IMPROVING FRUIT CRACKING RESISTANCE Of WONDERFUL POMEGRANATES

By

MAI HASSAN ISMAIL HASSAN Al-RIFAI
B.Sc. Agric. Sc (Horticulture), Ain Shams University, 2012

A Thesis Submitted in Partial Fulfillment
Of
The Requirements for the Degree of

MASTER OF SCIENCE
in
Agricultural Sciences
(Pomology)

Department of Horticulture
Faculty of Agriculture
Ain Shams University

2018

Approval Sheet

IMPROVING FRUIT CRACKING RESISTANCE Of WONDERFUL POMEGRANATES

By

MAI HASSAN ISMAIL HASSAN Al-RIFAI
B.Sc. Agric. Sc. (Horticulture), Ain Shams University, 2012

This Thesis for M.Sc. Degree has been approved by:

Dr. Hassan Mohmoud Korkar ………………………..
Prof. of Horticulture, Higher Institute for Agriculture Co-Operation

Dr. Hassan Fadel Elwakeel ………………………..
Prof. Emeritus of Pomology, Faculty of Agriculture, Ain Shams University

Dr. Eman Shaker Sawiris ………………………..
Head Research Emeritus, Land and Water Research Institute, Agricultural Research Center

Dr. Nazmy Abd Elhamid Abd Elghany ………………………..
Prof. of Pomology, Faculty of Agriculture, Ain Shams University

Date of Examination: / /2018

IMPROVING FRUIT CRACKING RESISTANCE Of WONDERFUL POMEGRANATES

By

MAI HASSAN ISMAIL HASSAN Al-RIFAI
B.Sc. Agric. Sc. (Horticulture), Ain Shams University, 2012

Under the supervision of:

Dr. Nazmy Abd elhamid Abd Elghany
Prof. of Pomology, Department of Horticulture, Faculty of Agriculture, Ain Shams University (Principal Supervisor).

Dr. Eman Shaker Sawiris
Emeritus Chief Researcher, Land and Water Research Institute, Agricultural Research Center

ABSTRACT

Mai Hassan Ismail Hassan: Improving Fruit Cracking Resistance of Wonderful Pomegranates. Unpublished M.Sc. Thesis, Department of Horticulture, Faculty of Agriculture, Ain Shams University, 2018.

The present investigation was carried out in two successive seasons of 2015 and 2016 on Wonderful“ Pomegranates trees grown in sandy soil under drip irrigation system in a private orchard located at Giza governorate, Egypt . Trees were sprayed two times (at fruits size 8-10 mm & re- spraying at one month later) with Potassium silicate at (2500 & 5000 ppm) , Boron at(5 &10%), Kaolin (1 &2%) , Zinc oxidase (1000 & 2000 ppm) with wrapping as a commercial treatments . of “wonderful” to improve fruit cracking resistance “Wonderful“ pomegranates and evaluate their effects upon yield components, physical, chemical fruit properties and market conditions at 20 ± 2 °C(15 days).

Results indicated that the “Wonderful“ pomegranates cultivar had the highest values of fruit weight and the minimum cracking values were obtained by spraying boron at (5 %) and potassium silicate at (5000 ppm) in both seasons and this treatments gave the maximum values with total yield /tree,/feddan and marketable yield /tree,/feddan .Meanwhile ,number of arils per fruit ,total soluble solids , total sugar ,total acidity , (arils)/fruit weight was not affected but when fruits treated with wrapping, without wrapping and zinc oxidase at (1000 ppm) sprays gave the minimum mentioned above characteristics. However , fruit weight , arils weight , ascorbic acid, anthocyanin and tannins %were increased as influenced by foliar spraying with all treatments in both studied seasons.

For the marketing experiment, preserve the fruits at 20 ± 2 ° C for 15 days. The treatment of trees with potassium silicate at 5000 & 2500 ppm as well as spraying with boron at a rate of 5 & 10% exhibited the highest values for sensory tests of fruits of taste,

As well as the highest values for the qualities of physical fruits of the peel thickness, hardness of fruits, the proportion of juice and the least in loss by weight

In addition to the highest values of chemical qualities such as solid soluble substances, ascorbic acid, anthocyanins and the least in the content of tannins & total acidity. The comparison treatment was given by covering and without cover. No significant differences between kolenite 1 & 2% and zinc oxide 2000 and potassium silicate 2500 ppm Which gave intermediate values for the studied traits and for both experiments

Therefore, boron at 5 % and Potassium silicate at 5000 ppm treatments could be recommended for improving Wonderful pomegranate cvs performance in cracking resistance alternative treatments to fruit wrapping under similar conditions

Keywords: Pomegranate (*Punica granatum* L. wonderful), Foliar spray, Potassium silicate, Kaolin, Zinc oxidase, Boron, Market conditions, Fruit cracking, Fruit quality pomegranates.

ACKNOWLEDGEMENTS

I would like to express my deepest gratitude thanks and appreciation to **Prof. Dr. Nazmy Abd El-Hamed Abd El-Ghaney,** Professor of Pomology, Faculty of Agriculture, Ain Shams University my supervision,. He steered me in the right the direction whenever he thought I needed it, endless advice and constructive criticism during the whole work and help during the course of this study and during preparation the manuscript.

I wish to offer my sincere gratitude to **Prof. Dr. Eman Shaker** Agricultural Research Center, Horticulture Research Institute for her for suggesting the current study and his supervision.

Great thanks are offered to **Dr. Samah Nasr** Researcher at the Higher Institute for Cooperation on Agriculture - Shubra Al Khaimah my second mother for her rich constructive information and great efforts, valuable suggestions, and all her love and appreciation for this work.

To my late beloved father **Hassan Ismail** thank you for showing me that the key to life is enjoyment. To my presence and my enlightenment, which enlightens me. But I can only pray to God to keep your to live the highest Jinan. I give you this success and every success that has not been achieved without your principles has not been achieved. My mother **Jasmine,** my sister **Bata, Menesh** , especially the gift that guided me by our Lord at the time of my plight and my sadness my future husband, **Eng- Mohamed Mokhtar**, I am sure this thesis would never have been completed. , my friends and colleagues in Dept. of Horticulture, Faculty of Agriculture, Ain Shams Univ., for their help, encouragement, co-operation and friendly atmosphere throughout the period of my study.

CONTENTS

LIST OF TABLES

LIST OF FIGER

INTRODUCTION

Pomegranate (*Punica granatum* L.) belongs to family Punicaceae, considered one of the oldest cultivated trees in the history of the world cultivated about 5000 years ago. Although it is one of the oldest known edible fruits and is capable of growing in different agro-climatic conditions ranging from the tropical to subtropical.

It is highly suitable for growing under arid and semiarid regions due to its versatile adaptability, hardy nature, low cost maintenance and high returns **(Al-Maiman and Ahmad, 2002) & Sarkhosh *et al*., 2006 and Hamouda *et al* 2015.**

Pomegranate fruits are widely consumed fresh or processed into juice, jams, syrup and sauce. The edible portion (arils) of fruit is about 55 – 60% of the total fruit weight and consists of about 75 – 85% juice and15 – 25% seeds **(Hamouda *et al* 2015).** It is a known fact that some fruits crack during the latter period of growth. Cracking causes a major fruits loss, which is a serious commercial loss to farmers. Fruit cracking, seems to be a problem that lessens application of some micronutrients such lessens the marketability to a great extent. Fruit cracking is one of the physiological on pomegranate fruit is very scanty.

Fruit cracking is a serious problem in pomegranate which hinders its cultivation to a large extent. Cracking varies from 10 to 70% depending upon the prevailing environmental conditions. Various factors are responsible for fruit cracking which include fluctuation in soil moisture regimes, climate, tree nutrition and cultivars . Cracked fruits lose their value for the fresh market and are used for processing only as fruit juice if not affected by fungi. Cracked fruits are susceptible to storage disease and have a shorter storage as well as shelf-life (**Hegazi *et al* 2014**).

INTRODUCTION

Fruit bagging is one of the most effective techniques to produce high quality, pollution-free fruits and got more attentions to the fruit producers during the recent decades were obvious. The quality of fruit bagging has been getting better and better. The effect of bagging on appearance quality (brightness, color, size and weight of single fruit), the quality of fruit contents such as total soluble solids, titrable acids, vitamin C, become more apparent procedure Also, the influence of bagging on fruit maturity period, storage property, protection of plant disease, insect pets, and sunburn **(Jing *et al.*, 2009)**. However **Bambal *et al* (1991)** found that foliar application of some micronutrients such as Si, B, ZnO, and K increased fruit yield, whereas B reduced the percentage of cracked fruits. Although, the effect of foliar applied chemicals on yield and fruit quality have been studied by many workers the information of such effect on pomegranate fruit is very scanty. **(Hasani *et al* 2012).**

Kaolin is an important material used in this concern, it is considered as an effective natural anti transpirant and was reported to mitigate the negative effects of water deficiency and environmental stresses, such as heat stress and sunburn damage as well as suppress diseases and protect crops from insect pests **(Kahn and Damicone, 2008).** Spraying tomato plants with 5% of kaolin suspension improved water status and yield under water stress conditions **(SrinivasaRao, 1985). Creamer *et al.* (2005)** illustrated that applications of kaolin at hot temperatures might help hot Chile pepper plants from being subjected to severe water stress. the main role of potassium is the activation of many enzyme systems involved in the structure of organic substances and promotes photosynthesis and transport of the assimilates of the carbohydrates to the storage organs.

In addition, K is involved in several basic physiological functions. It resulted also in improving the fruit quality parameters, i.e., TSS %, Total sugars and coloration **(Wahdan *et al* 2011).** These effects might be dedicated to the potassium role in increasing tolerance to stresses and improving the formation and accumulation rates of sugars (**Saleh & Abd El-Monem. 2003)**.

Silicon (Si) is the second abundant element in the crust of earth and in plants in which its content in plant is %0.1 to %10 of dry weight. **(Hassan *et al* 2013).**

Although silicon is not considered an essential element for plant nutrition, many authors report on beneficial effects when its supply to various cultivated plants is enhanced. In most cases, the favorable effects of Si on crop plants seem to originate from reinforcement of the cell walls due to deposition of Si in form of amorphous silica ($SiO_2 .nH_2O$) and opal phytoliths **(Stamatakis *et al* 2003).** Moreover, the mechanical strength provided by Si to the plant tissues increases their resistance to several bacterial, fungi and insect diseases **(Epstein 1999).** Si has been reported to generally improve plant growth, a feature linked to the ability of Si to balance nutrient uptake or the general enhancement of nutrient transport and distribution by Si (**Bertling *et al* 2009**) **.**The most commonly used from of Si in agricultural commodities is currently potassium silicate (K_2SiO_3), although other products, such as calcium ($CaSiO_3$) and sodium silicate (Na_2SiO_3) as well as NonTox-silica are available. However, as these products are either less soluble than KSil or, like Na, might affect fruit quality negatively **(Bertling *et al* 2009).**

Zinc is an essential component of some enzymes such as dehydrogenase, proteinase and peptidases. In this regard, zinc can affect electron transfer reactions such as the Crebs cycle and energy production of the plant. Zinc is also involved in other reactions such as protein construction and analysis **(Bose *et al*., 1988)**. According Suayn idea, total amount of zinc in soils is normally in the range of

300-100 ppm.). Although the effect of zinc on tree growth is not directly, but its indirect effect should be considered. Zinc is a prerequisite for making tryptophan and trryptophan is the raw material for making auxin and auxin plays an important role in increasing the leaf area and tree canopy (**Supriya *et al.*, 1993).**

Zinc and boron have promising effect on plant metabolism. They are responsible for producing the natural hormones IAA, activating some enzymes biosynthesis of chlorophylls, enhancing germination of pollens and regulating water uptake by plants **(Nijjar, 1985)..** Foliar application of nutrients, especially boron and zinc was essential for producing healthy fruit trees as well as producing productive trees. In addition, they are responsible for improving physical and chemical parameters of fruits (**Bahadur *et al* 1998**). Zinc is a cofactor of over 300 enzymes and proteins and has an early and specific effect on cell division, nucleic acid metabolism, and protein synthesis. It is an essential trace element for plants, being involved in many enzymatic reactions and is necessary for their good growth and development. Zinc is also involved in regulating the protein and carbohydrate metabolism **(Swietlik, 1999) .**

Storage temperature and relative humidity are important environmental factors Stellenbosch affecting postharvest life of fresh fruit because they regulate the rate of all associated physiological processes, biochemical reactions and microbial growth **(Li & Kader, 1989; Al Mughrabi *et al*., 1995)**. Previous reports have shown that physiological, physicochemical, phytochemical, mechanical, microbial and sensory qualities of pomegranate fruit are influenced by storage temperature, packaging and atmospheric conditions **(Gil *etal.*,1996; Fawole&Opara, 2013).** Changes in TSS contents in pomegranate during storage varied, depending on storage conditions, cultivar