ISSN 1110-0419

Annals Of Agric. Sc., Moshtohor,
Vol. 46(4): Ho. 419-428, (2008).

THE GROWTH AND BIOCHEMICAL CONTENTS OF SOME MANGO ROOTSTOCK SEEDLINGS UNDER SALT STRESS

BY

Abdrabboh, G.A. and Abdelrazik, A.M.
Dept. of Horticulture, Faculty of Agriculture, Al-Azhar University, Nasr City, Cairo, Egypt

ABSTRACT

This work is an attempt to elucidate the effect of salt stress on growth and some leaf mineral composition of two Mango rootstock seedlings (*Mangifera indica L*), namely: Sukkary and Turpentine. One year old mango rootstock seedlings were irrigated by saline water at concentrations, 750, 1500, 3000 and 6000 ppm of NaCl, compared with those irrigated with tap water (control).The results cleared that such treatments decreased the plant height, number of leaves/ plant, average leaf area and number of burned leaves/ plant, proportionally with the increase in salt concentration in irrigation water. The increase of salt in irrigation water decreased leaf K content and increased Na and Cl contents in the plant leaves. Total chlorophyll content of leaf decreased with increasing salt concentration while proline content in mango leaves increased with increasing salt concentration. Results also revealed that seedlings of Sukkary stock were more tolerant to salinity than Turpentine stock seedlings.

INTRODUCTION

Mango is one of the most popular fruits in Egypt due to its good flavor, delicious taste as well as the good return income for the growers especially in case of exporting this kind of fruits. Although Mango is classified as a salt-sensitive fruit, there are differences in salt tolerance among its cultivars (Gazit and Kadman, 1980 and Schaffer *et al.*, 1994). As a matter of fact, information about establishment of Mango orchard in the newly reclaimed land particularly those irrigated with saline water is still lacking. Therefore, the present study was planned to investigate the influence of irrigation with saline water on growth and chemical constituents of the two mango rootstocks namely Sukkary and Turpentine. The study might reveal out which rootstock is more tolerant to salinity.

MATERIALS AND METHODS

This experiment was carried out at the greenhouse of the research farm of Horticulture Department, Faculty of Agriculture, Al-Azhar University, Cairo, Egypt, through two successive seasons (2005 and 2006). Uniform mango seedlings, one year old from two mango stock cultivars, namely Sukkary and Turpentine were chosen as plant material for this study. The seedlings were transplanted on March 1st in 30cm porous clay pots, filled with 7kg sandy soil(one seedling per pot) and moisture content of soil was kept at 70% of the field capacity using Tensiometer. The seedlings were irrigated two times weekly only with tap water for one month. Salt then was dissolved in irrigation water at different saline concentrations to be as follows; 750, 1500, 3000 and 6000 ppm while the tap water was used to irrigate the control treatment. Rootstock seedlings devoted for each saline treatment were irrigated with saline solution every three days (one liter/ pot). To prevent salt accumulation, pots were irrigated with tap water every 12 days then irrigation with salt solution was applied the next time. Moreover, Hogland's nutrient solution (Hogland and Arnon, 1950) at the rate of 480 ml / pot was biweekly added as a nutritive mineral salts

resources all over the experiment period. At the end of August of each season, the seedlings were collected as complete symptoms of toxicity such as leaf burn and dead tissue along the outside edges of leaves had been occurred. A complete randomized block design was followed where each irrigation treatment consisted of three replicates and each replicate consisted of three stocks. The following determinations were recorded at the end of each season:

1. Vegetative growth parameters:

1.1. Plant height (cm).

1.2. Number of leaves/plant was counted and recorded.

1.3. Average leaf area: Area of the fourth distal healthy leaf was measured according the equation of Ahmad and Morsy (1999) as follows:

$$\text{Leaf area} = 0.7\ (L \times W) - 1.06.$$

Whereas L = (Leaf blade length cm), W = (Leaf blade width cm).

1.4. Number of burned leaves (salt-injured leaves which apparently burned to more than one third of their area) per plant were counted.

2. Biochemical characteristic:

2.1. Leaf mineral contents:-

Samples of leaves (three leaves from each replicate)were taken and dried at 70°C till constant weight then ground and used for subsequent determination of Na, Cl and K in each sample as follows:-

a) Potassium and Sodium were determined colorimetrically according to A.O.A.C (2000).

b) Chloride was extracted from ash samples with hot water titrated with standard silver nitrate solution and then determined according to A.O.A.C (2000).

2.2. Leaf Proline content:-

The proline content (g/100 g f.w) was colorimetrically determined in fresh leaves at 520 µm according to Bates *et al.* (1973).

2.3. Leaf chlorophyll content:-

The quantitative analysis of chlorophyll (mg/g. f.w) was colorimetrically determined in samples of fresh leaves according to Saric *et al.* (1967). A complete randomized block design was followed in this experiment and the data was analyzed according to Steel and Torrie (1989) to adjust the L.S.D. at 5%.

RESULTS AND DISSCUSSION

1. Effect of salinity on some growth characteristics of mango seedlings:

1.1. Plant height (cm):

Data in Table (1)and Fig.(1) showed that plant height of the two tested stock cultivars Sukkary and Turpentine was greatly affected under different concentrations of salt stress. As can be seen in Table (I), plant height as growth parameter showed an obvious reduction in its values under salt stress in comparison to that of control (irrigated with tap water). Maximum reduction in plant height was obtained at irrigation with 6000 ppm NaCl in the two studied rootstock cultivars in comparison to that of control. A comparison between the two rootstock cultivars regarding their reaction to the salt stress, the results of plant height in Table(1) and Fig.(1) showed that Turpentine rootstock cultivar was most affected by salt stress when compared with Sukkary cultivar. These results are in agreement with those of AbdEl-Karim (1991), Nigam and Misra (2004) and Dubey *et al.* (2006) who reported that plant height of mango seedling was significantly decreased as salt concentration increased in growth media.

1.2. Total number of leaves/ plant:

Data in Table (1) and Fig. (1) showed that total number of leaves decreased in general by increasing salt concentration in the irrigation water. No significant difference was noticed within the first three salt concentrations of 0, 750, 1500 ppm while a significant reduction effect on leaf number/ plant was noticed when salt concentrations of 3000 and 6000 ppm were used in the two tested rootstock cultivars. As plant height, Turpentine rootstock cultivar was most affected by salt stress when compared with Sukkary cultivar. Similar results were reported by Abd El-Karim, (1991) who reported that plant height as well as leaf number/ plant of mango seedlings were decreased by increasing salt concentration in irrigation water.

1.3. Leaf area:

Regarding the effect of saline in irrigation water on leaf area of the two tested rootstock cultivars, the results in Table(1) and Fig.(1) showed that leaf area of both cultivars (Sukkary and Turpentine) significantly decreased by increasing salt concentrations in irrigation water. Maximum reduction in leaf area in the two studied rootstock cultivars was obtained at irrigation with 6000 ppm NaCl solution in comparison to that of control. Comparing the results of total leaf area in both cultivars, data in the Table (1) and Fig.(1) showed that Turpentine cultivar was more sensitive to saline irrigation water than Sukkary especially in the second season while insignificant difference was observed in first one. These results are in agreement with that of Nigam and Misra (2004) and Dubey *et al.* (2006) who reported that leaf area of mango seedlings was decreased by increasing salt concentration in irrigation water.

1.4. Number of Burned leaves/plant:

Data presented in Table (1) and Fig. (1) showed that number of burned leaves/plant in the two tested cultivars was increased by increasing salt concentration in irrigation water in comparison to control. In this regard, an insignificant difference in number of burned leaves/plant was noticed between the treatments of control and 750 ppm at the season end in the two tested stock cultivars. By increasing salt concentration in irrigation water up to 1500, the two tested cultivars showed a significant difference in number of burned leaves/plant in comparison to control. Maximum number of burned leaves/plant in comparison to that of control was obtained at irrigation with 6000 ppm NaCl solution in the two studied rootstock cultivars. A comparison between the two rootstock cultivars regarding their reaction to the salt stress, the results in Table (1)and Fig.(1) showed that number of burned leaves/plant of Sukkary rootstock cultivar was less under salt stress when compared with those of Turpentine cultivar. Such results supported that Sukkary rootstock cultivar was more salt tolerant than Turpentine rootstock. Damage of leaf tissue is due to sodium accumulation to a degree that exceeds the tolerance of leaves tissue (FAO, 1976). These results are in agreement with those of Abd El-Karim, (1991) and El-Defan *et al.* (1999) who reported that burned leaf area was increased by increasing salt concentration in irrigation water of mango seedlings.

Table (1): Effect of irrigation with saline water on some vegetative growth characteristics

Variety	NaCL (ppm)	Plant height (cm)		Leaves number		Leaves area(cm)		Burned leaves number	
		2005	2006	2005	2006	2005	2006	2005	2006
Sukkary	Control	34.17 a	32.00 a	11.33 a	13.33 a	56.67 a	54.94 a	0.00 f	0.00 f
	750	28.83 c	29.50 abc	11.67 a	13.33 a	55.97 a	45.34 b	0.16 f	0.13 f
	1500	28.67 c	29.17 abc	10.67 a	13.00 a	51.56 ab	45.19 b	1.30 e	1.54 e
	3000	26.00 d	28.00 bc	8.00 b	9.67 b	45.11 abc	44.86 b	2.22 d	2.35 d
	6000	25.67 d	27.33 c	4.50 c	4.00 c	32.46 c	34.08 c	5.43 b	5.99 b
Turpentine	Control	31.00 b	31.50 ab	12.67 a	15.00 a	51.35 ab	46.94 b	0.00 f	0.00 f
	750	26.00 d	29.30 bc	12.33 a	14.33 a	47.63 ab	45.36 b	0.19 f	0.19 f
	1500	25.00 de	28.33 c	11.67 a	14.00 a	46.31 abc	44.23 b	1.51 e	1.22 e
	3000	24.67 de	27.67 abc	7.74 b	8.00 b	40.26 bc	43.70 b	3.33 c	3.09 c
	6000	23.25 e	27.00 c	1.17 d	0.00 c	10.67 d	0.00 d	6.56 a	6.99 a

Means in each column followed by the same letter are not significantly different.

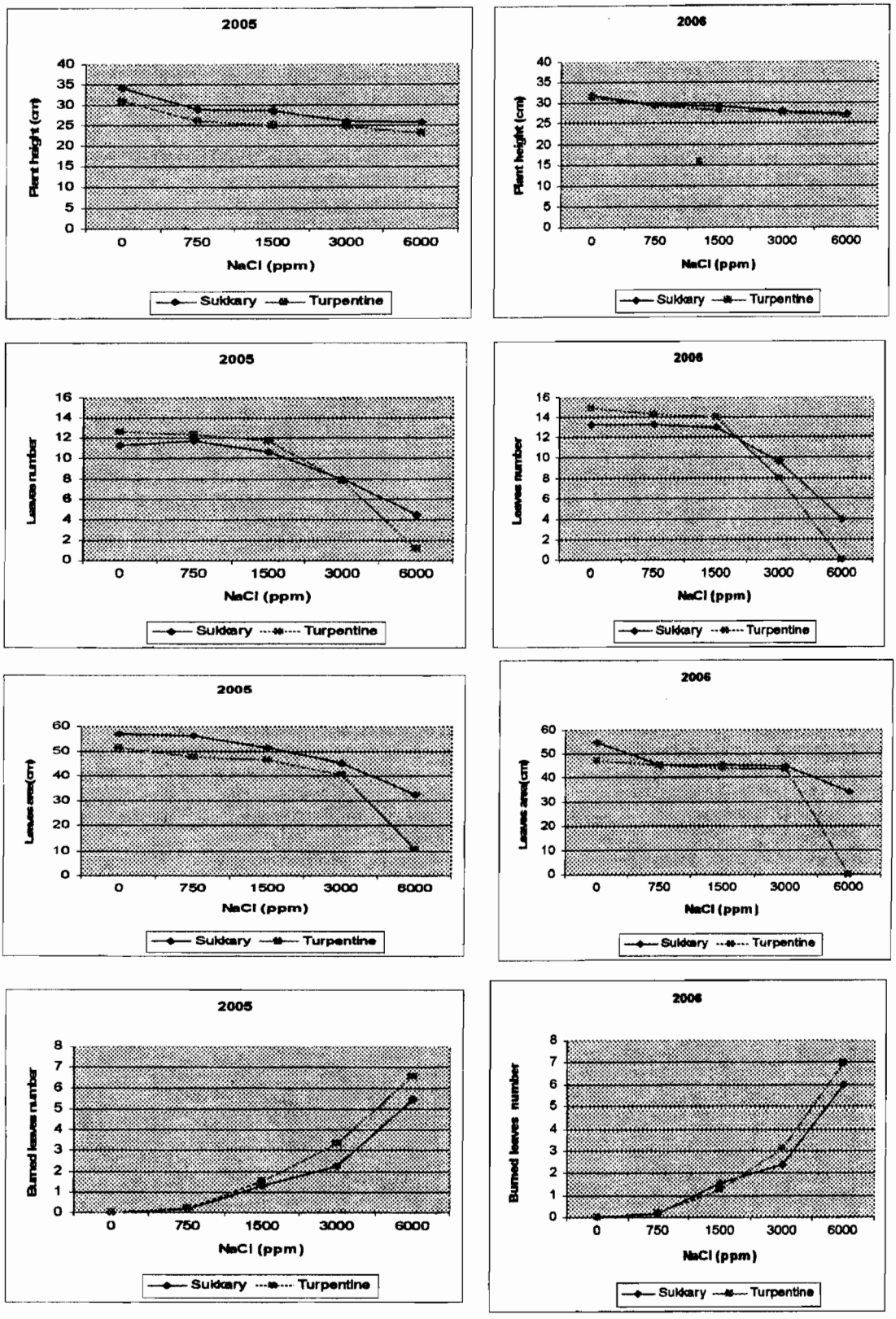

Fig. (1): Effect of NaCl with different concentrations in irrigation water on some growth parameters of two mango cultivars in seasons 2005 and 2006.

2. Effect of salt stress on some leaf nutrient content:

2.1. Na content: % (d.wt.):

Data in Table (2) and Fig. (2) cleared that leaf sodium content significantly and proportionally increased with the increase in concentration of NaCl in irrigation water in the two tested cultivars. The highest values of sodium leaf content was recorded at 6000 ppm of NaCl in irrigation water followed descendingly by 3000, 1500,750 ppm in comparison to control treatment, which showed the least percentage of leaf Na content in the two tested cultivars. Comparing the two tested cultivars, Sukkary seedling leaves significantly showed higher sodium content in the first season than those of Turpentine stock seedling. Insignificant differences were noticed between the two tested cultivars in the second season. Despite that Sukkary leaves accumulated more Na than Turpentine, Sukkary seedling growth was less affected than those of other cultivar. These results are in harmony with that of Jindal *et al.* (1975) who reported that the most vigorous mango seedlings had the lowest content of Na in their leaves. Greenway and Munns, (1980) claimed that ion toxicity caused by accumulation of sodium and chloride in the cell may affect the metabolic process and restrict the plant growth. Flowers *et al.* (1977) reported that the plant cell membrane function may be affected not only by high ion concentrations but also by the proportions of certain ions particularly sodium/ calcium and sodium/potassium.

2.2. Chloride content: % (d.wt.):

Results in Table (2) and Fig. (2) revealed that chloride leaf content of the two tested cultivars increased significantly with increasing salts concentration in irrigation water. The least chloride percentage was recorded in the leaves of the untreated mango seedlings (control) compared with those under different salt treatments. The irrigation with 6000 ppm NaCl solution gave maximum chloride percentage in the leaves compared with other treatments including control. This may indicate that the increase in Cl level in mango leaf was proportional to the increase of its concentrations in the growth media. Comparing the response of the two rootstocks to salinity, the results indicated that Sukkary seedling leaves significantly showed higher chloride content in all salt treatments only in the second season than those of Turpentine cultivar. Insignificant differences between the two tested cultivars were noticed in the first season. Thus, it could be concluded that Cl-uptake into both rootstocks was done equally without any selectivity for chloride. These results are in agreement with the finding of Jindal *et al.* (1979) and Nigam and Misra (2004) who stated that mango seedlings absorbed the ions of Na and Cl in toxic amount. They also reported that accumulation of these ions increased proportionally to the increase of its concentrations in the growth media. Nijjar (1985) cleared that the harmful effect of salinity caused by NaCl on plant growth might be due to the disturbance occurred in ions balance in the soil, which may associated with the absorption lack of calcium. Miller *et al.* (1990) added that Salinity adversely affected the uptake of nutrients through raising osmotic pressure which might be reflected on lowering the movement of water from roots via vegetative portions. Moreover, the effect of salinity caused by NaCl might reduce xylem tissues and number of vessels in xylem which again affect absorption and translocation of nutrients towards vegetative portions which offer another explanation for the inhibiting effect of salinity on the uptake of elements (El-Hammady *et al.*, 1986).

2.3. Potassium content% (d.wt.):

It is obvious from the data presented in Table (2) and Fig.(2) that untreated plants (control) in the two tested cultivars contained higher potassium content in their leaves than those irrigated with saline water. On the other hand, it can be noticed that leaf k content decreased gradually with increasing salt concentrations in the irrigation water from 750 up to 6000 ppm. Sukkary seedling leaves significantly showed higher potassium content than those of Turpentine cultivar. This depressive effect of NaCl on k level in the leaf may explain the competitive effect of Na^+ ions existed in the growth media, which negatively affected the absorption of k ions. These results are in agreement with Rains (1972) who confirmed such a competition between Na and k ions in the growth media. Also, Nigam and Misra (2004) reported that k level content of mango cultivars was decreased by increasing

salt level in the irrigation water. In regard to the function of potassium in the plant, that it is responsible for water and assimilate translocation in the plant, it will be comprehensive to get plant drought after subjecting to salinity stress.

Table (2): Accumulation of some elements in leaves of the two mango cultivars under salt stress.

Variety	Treat.	Na (% d.wt.)		Cl (% d.wt.)		K (% d.wt.)	
		2005	2006	2005	2006	2005	2006
Sukkary	Cont	0.120 i	0.140 i	0.370 f	0.400 h	1.350 a	1.320 b
	750	0.150 h	0.160 h	2.08 e	2.11 g	1.290 b	1.270 d
	1500	0.190 e	0.220 e	2.210 d	2.250 e	1.250 bc	1.237 e
	3000	0.300 c	0.320 b	2.250 cd	2.260 d	1.180 de	1.170 g
	6000	0.340 b	0.350 c	2.810 b	2.940 a	1.110 fg	1.090 i
Turpentine	Cont	0.120 i	0.140 i	0.380 f	0.390 i	1.360 a	1.340 a
	750	0.160 g	0.170 g	2.060 e	2.110 g	1.280 bc	1.290 c
	1500	0.180 f	0.200 f	2.230 d	2.240 f	1.230 cd	1.200 f
	3000	0.270 d	0.300 d	2.300 c	2.310 c	1.150 ef	1.160 h
	6000	0.350 a	0.380 a	2.900 a	2.870 b	1.090 g	1.070 j

Means in each column followed by the same letter are not significantly different

3. Some leaf organic substances under salt stress:

3.1. Leaf proline content (mg/g f. wt.):

Data in Table (3) and Fig. (3) cleared that leaf proline content significantly and proportionally increased in leaves with increasing salt concentration up to 6000 ppm in the two tested cultivars and in the two studied seasons compared with that of control, which showed the lowest values among all treatments. Comparing the proline content in the two studied rootstock cultivars under salinity stress, Sukkary rootstock cultivar showed higher proline content in their leaves than those of Turpentine cultivar in all salinity concentrations and also in control plants in the two seasons. Many workers showed that the amino acid proline greatly increased in plant, which suffered from high salt stress (Stewart, 1972 and Singh *et al.*, 2000). The results are also in harmony with those of Watad *et al.* (1983), who reported that the accumulation of proline was one of the most remarkable metabolic consequences of salinity stress. Singh *et al.* (2000), reported that proline content of grape stem tissue gradually increased by increasing NaCl in the medium up to 200mM. Proline is an osmotically active substances (Stewart, 1972), which may be released from the cells due to shock of stress.

3.2. Total leaf chlorophyll content (mg/g f. wt.):

Data in Table (3) and Fig. (3) cleared that leaf chlorophyll content of the two tested rootstocks significantly decreased by increasing salt concentration in irrigation water. Table (3) and Fig. (3) clearly showed that leaf of control treatment exhibited the highest chlorophyll content, while plants irrigated with saline water at concentration 6000 ppm possessed the lowest level of chlorophyll content. The decreasing in chlorophyll content under salinity stress may be due to the depressive effect of NaCl on leaves tissues as a resultant of the disturbances occurred in plant biological operations. These disturbances may decrease the synthesis of several organic materials. Dubey *et al.* (2006) confirmed these findings as he reported that chlorophyll content depended on the biological processes, plant developmental stages and also on the type and concentration of the salt. He also claimed that chlorophyll content was sharply decreased by increasing salt concentration in irrigation water. Data presented in Table (3) and Fig. (3) also showed insignificant effect for mango cultivar on leaf chlorophyll content in the first season, while the second season showed that leaf chlorophyll content in Sukkary mango cultivar under salt stress was higher than those of Turpentine cultivar. This might reflect the varietals responses to the environment which is vary from season to season.

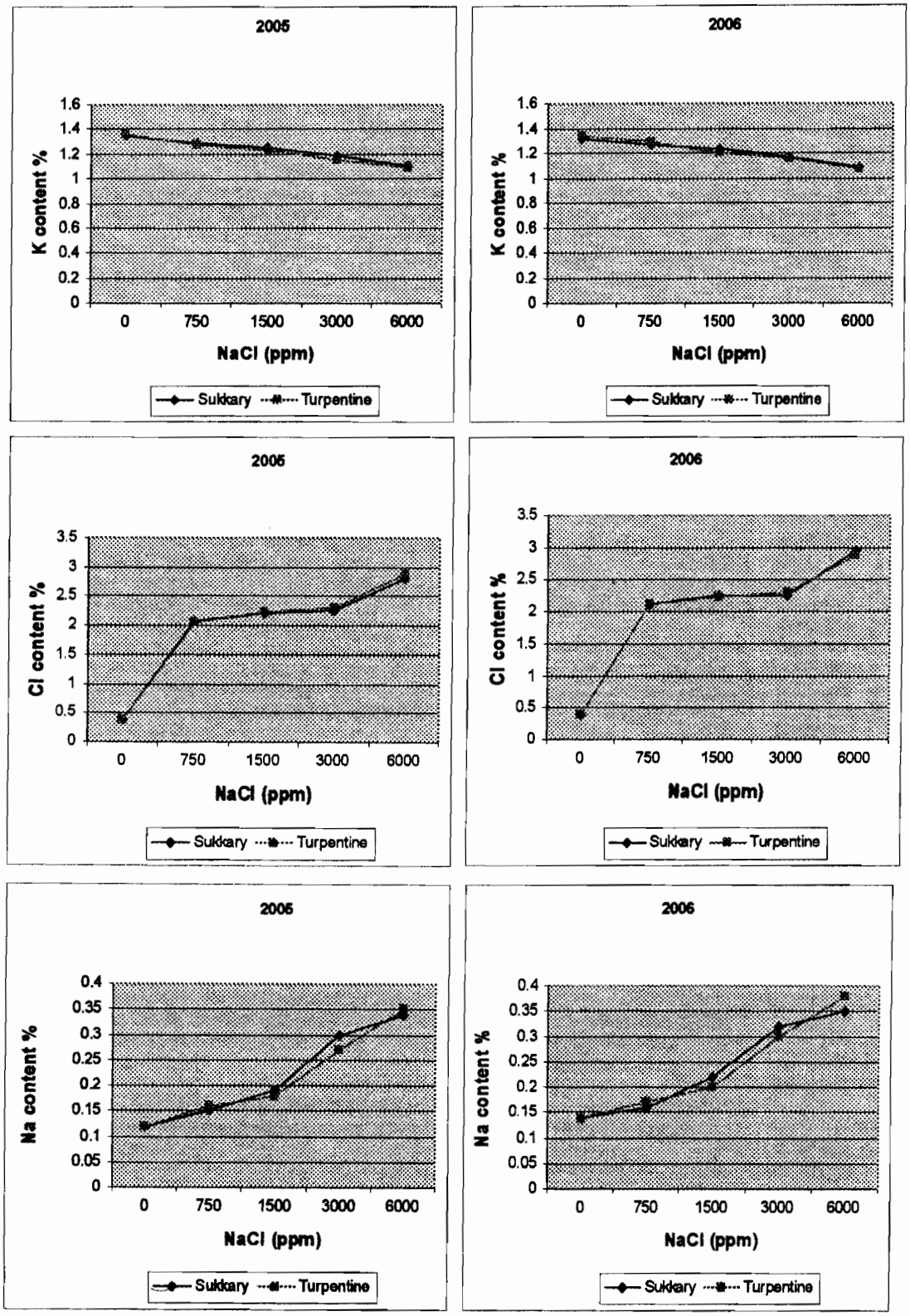

Fig. (2): Effect of NaCl with different concentrations in irrigation water on accumulation of some nutrient contents in leaves of two mango cultivars in seasons 2005 and 2006.

Table (3): Accumulation of some organic substances in leaves under salt stress.

Variety	NaCl (ppm)	Proline (mg/g f.wt.)		Total chlorophyll (mg/g f.wt.)	
		2005	2006	2005	2006
Sukkary	Cont	0.113 g	0.133 h	1.660 a	1.720 a
	750	0.130 fg	0.146 f	1.600 a	1.627 bc
	1500	0.223 de	0.260 d	1.170 b	1.200 d
	3000	0.353 ab	0.346 b	1.130 bc	1.150 de
	6000	0.380 a	0.390 a	1.063 cd	1.083 f
Turpentine	Cont	0.110 g	0.120 i	1.640 a	1.680 ab
	750	0.130 fg	0.140 g	1.597 a	1.610 c
	1500	0.173 ef	0.190 e	1.150 b	1.167 de
	3000	0.256 cd	0.260 d	1.130 bc	1.140 e
	6000	0.310 bc	0.320 c	1.050 d	1.07 f

Means in each column followed by the same letter are not significantly different.

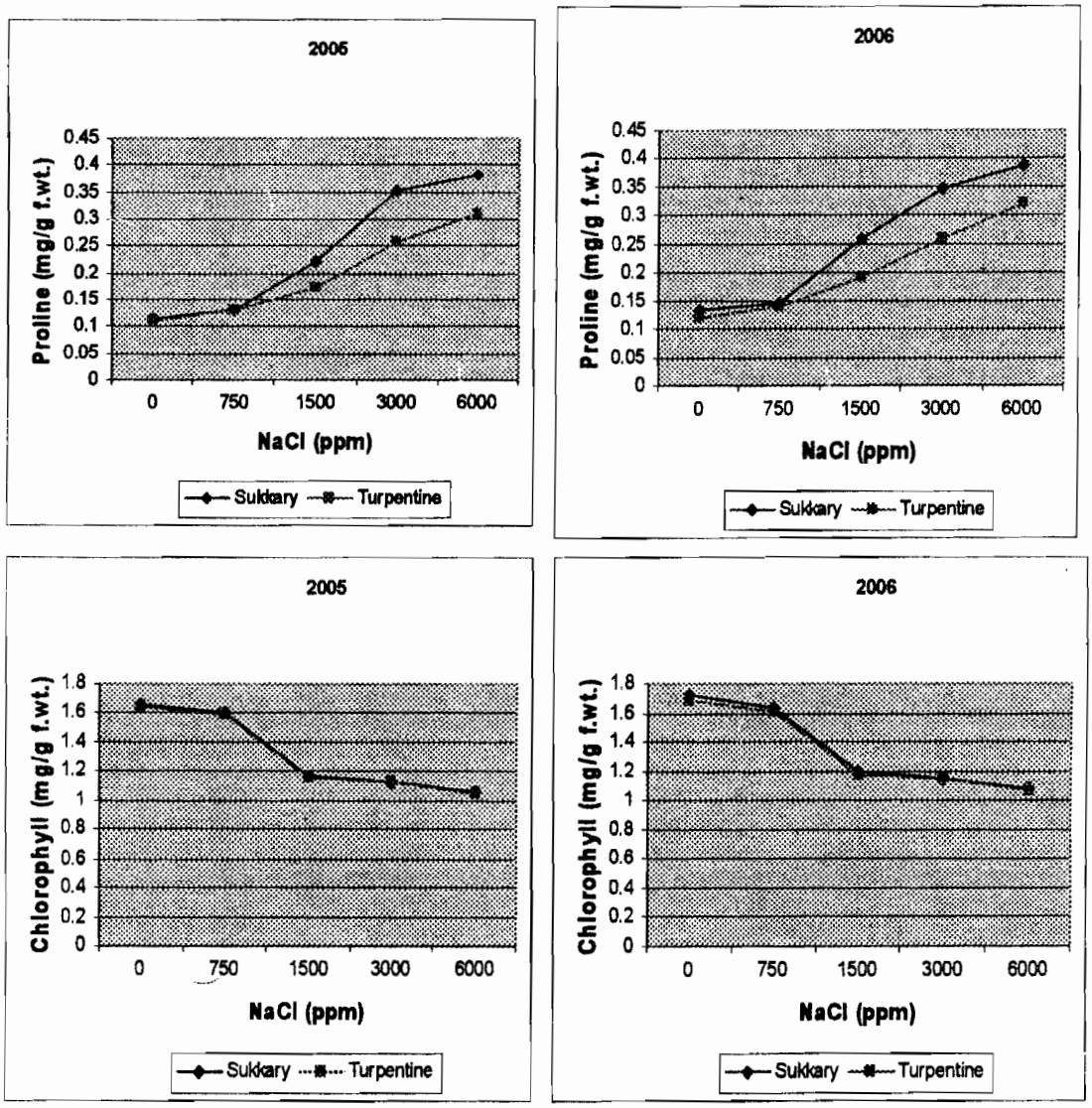

Fig. (3): Effect of NaCl with different concentrations in irrigation water on accumulation of proline and chlorophyll contents in leaves of two mango cultivars in seasons 2005 and 2006.

REFERENCES

A.O.A.C (2000): Association of official agricultural. Official methods of analysis of chemists 17th Ed Gaithersburg, Maryland, U.S.A.

AbdEl-karim, N.Y. (1991): Studies on the effect of salinity on mango seedlings. PhD Thesis, Fac. Agric. Ain Shams Univ., Egypt.

Ahmed F.F. and Morsey M.H. (1999): Anew method for measuring leaf area in different fruit. Minia j. of agric. Res. develops.

Bates, L.S.; Waldren R.P. and Teare, I.D (1973): Rapid determination of free proline for water stress studies. Plant physiology. 39:205-207.

Dubey, AK; Srivastav. M; Singh. R; Pandy, R.N. and Deshmukh, P.S (2006): Response of mango (*Mangifera indica*) genotypes to graded levels of salt stress. Indian Journal of Agricultural Science.76 (11):670-672.

El- Defan, T.AA; El-Ghanam M.M and El-Kishky, S.A. (1999): Assessment of some mango seedling varieties for salt tolerance. Annals of Agricultural science, Moshtohor, Faculty of Agriculture, Zagazig University, Moshtohor, Egypt: 1999. 37:4, 2813-2822.

El-Hammady, M.M.; Abo-El-Atta, D.K. and Salama, M.I. (1986): Anatomical changes in the stem of Sour orange, Cleopatra mandarin and Troyer citrange as affected by high concentration of Na Cl. Proc. First. Hort. Sci. Conf. Tanta Univ. Vol.11:776-8030

FAO (1976):"Water quality for agriculture". Bull. 29. pp.64.

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

Gazit, S. And Kadman, A. (1980): 13/1 mango rootstock selection. Hort. Sci. 15: 669.

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

Hoagland, D.R. and Arnon, D.I. (1950): The water culture method for growing plants without soil. Calif. Agric. Exp. Sta. Circ. 347: 1-32.

Jindal, P.C.; Singh, J.P. and Gupta, O.P. (1975): Screening of mango seedlings for salt tolerance. Haryana J. Hort. Sci., 4 (314):112-115. (Cf. Hort. Abst, 47. (4): 4081).

Jindal, P.C.; Singh, J.P. and Gupta, O.P. (1979): Effect of salinity on the mineral nutrients in mango seedlings. Indian J. Agric. Sci. 49(2): 105-109. (Cf. ESA Information Retrieval Service).

Miller, R.W.; Donahue, R.L. and Miller, D.U. (1990): Soil "An introduction to soil and plant growth" Prentic hall international Inc. Englewood cliffs. New Jersey P.P.:308-339.

Nigam, JK and Misra, K.K. (2004): Uptake and distribution of nutrient ions in salt treated seedlings of mango germplasm. Scientific Horticulture. Scientific publishers, India, 2004. 9: 1-13.

Nigam, J.K and Misra, K.K (2004): Screening of mango (Mangifera indica) seedling germplasm for salt tolerance. Indian Journal of Agricultural Science. Indian council of Agricultural Research, New Delhi, India: 2004.74:3, 138-141. 14ref.

Nijjar, G.S. (1985): Nutrition of fruit trees. Mrs. Usha Raj Kumar for Kalyani Publishers. NewDelhi.

Rains, D.W (1972): Salt transport by plants in relation to salinity. Ann. Rev. plant physiol 23: 367-388.

Saric, M.; Kastrol, R; Caric, R. and Geric, I. (1967): Effect of salinity on some citrus rootstocks. Prak Fiziol. Anjiga, PP: 215 (Hort- Abst. 38:319).

Schaffer, B., Whily, A.W. and Crane, J.H. (1994): Mango. In: Handbook of Environ. Physiol. of Fruit Crops, Vol.11: Sub-Tropical and Tropical Crops. Schaffer, B. and Anderson, P.C. (Eds). CRC Press, Boca Raton.

Singh, S. K.; Sharma, H.C.; Goswami A.m.; Datta, S.P. and Singh, S.P. (2000): In vitro growth and leaf composition of grape vine cultivars as affected by sodium chloride. Biologia Plantarum 43(2): 383-286.

Steel, R.G.D and Torrie, T. H. (1989): Principles and procedures of statistics.N.Y.2 Ed. Mc. Graw Hill, N.Y., U.S.A. Vol. (19) pp 97-105.

Stewart, C.R. (1972): Effects of proline and carbohydrates on the metabolism of exogenous proline by excised bean leaves in the dark. Plant physiol., 5:551.

Watad, A.A.; Reinhold, L. and H.R. Lerner (1983): Comparison between a stable NaCl-selected Nicotiana cell line and the wild type. Plant Physiol., 73:624-629.

النمو والمحتوى البيوكيميائى لشتلات بعض أصول المانجو تحت ظروف الإجهاد الملحى

جمال عبد ربه السيد عبد ربه ، أحمد محمد عبد الرازق

قسم البساتين – كلية الزراعة – جامعة الأزهر – مدينة نصر – القاهرة

أجريت هذه الدراسة على شتلات مانجو عمر سنة وذلك بمزرعة قسم البساتين – كلية الزراعة جامعة الأزهر بالقاهرة خلال موسمى ٢٠٠٥ و ٢٠٠٦ وذلك لدراسة تأثير الإجهاد الملحي علي نمو شتلات أصلين من أصول المانجو هما السكري والتربنتين. وفي هذا فقد تم زراعة شتلا ت عمرها عام من كلا الأصلين في أصص ورويت بالماء المزود بمستويات مختلفة من كلوريد الصوديوم كما يلي صفر، ٧٥٠، ١٥٠٠، ٣٠٠٠ ، ٦٠٠٠ جزء في المليون.

هذا وقد أوضحت النتائج أن هذه المعاملات قد أدت الي نقص في جميع قراءات النمو لكلا الأصلين والمتمثلة في ارتفاع النبات وعدد الأوراق للنبات الواحد ومتوسط مساحة الورقة وكذا عدد الأوراق المحترقة في كل نبات وقد كان هذا النقص متناسبا مع الزيادة في تركيز الملح في ماء الري. كذلك أوضحت النتائج أن نمو الشتلات تحت ظروف الملوحة قد أدى الي نقص محتوي الأوراق من البوتاسيوم وعلي النقيض زيادة تركيز كلا من الصوديوم والكلوريد. أيضا أدي نمو النباتات تحت ظروف الملوحة الي نقص محتوي أوراق النباتات من الكلوروفيل الكلي وزيادة محتواها من الحامض الأميني " البرولين" وهذه الزيادة ارتبطت بزيادة محتوي ماء الري من الملح . أخيرا تعكس النتائج المتحصل عليها أن شتلات الأصل السكري قد أظهرت تحملا للملوحة أكثر من شتلات الأصل التربنتين.