

بسم الله الرحمن الرحيم





شبكة المعلومات الجامعية التوثيق الالكتروني والميكرو فيلم



جامعة عين شمس

التوثيق الإلكتروني والميكرو فيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
على هذه الأقراص المدمجة قد أعدت دون أية تغييرات



يجب أن

تحتفظ هذه الأقراص المدمجة بعيدا عن الغبار



**IMPROVEMENT POTATO MINITUBER
CHARACTERISTICS FOR PRE-BASIC SEED
POTATO PRODUCTION**

By

MUHAMMAD MOTAWIE MUHAMMAD REFAIE

B.Sc. Agric. Sci. (Horticulture), Fac. Agric., Cairo Univ., 2004

M.Sc. Agric. Sci. (Vegetable Crops), Fac. Agric., Cairo Univ., 2013

THESIS

**Submitted in Partial Fulfillment of the
Requirements for the Degree of**

DOCTOR OF PHILOSOPHY

In

**Agricultural Sciences
(Vegetable Crops)**

**Department of Vegetable Crops
Faculty of Agriculture
Cairo University
EGYPT**

2021

APPROVAL SHEET

**IMPROVEMENT POTATO MINITUBER
CHARACTERISTICS FOR PRE-BASIC SEED
POTATO PRODUCTION**

**Ph.D. Thesis
In
Agric. Sci. (Vegetable Crops)**

By

MUHAMMAD MOTAWIE MUHAMMAD REFAIE

**B.Sc. Agric. Sci. (Horticulture), Fac. Agric., Cairo Univ., 2004
M.Sc. Agric. Sci. (Vegetable Crops), Fac. Agric., Cairo Univ., 2013**

APPROVAL COMMITTEE

Dr. MOHAMMED MOHAMMED SHAHEIN
Professor of Vegetable Crops, Fac. Agric., Cairo University

Dr. FARHA HOSNEY HASSAN FARGALLA.....
Professor, Plant Protection Research Institute, ARC

Dr. MERGHANY MOHAMED MERGHANY.....
Professor of Vegetable Crops, Fac. Agric., Cairo University

Date: 5 / 7 / 2021

SUPERVISION SHEET

**IMPROVEMENT POTATO MINITUBER
CHARACTERISTICS FOR PRE-BASIC SEED
POTATO PRODUCTION**

Ph.D. Thesis

In

Agric. Sci. (Vegetable Crops)

By

MUHAMMAD MOTAWIE MUHAMMAD REFAIE

B.Sc. Agric. Sci. (Horticulture), Fac. Agric., Cairo Univ., 2004

M.Sc. Agric. Sci. (Vegetable Crops), Fac. Agric., Cairo Univ., 2013

SUPERVISION COMMITTEE

Dr. MERGHANY MOHAMED MERGHANY

Professor of Vegetable Crops, Fac. Agric., Cairo University

Dr. FARIDA FAROUK KABIL

Lecturer, Vegetable Crops, Fac. Agric., Cairo University

Dr. MOHAMMAD MOSTAFA KHALIL

Researcher, Horticulture Research Institute, ARC

Name of Candidate: Muhammad Motawie Muhammad Refaie **Degree:** PhD.

Title of Thesis: Improvement Potato Minituber Characteristics for Pre-Basic Seed Potato Production.

Supervisors: Dr. Merghany Mohamed Merghany
Dr. Farida Farouk Kabil
Dr. Mohamed Mostafa Khalil

Department: Vegetable Crops

Date: 5 / 7 / 2021

ABSTRACT

This study was carried out in the Tissue Culture Research Laboratory, Horticulture Research Institute, during the period from 2016 to 2020. The study included: (1) Production of microtubers (*in vitro* tubers), (2) Utilization of microtubers in greenhouse production of minitubers and (3) pre-basic seeds production from minitubers. Two commercial cultivars, 'Diamant' and 'Spunta', were used in the studies. Four tuberization media were used, include MS medium added to it different amount of sucrose, Benzyl adenine (BA), Chloro choline chloride (CCC) and the combination between them. In the three nutrition treatments (MS macro and micronutrients, Hoagland nutrient solution and commercial compound fertilizer) were used in the greenhouse phase. Effects of plant spacing and nitrogen fertilization on pre-basic seeds production were also tested. For microtuberization *in vitro* the best media was MS supplied with 8% g sucrose. In the greenhouse minitubers production fertilized with Hoagland solution showed the best values regarding minituber weight per plant and average minituber weight. The interaction between 20 cm spacing and 120 kg N/feddan gave the highest values of minitubers number per plot (86.06). The results obtained also revealed that the highest values of minitubers weight per plot (2417.1 g) resulted by interaction between 10 cm spacing and 150 kg N/fed.

Key words: *Solanum tuberosum* L., *In vitro*, tip meristem, Microtuber, tuberization, Minitubers.

DEDICATION

*First of all: Thanks to Allah for offering me
the strength to fulfill this hard mission*

I would like to thank all my family and my wife for their love and support and the sacrifices they made for me over the years. I would not have made it this far without them. To my baby son, AAsr And my baby girl, Marium, thank you for being a constant joy of our family.

I am indebted as gift to all my family for their continuous encouragement and praying for me.

I would like to thank my best friend Ebtsam Hemida Eisa for the sacrifices he made for me.

ACKNOWLEDGEMENT

***First of all: Thanks to Allah for offering me
the strength to fulfill this hard mission***

*I wish to express my sincere appreciation and deep gratitude to **Dr. MERGHANY MOHAMED MERGHANY**, Professor of Vegetables, Vegetables Dept., Cairo Univ. for his kind supervision, the facilities he offered to me during the preparation of this work, his valuable advices and for his help during writing the manuscript. I will always remember his generous help.*

*The author wishes to thank **Dr. FARIDA FAROUK KABIL**, Lecturer, Vegetables Dept., Cairo Univ. for her kind supervision, and revise of my manuscript paper and thesis.*

*I feel deeply thankful to **Dr. MOHAMMAD MOSTAFA KHALIL**, Researcher, Horticulture Res. Inst., ARC. for his kind supervision, the facilities he offered to me during the preparation of this work, his valuable advices and for his help during writing the manuscript. I will always remember his generous help.*

*Also, I wish to express my deep thanks to **Dr. MAHMOUD SAMY**, head of Research, Horticulture Res. Inst., ARC. **And Dr. AHMAD HAMED**, Researcher, Horticulture Res. Inst., ARC. and all my colleges in Tissue culture lab for their kind encouragement and sincere help.*
*My sincere thanks to my friend **Dr. Ali Hamed** for his help.*

*Very special thanks and deep gratitude to **Dr. ESSAM MUSTAFA**, **Dr. SHERIF SAIED**, **SHERIF FATHY**.*

CONTENTS

	Page
INTRODUCTION	1
REVIEW OF LITERATURE	7
A. Establishment of first stage (microtuberization).....	8
B. Establishment of second stage (minituber production)	18
C. Effects of plant spacing and nitrogen fertilization on pre-basic seeds production.....	23
MATERIALS AND METHODS	41
RESULTS AND DISCUSSION	48
I. Establishment of first stage (microtuberization).....	48
2. Establishment of second stage (minituber production).....	55
a. effects of different nutrient solutions on minituber production.....	55
b. Effects of plant spacing and nitrogen fertilization on pre-basic seeds production.....	66
SUMMARY AND CONCLUSION	83
REFERENCES	91
ARABIC SUMMARY	

LIST OF TABLES

No.	Title	Page
1.	Composition of MS culture medium which used for potato <i>in vitro</i> culture.....	43
2.	The nutrient media which used for microtuberization.....	43
3.	Effect of the interaction between potato varieties and type of medium on microtuberization after 8 weeks.....	52
4.	Differences between the two varieties on leave number, plant height, minituber number, minituber, stem, leave and root dry weight after 65 DAT.....	57
5.	Effect of nutrient solution on leave number, plant height, minituber number, minituber, stem, leave and root dry weight after 60 DAT.	58
6.	Combined effect of potato varieties and nutrient solution on leave number and plant height after 10, 35, 50 days after planting.	59
7.	Combined effect of potato varieties and nutrient solution on leave number, plant height, minituber number, minituber, stem, leave and root dry weight after 65 DAT.....	60
8.	Effect of different combination of potato varieties and nutrient solution on minituber number, minituber weight and average minituber weight at harvesting time.....	63
9.	Differences between the two varieties on vegetative growth characteristics after 75 DAT.	66

No.	LIST OF TABLES (Continued)	Page
10.	Effect of spacing on vegetative growth characteristics after 75 DAT.....	67
11.	Effect of nitrogen fertilizer on vegetative growth characteristics after 75 DAT.....	68
12.	Combined effect of potato varieties and spacing on vegetative growth characteristics after 75 DAT.....	68
13.	Combined effect of potato varieties and nitrogen fertilizer on vegetative growth characteristics after 75 DAT.....	70
14.	Combined effect of spacing and nitrogen fertilizer on vegetative growth characteristics after 75 DAT.....	71
15.	Combined effect of potato varieties, spacing and nitrogen fertilizer on vegetative growth characteristics after 75 DAT.....	72
16.	Differences between the two varieties on minitubers yield characteristics at harvest time.....	73
17.	Effect of spacing on minitubers yield characteristics at harvest time.....	74
18.	Effect of nitrogen fertilizer minitubers yield characteristics at harvest time.....	74
19.	Combined effect of potato varieties and spacing on minitubers yield characteristics at harvest time.....	75

20.	Combined effect of potato varieties and nitrogen fertilizer on minitubers yield characteristics at harvest time.....	76
-----	--	----

No.	LIST OF TABLES (Continued)	Page
21	Combined effect of Spacing and nitrogen fertilizer on minitubers yield characteristics at harvest time.....	77
22	Effect of potato varieties, spacing and nitrogen fertilizer interaction on minitubers yield characteristics at harvest time.....	80

LIST OF FIGURES

No.	Title	Page
1.	Improved potato seed production from the laboratory to the farm (Agriculture and Land Reclamation Ministerial Decree 2011).....	3
2.	a. The meristem separation and b. meristematic cultures proliferated after two months.....	49
3.	Differences Diamant and Spunta of potato in microtuberization after 8 weeks.	50
4.	Effect of media components on microtuberization after 8 weeks.	51
5.	Microtuberization on the different culture media	53
6.	Transplant establishment and growth in greenhouse	56
7.	Differences between the two varieties on leave number and plant height after 10, 35, 50 days after planting.	56
8.	Effect of nutrient solution on leave number and plant height after 10, 35, 50 days after planting.	58
9.	Effect of Diamant and Spunta on minituber number, minituber weight and average minituber weight at harvesting time.	61
10.	Effect of nutrient solution on minituber number, minituber weight and average minituber weight at harvesting time.	62

No.	LIST OF FIGURES (Continued)	Page
11.	Effect of nutrient solution on minitubers yield characteristics at harvest time.....	64
12.	Effect of spacing and nitrogen fertilizer on minitubers yield characteristics at harvest time.....	80