RESPONSE OF SOME NEW PROMISING STRAWBERRY HYBRIDS FOR SALT TOLERANCE

BY

HEBA ZEINELABEDIN IBRAHIM

B. Sc. Agric. (Soil Sci.), Cairo University, 2004

A thesis submitted in partial fulfillment
of
the requirements for the degree of

MASTER OF SCIENCE
in
Agricultural Sciences
(Vegetable Crops)

Department of Horticulture
Faculty of Agriculture
Ain Shams University

2014

Approval sheet

RESPONSE OF SOME NEW PROMISING STRAWBERRY HYBRIDS FOR SALT TOLERANCE

BY

HEBA ZEINELABEDIN IBRAHIM

B. SC. Agric. (Soil Sci.) Cairo University, 2004

This thesis for M.Sc. degree has been approved by:

Dr. Shamel Ahmed Shanan …….
Prof. Emeritus of Vegetable Crops, Faculty of Agriculture, Al-Azhar University

Dr. Usama Ahmed El –Behairy …….
Prof. of Vegetable Crops, Faculty of Agriculture, Ain Shams University

Dr. Mohamed Emam Ragab …….
Prof. of Vegetable Crops, Faculty of Agriculture, Ain Shams University

Dr. Salah El-Din Mahmod El- Miniawy …….
Associate Prof. of Vegetable Crops, Faculty of Agriculture, Ain Shams University

Date of Examination: 17 /6 /2014

RESPONSE OF SOME NEW PROMISING STRAWBERRY HYBRIDS FOR SALT TOLERANCE

BY

HEBA ZEINELABEDIN IBRAHIM

B. SC. Agric. (Soil Sci.), Cairo University, 2004

Under the supervision of:

Dr. Mohamed Emam Ragab
Prof. of vegetable crops, Department of Horticulture, Faculty of Agriculture Ain Shams University (Principal supervisor)

Dr. Salah El-Din Mahmod El-Miniawy
Associate Prof. of vegetable Crops, Department of Horticulture, Faculty of Agriculture, Ain Shams University

Dr. Mahassen Abd El-Hakim Mohamed …….
Chief Researcher Emeritus, Department of Vegetable Crops Breading, Horticulture Research Institute, Agricultural Research Center

ABSTRACT

Heba ZeinEl-Abedin Ibrahim: Response of Some New Promising Strawberry Hybrids for Salt Tolerance. Unpublished M. Sc. Thesis, Department of Horticulture, Faculty of Agriculture ,Ain Shams University. 2014.

This study was conducted in research facilities of Horticulture Research Institute, Agriculture Research Centre, during the period from 2009 to 2011 to study the effect of salinity on growth and yield components of two strawberry cultivars. Plants were grown in pots and irrigated by sodium chloride solution with concentrations of (1000, 1500, 2000, 2500, and 3000 mg/L .Nutrient solution was added with each treatment. Beside, control treatment which was irrigated by only nutrient solution. Data were recorded on vegetative, yielding ability, fruit quality and some chemical constituents. Results indicated that hybrid Genotype y was superior to cultivar Sweet Charlie in most characters studied .i.e. in the first year values of plant height were 12.6 and to 11.7 cm early yield was 30.7 and 21.7gm, total yield was 51.2 and 36.1gm, average fruit weight was 10.2 and 7.22gm and leaf area was 22.2 and 13.5 chlorophyll content was 49.07 and 41.38 for both genotype y and Sweet Charlie respectively. Similar results were obtained in the second year. Higher concentration of sodium chloride solution resulted in reduction in plant height, leaf number and area, number of fruits, early and total yield, average fruit weight and total chlorophyll content. Total soluble solids were not affected by higher salt concentrations up to 2500 mg/L in both years of study for both cultivars, but it was much reduced with the highest concentration 3000mg/L. It can be concluded that Genotype y is a promising cultivar, it can be grown in wide scale cultivation, and it can tolerate moderate salinity.

Key Words: - strawberry, *Fragaria x ananassa* Duch, genotypes, hybrids, salinity, tolerance, response.

ACKNOWLEDGEMENT

First of all, I would like to express my deepest and endless thanks to **"ALLAH**" for his great guidance, care and immortal help through my whole life.

I'm deeply indebted to **professor. Dr. Mohamed Emam Ragab,** prof of vegetable crops and Vice Dean for Community Service and Environment Tnimah, Ain Shams University, for suggesting the research work, kind supervision, his faithful encouragement, valuable advice and guidance during the progress of this study until the preparation and writing this manuscript.

I'm grateful to **Dr. Salah El-Din Mahmoud El- Miniawy** prof. of Vegetable crops and Director of Strawberry and Non –Traditional Crop Center, Faculty of Agriculture, Ain Shams University for his supervision, great support and continued help during the preparation of this work.

I would like to thank **Professor. Dr.Mahassen Abd El-Hakim Mohamed**, vegetable Breeding Research., Horticulture Research Institute, Agriculture Research Center , for her valuable help and suggesting the research work, kind supervision, her faithful encouragement, valuable advice and guidance during the progress of this study until the preparation and writing this manuscript.

Deepest and sincere gratitude are also , extended to **Prof .Dr** of Soil Science, **Mohamed Seif El-Din Abd-ElWahed** Department of Soil Science, Faculty of Agriculture, Ain Shams University. for his help and advice of this thesis.

My sincere thanks to all staff member of Vegetable Breeding Research Department Horticulture Research Institute Dokki, Giza for their useful cooperation

I would like to express my sincere thanks, my appreciation and my gratitude to **My Mother** and my **Sisters** for their endless help, support continuous encouragement.

Finally, I would like to especially thank **My Husband** and **My Father** God's mercy on them and makes this science in the balance of good deeds.

CONTENTS

LIST OF TABLES

Page

LIST OF FIGURES

Page

1-INTRODUCTION

Strawberry (*Fragaria x ananassa* .Duch.) is considered one of the most important vegetable crops for local consumption and export in Egypt. Because of the definite market windows and the strong demand existed in Europe during the months from late November until late march.

The total area grown with strawberry in Egypt is 13206 feddan in both old and new reclaimed lands, as reported by Bulletin of the agriculture statistics, January 2012.This area produce 237432 ton annually with average of 17.979 ton per feddan.

Salinity stress has become an important problem regarding agricultural production in many regions of the world especially in arid and semi-arid regions. As the world population continues to expand, the use of brackish water for irrigation may be necessary. One way to overcome these problems is through the use of improved crops that are tolerant to the saline conditions **(Esensee *et al*., 1990).**

It is known that salt accumulation in soil and salt concentration of irrigation water encourage stain formation on leaves, weak vegetative growth and weak fruit production in strawberries(**Kepenek and Koyuncu, 2002, D'Anna *et al.* 2003, Keutgen and Keutgen, 2003 and Saied *et al*, 2005)**. Furthermore, it is known (**Ondrasek *et al*., 2006)** that they have forcing effects on stolen production**.**

In the classification, which is done by considering as growth leaves of plants under saline condition, it was seen that strawberry takes place among most sensitive plant species **(Maas and Hoffman, 1977, Bould *et al*. 1983).** However, it was observed that strawberry cultivars were not affected at identical levels in case of identical salt concentrations

(**Saied *et al*., 2003, Casierra –Posada and Garcia, 2005, Turhan, and Eris, 2002).**Besides, genetic characteristic of strawberry cultivars (**Dziadczyk *et al*.2003)**,type of salt and certain conditions in root section (**Barroso and Alvarez,1997, Kaya *et al*.,2001)** have effects on damage threshold. Strawberry plant is seriously damaged by them. It is expressed that Na^+ and Cl^- ions

accumulation in leaves are the most important factors affecting formation of salt damages **(Barroso and Alvarez, 1997)**

The aim of this experiment is to study the performance of two strawberry cultivars under different salt concentrations.

2- REVIEW OF LITERATURE

2-1- Vegetative growth characteristics:-

2-1-1-Plant height (cm):-

Kepenek and Koyuncu, (2002) Found that plant length of strawberry was reduced by salinity at levels between 10-16 m moll- NaCl. The responses of Gloria strawberry cultivar showed a slow decrease regenerated as stated by **Saied *et al.* (2003), Casiera-Posada and Garcia (2005)** .They concluded that salt-borne damages caused very rapid variations in vegetative characteristics considering variations in vegetative characteristics, and stated that plant height of strawberries differ under salinity between different cultivars. It's known that strawberry plant is one of the most sensitive plants to salinity of soil and water.

2-1-2-Number of leaves:-

Kepenek and Koyuncu (2002) working on strawberry reported that drying which expanded from edges of existing leaves through inside them was observed in higher salt concentrations .Avery significant decrease occurred in leaf surface area and accordingly fresh and dry leaf weights of Kabarla cultivar in 1500 mgl^{-1} application. This situation is an important indicator for damages from salt and also employed to characterize excessive salt damage in agreement with, regenerated by **Casiera-posada and Garcia (2005a). Saied *et al.* (2005)** who found that the effect of salinity was more severe in Elsanta than Korona cvs..The shoot/root ratio remained fairly constant in both cvs. with the exception of Elsanta at the higher salinity level. They attributed this decrease to leaf loss. They added that Korona was more tolerante to salinity than Elsanta. **Gulen *et al.* (2006**) concluded that leaf damaged in some strawberry cultivars when subjected to 34 mM NaCl treatment, could be attributed to reduction in total soluble protein content by salinity (from 11.35 to 5.86mg Dw in Tioga and from 9.35 to 3.90 mgg^{-1} Dw in Chandler cultivars). Reduction in leaf number and leaf area were recorded in cv. Camarosa. **Rahimi and Biglarifard (2011**) concluded that significant reduction in Fe content of 40 and 49% in root and shoot tissue respectively, due to NaCl salinity at 90 mM. They considered Camarosa is a salt sensitive plant. Total dry

weight accumulation in plants was not inhibited at low salinities, but it was significantly inhibited at 60 mM NaCl. Dry mass (DM) partitioning in NaCl-stressed plants was in favor of crown and petioles and at the expense of root, stem and leaf, whereas leaf, stem and root DM progressively declined with an increase in salinity. Specific leaf area (SLA) and leaf area ratio (LAR) significantly decreased in cv. 'Camarosa' at 60 and 90 mM.

2-1-3-Leaf area:-

Munns and Termeat (1986) reported that the reduction in leaf growth is the earliest response of glycophytes to salinity stress, which was related to a small photosynthetic area. The smallest leaf area was found in the NS treatment, which not only correlated to the inhibitory effects of NaCl, but also to the plants' defoliation. **Kepenek and Koyuncu (2002)** found that new leaves of strawberry cvs; Kabarla and Gloria did not develop sufficiently and stayed small in higher salt concentration (1500ppm). They recorded very significant decrease in leaf surface area and accordingly fresh and dry leaf weight**.** This was confirmed by **Dziadczyk *et al*., (2003) ,Casierre-Posada and Garcia, (2005). Yildiz *et al*. (2008)**, added that the genetic constituents of different cultivars is important in clearance or sensitivity to different levels of salinity. Degradation of chlorophyll agree with the results obtained by **Yilmaz and Kina (2008)**, **Tehranifar *et al.* (2009) and Khayyat *et al*.(2009)** who found that sodium and chlorine toxicity, calcium deficiency and accumulation of ions in tissues under NaCl stresses resulted in limited gas exchange. **Bisko *et al.* (2010)** concluded that damage degree of leaves can be used as a best indicator for initial selection of tolerant genotype. **Khayyat *et al*. (2011)** mentioned that because plants faced higher salt concentration, their cell membrane structure and activity got disturbed and that higher rates of elements flowed into plant organs. They added that gas exchange activities by leaves, increases the movement of nutrient elements into this organ. This result was in agreement with findings of **Saied *et al*. (2003)**

2-1-4-Number of fruits:-

Yilmaz and Kina (2008) found that cultivar Kabarla grew better under saline conditions (up to 1500ppm) compared to the control Gloria. They added that plant ion accumulation rations of K^+/Na^+ and Ca^{+2}/Na^+ had significant effects on plant performance under salt stress. These results indicated that higher Na^+ ion accumulation and ion accumulation ratios of K^+/Na^+ and Ca^{+2}/Na^+ were obtained in case of cv. Kabarla which were understood to grow better under saline conditions

2-2-Yield components:

2-2-1-Early yield (g/plant):-

Michell *et al*.(1991) working on tomato found that reduction in fruit number by salinity was due to reduction of fruit number and fruit weight. These results agree with **Yahiya *et al*. (1995)** and **Giuffrida *et al*.(2001)**, **Saied *et al*. (2005)** and **(Khayyat *et al*. ,2007))** in strawberry. **Awang *et al*. (1993)** reported reduction in fruit yield in strawberry, but fruit quality was improved at moderate salinity stress, because the concentration on reducing sugar and acids increased on a fresh weight basis due to decreasing fruit water content.

2-2-2- Total yield (g/ plant):-

Awang and Atherton (1995) observed that an increase in the EC of nutrient solution from 2 to 8 dS/m was associated with a reduction of approximately 60% in fruit production. **Barroso and Alvarez** (**1997)** concluded that the increase in the dead plant percentage could be explained by a progressive accumulation of Cl^- in plant tissue. and also by an increase in maximum air vapour 677 pressure deficit from the beginning to the end of growing period (from 1.8 to 2.4 kPa) which can emphasize negative effects of salt stress (Li, 2000).When considering the components of marketable yield, both fruit number and unit fruit weight were negatively affected, the relative reduction due to the increasing of nutrient solution EC was similar for both parameters, being 56 and 52 % respectively. The effect on yield due to salinity was correlated with the length of harvesting period **Giuffrida *et al*.(2001)** They attributed yield reduction from salt stress to reduction