بسم الله الرحمن الرحيم

MONA MAGHRABY

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

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شبكة المعلومات الجامعية

التوثيق الإلكتروني والميكروفيلم

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

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MONA MAGHRABY

EFFECT OF AIR POLLUTANTS AND CLIMATE CHANGE ON SOME HORTICULTURAL CROPS

By

HAMDY BAYOUMY EL SAYED BAYOUMY
B.Sc. Agric. Sc. Economy, Banha University, 2007
M.Sc. Agric. Sc. Economy, Banha University 2011

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

DOCTOR OF PHILOSOPHY
in
Agricultural Sciences
(Desert Agriculture and Areas Affected by Salinity)

Department of Arid Lands
Faculty of Agriculture
Ain Shams University

2021

Approval Sheet

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ABSTRACT

Hamdy Bayoumy Elsayed Bayooumy. Effect of Air Pollutants and Climate Change on Some Horticultural Crops. Unpublished Ph.D. Thesis, Department of Arid Lands, Faculty of Agriculture, Ain Shams University, 2021.

To examine the responses of three vegetable plants to cadmium and salinity stresses, this study was conducted in a greenhouse at the National Research Center, Dokki, Giza Governorate, and repeated over two successive years, 2019 and 2020. The chosen plants are radish *Raphanus sativus*, rocket *Eruca sativa* and turnip *Brassica rapifera*.. The cultivated experimental plants were divided into four sub-groups of five pots contained four plants each with a total 20 plants for each treatment sub-group. The treated plants were exposed separately to cadmium levels of 5, 25 and 50 ppm, and salinity levels of 1000, 1500 and 3000 ppm in addition to the control treatments (0 ppm Cd or salinity).

Cadmium stress on the three vegetable plants caused clear reduction in plant height, root length, biomass, chlorophyll pigments and overall growth parameters over time, with either of spray or irrigation treatments. Radish, rocket and turnip plants were found to accumulate Cd in their leaves when exposed to different Cd concentrations. Accumulated Cd was increased in leaves tissue with the increase of Cd concentration level. A general decrease in chlorophyll a and b, with the increase of Cd concentration was also detected.

The growth of radish, rocket and turnip plants exposed to salinity has been affected and main reductions in plant height and root length with salinity level were observed on the last growth stage (120 days). The results indicated that cadmium treatments had a greatest impact than salinity treatment. Moreover, percentage levels of nitrogen, phosphorus and potassium in leaves of treated different plant species have been affected by cadmium and salinity treatments. Furthermore, drought and

heat stress were affected plants and induced big reduction in water contents with long drought and high temperature.

In conclusion, radish, rocket and turnip exposed cultivars showed variation in response to these stresses and confirms that species and genotypes crops are differ in their sensitivities to abiotic stresses.

Key words: Air, Pollutants, Climate, Cadmium, Salinity, Chlorophyll, Drought, Heat, Horticultural

ACKNOWLEDGEMENT

The author wishes to express his gratitude and sincere thanks to **Professor Dr. Ayman Farid Abu Hadid,** Honorary Professor of Vegetable Crops and Former Minister of Agriculture in Egypt, for his generous supervision, assistance, follow-up, ideas and constructive guidance.

My sincere thanks and appreciation to **Prof. Dr. Mohamed Zaky El-Shinawy,** Professor of Vegetable Crops Department of Horticulture, Faculty of Agriculture, Ain Shams University, for his generous supervision, valuable assistance, and moral and sincere standing during its preparation, this manuscript.

Sincere thanks, gratitude and appreciation. **Prof. Dr. Yasser Hassan Ibrahim**, Professor Emeritus, Department of Air Pollution Research, National Research Center, to assist and direct it through this work.

My sincere thanks and appreciation to **Prof. Dr. Nasser Mohamed Mustafa Abdel-Latif,** Professor Emeritus, Department of Air Pollution Research at the National Research Center, for his supervision, encouragement, support, kindness and valuable assistance during this study.

My thanks to my colleagues in the Air Pollution Research Department at the National Research Center for their generous assistance and facilities granted to them during this work.

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INTRODUCTION

Air pollution is defined by IPCC as "the presence of any solid, liquid or gaseous materials in the air in quantities that lead to physiological, economic and biological damages to humans, animals, plants, machines and equipment, or affect the nature of things" (**IPCC, 2018**).

Cadmium (Cd) is a non-essential, toxic heavy metal that is easily taken up by plants (**Yang *et al.*, 2009**; **Ding *et al.*, 2013; Yang *et al.*, 2017**). Dietary exposure of Cd through vegetable consumption has been identified as a potential risk to human health (**Jolly *et al.*, 2013; Lin *et al.*, 2015; Hu *et al.*, 2017**) and Cd accumulation in vegetable edible parts is one of the major threats for human health (**Dziubanek *et al.*, 2017**). Heavy metals can be absorbed by vegetables from contaminated soils, as well as from deposits dust particles on the vegetables exposed to the air from polluted environments (**Wang *et al.*, 2005**).

Soils and crops in many region areas in Egypt are contaminated with heavy metals such as lead and cadmium due to air pollution emissions as the main source of heavy metals in Egyptian environment (**Abdel-Latif, 2001; Abdel-Latif *et al.*, 2013; Alkhdhairi *et al.*, 2018; Salman *et al.*, 2019**). Other essential reasons for contamination of agricultural soils and crops in Egypt are low-quality irrigation water, pesticides, fertilizers, agricultural activities and municipal waste (**El-Hassanin, 2020; Elnazer *et al.*, 2015; Ghoneim *et al.*, 2014; Mahmoud and Ghoneim, 2016; Zeid *et al.*, 2018**).

Soil salinity is one of the major abiotic stresses that adversely affect plant productivity and quality (**Ayyub *et al.*, 2016**). Crop salinity sensitivity varies with species, genotypes, and growth stages (Pujari and Chanda, 2002). The deteriorating trend of the global climate is worsening the situation. Response to salinity has rapidly expanded in recent decades as great economic losses and yield reduction by soil salinity. Soil and

water salinization is an ever-growing problem which is amplified by the irrational use of fertilizers and agrochemicals, over pumping of groundwater for irrigation (**Daliakopoulos *et al*., 2016; Libutti and Monteleone, 2017**). Furthermore, high salinity was estimated to deteriorate 20% of total cultivated and 33% of irrigated agricultural lands worldwide, and 50% of the arable land is predicted to be salinized by the year 2050 (**Jamil *et al*., 2011**).

Climate change is an increase in the atmosphere and ocean temperature, a decrease in the amount of snow and ice, high levels of the sea and greenhouse gas concentrations. These changes can greatly affect living organisms, as well as affect the productivity index of different economic sectors. **(Pirovani *et al*., 2018).**

The research relied to study the effects of some abiotic stresses on the growth of three horticultural vegetable plants. Horticultural crops are plants that require special attention to their production and circulation. These crops require also high cost and high capital in addition to skilled technical and technological expertise to obtain good results and achieve optimal utilization of the agricultural area. Three horticultural crops were chosen to conduct this study; Radish, rocket and turnip.

Rocket, *Eruca sativa,* is a leafy vegetable plant. It is an herbaceous plant that grows in moist soil and on the edges of canals and streams. It is eaten raw or used in salad dishes and is not usually cooked. Radish, *Raphanus sativus,* is a root vegetable as well and follows the (Cruciferae and Brassicaceae). Eating root and leaves stimulates appetite as well as digestibility. Turnip, *Brassica rapifera,* is another root vegetable and follows the (Cruciferae and Brassicaceae). It is one of the vegetables that spread widely in the markets and it is one of the vegetables that are frequently used after pickling, boiling and salting. Leaves are eaten after cooking and its seeds are used to produce the oil.(**Aghababaie *et al*., 2019**).

INTRODUCTION

This study aims to examine and compare the responses of these vegetable crops, which are grown in Egypt, radish *Raphanus sativus* , rocket *Eruca sativa* and turnip *Brassica rapifera* under greenhouse conditions to cadmium and salinity stresses at different growth stages.