PRE AND POSTHARVEST TREATMENTS TO ENHANCE SWEET PEPPER (*CAPSICUM ANNUUM* L.) PRODUCTIVITY AND QUALITY

By

MOHAMED AHMED AHMED ABDALLA

B. Sc. Agric. Sc. (Horticulture), Ain Shams University, 2001

M.Sc. Agric. Sc., (Vegetable), Ain Shams University, 2008

A thesis submitted in partial fulfillment

of

the requirements for the degree of

DOCTOR OF PHYLOSOPHY

in

Agricultural Science

(Agriculture in Desert and Salt Affected Areas)

Arid Land Agricultural Graduate Studies and Research Institute

Faculty of Agriculture

Ain Shams University

2013

Approval Sheet

PRE AND POSTHARVEST TREATMENTS TO ENHANCE SWEET PEPPER (*CAPSICUM ANNUUM* L.) PRODUCTIVITY AND QUALITY.

By

MOHAMED AHMED AHMED ABDALLA

B. Sc. Agric. Sc. (Horticulture), Ain Shams Uni., 2001

M.Sc. Agric. Sc., (Vegetable), Ain Shams Uni., 2008

This thesis for Ph.D. degree has been approved by:

Dr. Samir Osman El-Abd .....

Research Prof. Emeritus of Vegetable Crops, National Research Center

Dr. Ayman Farid Abou-Hadid .....

Prof. Emeritus of Vegetable Crops, Faculty of Agriculture, Ain Shams University.

Dr. Hany Abduallah Mohamed Sror .....

Assistant Professor of Biochemistry, Faculty of Agriculture, Ain Shams University.

Dr. Usama Ahmed El-Behairy .....

Prof. of Vegetable Crops, Faculty of Agriculture, Ain Shams University.

Date of Examination: 14/9/2013

PRE AND POSTHARVEST TREATMENTS TO ENHANCE SWEET PEPPER (*CAPSICUM ANNUUM* L.) PRODUCTIVITY AND QUALITY

By

MOHAMED AHMED AHMED ABDALLA

B. Sc. Agric. Sc. (Horticulture), Ain Shams University, 2001

M.Sc. Agric. Sc. (Vegetable), Ain Shams University, 2008

Under the supervision of:

Dr. Usama Ahmed El-Behairy

Prof. of Vegetable Crops, Department of Horticulture, Faculty of Agriculture, Ain Shams University. (Principal Supervisor)

Dr. Hany Abduallah Mohamed Sror

Assistant Prof. of Biochemistry Department of Agricultural Biochemistry, Faculty of Agriculture, Ain Shams University.

Dr. Rawia EL-Bassiouny Ibrahim

Head of Research Emeritus of Vegetable Handling, Horticulture Research Institute, Agricultural Research Center.

ACKNOWLEDGEMENT

First and foremost, I would like to express my deepest grateful and thanks to Allah, the God Almighty, for his continuous blessings.

My heartfull thanks and gratefulness are extended to **Prof. Dr. Usama Ahmed El-Behairy,** professor of Vegetable Crops, Faculty of Agriculture, Ain Shams University for constructive guidance and continuous advise, kind help, follow up and valuable constructive ideas.

Great thanks are expressed to **Prof. Dr**. **Rawia EL-Bassiouny Ibrahim,** head of research emeritus of Vegetable Handling, Horticulture Research Institute, Agricultural Research Center for his constructive supervision, follow up and valuable helping throughout this study.

Deepest and sincere gratitude and appreciation to **Dr. Hany Abduallah Mohamed Sror,** associate professor of Biochemistry, Faculty of Agriculture, Ain Shams University for his constructive supervision and support during this work.

I am grateful to **Prof. Dr**. **Said Zakaria Abd El-Rahman,** head of research emeritus of Vegetable Handling, Horticulture Research Institute, Agricultural Research Center for his continuous supervision and encouragement during this study.

My heartfull thanks and sincere appreciation to **my family** for their helpful support and encouragement allover my life.

Then my deepest gratitude is due to **my wife Huda** for her continuous unconditional love, support, encouragement, and guidance throughout my life, without which I wouldn't be able to finish this work.

CONTENTS

LIST OF TABLES

ABSTRACT

Mohamed Ahmed Ahmed Abdalla: Pre and Postharvest Treatments to Enhance Sweet Pepper (*Capsicum annuum* L.) Productivity and Quality. Unpublished Ph.D. Thesis, Department of Arid Land Agricultural Graduate Studies and Research Institute (ALARI), Faculty of Agriculture, Ain Shams University, 2013.

This study was conducted at the vegetable research farm of Horticultural Research Institute, Agriculture Research Center and De Bruin Farm, Wadi Natrun, Elbehira Governorate, Egypt during 2009/2010 and 2010/2011. Environmental condition in greenhouses affected pepper productivity and quality. Also, postharvest treatments can extend the shelf life of pepper crop. This study aims to evaluate the effects of solar UV radiation on the behavior and production of sweet pepper. Seedlings were grown in green houses and exposed to tow different UV treatments created by using tow different types of plastic films transmitted different levels of solar UV (4% in UVL and 83% in UVT) and compared to regular plastic film without any thermal or diffusion properties as control. Tow types plastic film transmitted the same level of photosynthetic active radiations and have the same thermal and diffusion properties. In addition, the effect of some post-harvest treatments, packing materials and storage period on quality of sweet pepper fruits during storage was investigated. The results show that the sweet pepper exposed to low level of solar UV showed the best plant vegetative and generative growth. The vegetative growth parameters (plant height, stem diameter, number of branches per plant, number of leaves per plant, total leaf area, plant fresh and dry weight) in pepper plants grown under UVL films was higher than other treatments. The generative growth parameters i.e. yield parameters (fruit weight, fruit diameter, fruit length, flesh thickness, number of marketable fruits per plant at harvest, number of fruits per plant at harvest, total fruits marketable yield per plant and total yield kg/plant) of UVL treatment were significantly higher than that of other two treatments in both seasons . For the postharvest experiment this study aims to increase the storage period of pepper by using postharvest safe treatments including

dipping in the solution of 5% hydrogen peroxide (H_2O_2) for 5 minutes and hot water at 45˚C for 2 minutes .The effects of these treatments on fruit quality were compared with the effects of tap water for 5 minutes which served as control. after that fruits from every previous treatment were packaged in different packaging perforated polyethylene bags (PE) 30 micron thickness, (38 x25 cm in size) with 6 holes (each 5 mm in diameter) for a total 0.0082% perforation, or Packed in polypropylene films (PP) 20 micron thickness (38 x 25 cm) in size, compared with un packed fruits was served as control. The obtained data of pepper fruits showed that dipping for 5 minutes in 5% hydrogen peroxide H_2O_2 led to the lowest weight loss percentage, decay. Also H_2O_2 treatments improved general appearance of pepper fruits, maintained fruit firmness, dry matter content, total soluble solids (TSS), ascorbic acid, chlorophyll content and total sugars. Polyphenol oxidase (ppo) activity was inhibited by H_2O_2 treatments and hot water treatment. Data also showed that packing by polypropylene film (PP) and polyethylene bags (PE) gave the best value of weight loss percentage, decay, general appearance, maintained fruit firmness, dry matter content, total soluble solids (TSS), ascorbic acid, chlorophyll content, total sugars and reduced polyphenol oxidase (ppo) activity at the end of storage compared with unpacked. The results clarify that dipping of pepper fruit in H_2O_2 5% for 5 minutes with packing by polypropylene film (PP) can be considered the most effective postharvest treatments due to maintaining the good appearance, fruit firmness , dry matter content and other tested parameters. In conclusion, the results indicated that H_2O_2 treatments and hot water treatment can be used to extend the storage period and maintain the quality of pepper fruit up to 35 days storage period.

Key Words:

Sweet pepper - *Capsicum annuum* L. - Greenhouse - Ultraviolet transparent - Thermal heat barrier - Packing film - Polyethylene bags - Polypropylene film - Storage period – Quality.

1- INTRODUCTION

Sweet pepper is one of the most important vegetable crops cultivated under protected cultivation in Egypt. Production of pepper from greenhouses in Egypt is used for exportation and local consumption. To produce sweet pepper under greenhouse conditions, seeds must be sown from 15th of June till 15th of July and seedlings of sweet pepper must be transplanted in the greenhouses during August. Depletion of stratospheric ozone layers is leading to increase UV radiation reaching earth's surface. Egypt is exposed to a high level of solar UV radiation due to its geographical position. Although, UV is only a minor component of solar radiation its potential to cause biological effects on plants is higher than other radiations due to its high energy. During early stages of plant growth, sweet pepper seedlings are suffering heat and light stresses and exposed to high level of UV solar radiations. The high temperature and high solar radiations in July and August inhibit seedling growth through acceleration the rate of transpiration and respiration. Root and shoot growth of pepper seedlings were inhibited when seedlings grow in high temperature regime compared with plants grown at 25ºC /18ºC **(Aloni *et al*., 1992).** Transpiration rate and stomata conductance increased with the high-temperature treatments while the yields were considerably reduced. There was a clear negative relationship between vegetative and reproductive growth under high temperature conditions, flower abscission at a high temperature was considered to be a strategy to maintain a minimum level of plant growth (**Talagabi *et al*. 1993)**. Also, recent studies shown that UV exposure leads to primarily oxidative stress in plants **(Mackerness and Thomas 1999).**

Current trends in new plastic films concentrate on improvements in optical and thermal properties, by the incorporation of copolymers in the manufacture of co extruded multilayer plastic films. As regards the optical properties, the incorporation of specific additives partially reduces UV-radiation and so affects fungus behavior. In addition, the modification of incident UV-radiation could affect the physiology of plants and their yield