugar beet industry. J. Am. Soc., Sugar beet Technol. 14: 433-454.

Duncan, D.B. 1955. Multiple range and multiple 'F' tests. Biometrics, 11: 1-42.

Ebrahim, M.K.H. 2005. Amelioration of sucrose-metabolism and yield changes, in storage roots of NaCl-stressed sugarbeet, by ascorbic acid. Agrochimica, 49 (3/4): 93-103.

Ebrahimian, H.R., Z.A. Ranji, M.A. Rezaee and Z. Abbasi. 2008. Screening sugar beet genotypes under salinity stress in the greenhouse and field conditions. J. Sugar Beet, 24 (1): 1-21.

Flowers, T.J., P.F. Troke and A.R. Yeo. 1977. The mechanism of salt tolerance in halophytes. Annu. Rev. Plant Physiol., 28: 89-121.

Ford, C.W. and S. Wilson. 1981. Change in levels of solutes during osmotic adjustment to water stress in leaves of four tropical pasture species. Aust. J. Physiol., 8:77-90.

Fotouhi, K., M. Mesbah, S.Y. Sadeghyan, Z. Ranji and M.R. Orazi Zadeh. 2006. Evaluation of salinity tolerance in sugar beet genotypes.J.Sugar Beet, 22 (2): 1-18.

Ghoulam, C., A. Foursy and K. Fares. 2002. Effects of salt stress on growth, inorganic ions and proline accumulation in relation to osmotic adjustment in five sugar beet cultivars. Environ. Exp. Bot., 47: 39-50.

Gomez, K.A. and A.A. Gomez. 1984. Statistical Procedures for Agricultural Research. John Wiley & Sons. New York, U.S.A.

Greenway, H. and R. Munns. 1980. Mechanisms of salt tolerance in non-halophtes. Annu. Rev. Plant Physiol., 31: 149-190.

Gzick, A. 1996. Accumulation of proline and pattern of alpha - amino acids in sugar beet plants in response to osmotic, water and salt stress. Environ. Exp. Bot., 36 (1): 29-38.

Hajiboland, R., A. Joudmand and K. Fotouhi. 2009. Mild salinity improves sugar beet (*Beta vulgaris* L.) quality. Acta Agriculturae Scandinavica, Section B-Plant Soil Science, 59 (4): 295-305.

Hajiboland, R. and A. Joudmand. 2009. The K/Na replacement and function of antioxidant defence system in sugar beet (*Beta vulgaris* L.) cultivars. Acta Agriculturae Scandinavica. Section B, Plant Soil Science, 59 (3): 246-259.

Hammad, Salwa A.R. and A.M.Y. Abou El-Khir. 2005. Effect of total salinity and salinity type on soybean growth and its chemical composition. Minufiya J. Agric. Res., 30 (3): 835-852.

Hernandez, J.A., M.A. Ferrer, A. Jimenez, A.R. Barcelo and F. Sevilla. 2001. Antioxidant systems and O_2 / H_2O_2 production in the apoplast of pea leaves-its relation with salt-induced Necrotie lesions in Minor veins. Plant Physiol., 127: 817-831.

Jamil, M., S. Rehman and E.S. Rha. 2007. Salinity effect on plant growth, PSII photochemistry and chlorophyll content in sugar beet (*Beta vulgaris* L.) and cabbage (*Brassica oleracea* capitatal.). Pak. J. Bot., 39 (3): 753-760.

Kandil, S.A., M.S.A. Abo El-Kheir and A.A. Abou-Ellil. 2001. Physiological response of some sugar beet (*Beta vulgaris L.*) varieties to irrigation with different levels of chloride salinization. Bull. Nat. Res. Center (Cairo), 26 (1): 79-92.

Khafaga, H.S. and H.A. Sallam. 1999. Effect of K foliar application on growth, yield and chemical constituents of

some sugar beet varieties under calcareous soil. Ann. Agric. Sci. Moshtohor, 37(1): 113-133.

Khafagi, O.M.A. and W.I. El-Lawendy. 1996. Salt tolerance of sugar beet (*Beta vulgaris* L.). II. Metabolic products and ion accumulation. Ann. Agric. Sci. Moshtohor, 34(4): 1647-1663.

Last, P.J., A.P. Draycott, H. Messem and D.J. Webb. 1983. Effects of nitrogen fertilizer and irrigation on sugar beet at Broom's Barn 1974-1978. J. Agric. Sci., 16 (1): 185-205.

Le-Docte, A. 1927. Commercial determination of sugar in beet root. Le Docte process. Int. Sug. J., 29 : 488 - 492. (C.F. Sugar Beet Nutrition, 1972. Appl. Sci. Pub. LTD., London, A.P. Draycott).

Lowry, O.H., N.J. Rosebrough, A.L. Farr and R.J. Randall. 1951. Protein measurement with Folin phenol reagent. J. Biol. Chem., 193: 265-275.

Marschner, H. 1995. Minerals nutrition of higher plants. 2nd edition. Academic press, London. pp. 32-40.

Mekki, B.B. and M.M. El-Gazzar. 1999. Response of root yield and quality of sugar beet (*Beta vulgaris* L.) to irrigation with saline water and foliar potassium fertilization. Ann. Agric. Sci., 44 (1): 213-225.

Miller, G.L. 1959. Use of dinitrosalicylic acid reagent for determination of reducing sugars. Anal. Chem., 31: 426-428.

Misra, A.N., S.M. Sahu, M. Meena, N.K. Ramaswamy; T.S. Desai, M. Misra; G. Horvath and Z. Szigeti. 1999. Sodium chloride salt stress induced changes in thylakoid pigment-protein complexes, photosystemII activity and thermoluminescence glow peaks. Proceed. Int. Workshop at Tata, Hungary, 23-26 August, 1999. Zeitschrift fur Naturforschung. Section C, Biosciences. 54 (9-10): 640-644. (C.F.CAB Abstracts (1998 /08-2000/07 AN: 19990710843).

Munns, R. 2002. Comparative physiology of salt and water stress. Plant Cell Environ., 25: 239-250.

Munns, S., M. Akbar and E.W.R. Barlow. 1979. Solute accumulation in the apex and leaves of wheat during water stress. Aust. J. Plant Physiol., 6: 379-389.

Murphy, J. and J.H. Riley. 1962. Amodified single solution method for the determination of phosphate in natural waters. Anal. Chim. Acta, 27: 31-36.

Nagesh Babu, R. and V.R. Devaraj. 2008. High temperature and salt stress response in French bean (*Phaseolus vulgaris).* Aust. J. Crop Sci., 2 (2): 40-48.

Naguib, A., S.Y. Besheet, Z.M. Ramadan and S.H. Ashmawy. 1999. Influence of soil salinity and potassium fertilizer on some biochemical aspects of sugar beet. Ann. Agric. Sci. Moshtohor, 37(4): 2491-2500.

Netondo, G.W., J.C. Onyango and E. Beck. 2004. Sorghum and salinity II-Gas exchange and chlorophyll fluorescence of sorghum under salt stress. Crop Sci., 44: 806-811.

Orabi, S.A. and B.B. Mekki. (2008) Root yield and quality of sugar beet (*Beta vulgaris* L.) in response to ascorbic acid and saline irrigation water. American-Eurasian J. Agric. Environ. Sci., 4 (4): 504-513.

Pakniyat, H. and M. Armion. 2007. Sodium and proline accumulation as osmoregulators in tolerance of sugar beet genotypes to salinity. Pak. J. Biolog. Sci., 10(22): 4081-4086.

Ranji, Z., E. Majidi, A.H. Dezfuly and A. Ghalvand. 1997. A study on proline accumulation in the leaves of tolerant and sensitive sugar beet lines to salinity. Iranian J. Agric. Sci., 28 (1):87-95.

Rao, G.G. and G.R. Rao. 1981. Pigment composition & chlorophyllase activity in pigeon (*Cajanus indicuc* spreng) and gingelley (*Sesamum indicum* L.) under NaCl salinity. Indian J. Exp. Biol., 19: 768-770.

Reddy, M.P. and A.B. Vora. 1986. Salinity induced changes in pigment composition and chlorophyllase activity of wheat. Indian J. Plant Physiol., 29: 331-334.

Shehata, M.M. 1999. Effect of ground water depth and irrigation with saline water on sugar beet. II: Chemical constituents. Egyptian J. Agric. Res., 77(4): 1675-1686.

Shehata, M.M., T.S. El-Ammari and N.E.M. Taha. 2000. Using free proline concentration as an indicator for identifying sugar beet varieties relatively tolerant to salinity. Egyptian J. Agric. Res., 78(2): 733-744.

Singh, A.K. and R.S. Dubey. 1995. Changes in chlorophyll a and b contents and activities of photosystems 1 and 2 in rice

seedling induced by NaCl. Photosynthetica, 31 (4): 489-499.

Snedecor, G.W. and W.G. Cochran. 1967. Statistical Methods. 6th Ed.Iowa State Univ. Press Ames., Iowa, USA

Tester, M. and R.A. Davenport. 2003. Na^+ tolerance and Na^+ transport in higher plants. Ann. Bot., 91: 503-527.

Thakur, P.S. and V.K. Rai. 1982. Effect of water stress on protein content in two maize varieties differing in drought resistance. Biol. Plant., 24: 96-100.

Yeo, A.R. and T.J. Flowers. 1983. Varietal differences in the toxicity of sodium ions in rice leaves. Physiol. Plant., 59: 189-195.

Zhao, S.J., C.C. Xu. and Q. Zou. 1994. Improvement of method for measurement of malondialdehyde in plant tissue. Plant Physiol. Commun., 30: 207-210.

Zhu, J.K. 2004. Salt and drought stress signal transduction in plants. Annu. Rev. Plant Bol., 53: 247-273.

Zagazig J. Agric. Res., Vol. 37 No. (3) 2010

التغيرات البيوكيميائية لبعض التراكيب الوراثية لبنجر السكر وعلاقتها بالمحصول ومكوناتة تحت ظروف رأس سدر

محمد حامد هنداوى[١] - أحمد السيد عطية[٢]

١- وحدة الكيمياء الحيوية- قسم الاصول الوراثية- مركز بحوث الصحراء- المطرية – القاهرة – مصر.

٢- معهد المحاصيل السكرية- مركز البحوث الزراعية- الجيزة- مصر.

تم زراعة ١٥ صنف من بنجر السكر (Pleno, Gazela, H-Poly1, Oscar poly, Toro Kawemera, Disprerez PolyN, Demapoly, Farida, Karola, Negma, Baraka, Gloria, Top and Chems) فى موسمين متتاليين (٢٠٠٧/٢٠٠٨ -٢٠٠٨/٢٠٠٩) فى محطة بحوث رأس سدر وذلك بهدف دراسة التغيرات البيوكيميائية لبعض التراكيب الوراثية لبنجر السكر وعلاقتها بالمحصول ومكوناته. أوضحت النتائج أن معظم التراكيب الوراثية النامية تحت ظروف الملوحة تختلف بدرجة كبيرة فى قدرتها على النمو وبالتالى قدرة تحملها والتمثيل ونقل المكونات البيوكيميائية. فقد تفوق صنف Pleno ، Gazela على باقى الأصناف فى قطر ووزن ومحصول الجذور. سجل صنف Oscar poly، Pleno ، Gazela أعلى القيم لمحصول السكر على التوالى وقد كان هذا مرتبطا مع احتوائها على نسبة عالية من بعض المكونات البيوكيميائية مثل صبغات التمثيل الضوئى والبرولين والبروتين الذائب والأحماض النووية ونقص فى محتوى بعض المكونات مثل malondialdehyde مقارنة بالتراكيب الوراثية الأخرى. وجد أن عدم النقاوة والنسبة المئوية للسكروز وكذلك النسبة المئوية للأستخلاص فى الجذور قد تأثرت بالتراكيب الوراثية والملوحة. تظهر هذه الدراسة أن التراكيب الوراثية لبنجر السكر لأصناف Pleno ، Gazela ، Oscar poly كانت الأعلى فى إنتاجيتها ومقاومتها للملوحة (وتوصى بإستخدامها تحت الظروف الملحية)، كما أظهرت الدراسة أهمية الدلائل البيوكيميائية والتى يمكن الاستفادة منها فى دفع الأصناف الحساسة على مقاومة الملوحة (تفعيل دور المقاومة المستحثة).