

PHYSIOLOGICAL STUDIES ON PRODUCTION OF SOLIDAGO AS A POT PLANT

By

MOHAMED FAWZEY GABER

B.Sc. Agric. Sci., (Ornamental Horticulture), Fac. Agric. Al-Azhar Univ., 2001

M.Sc. Agric. Sci. (Ornamental Horticulture), Fac. Agric. Al-Azhar Univ., 2010

THESIS

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

DOCTOR OF PHILOSOPHY

In

**Agricultural Sciences
(Ornamental Horticulture)**

**Department of Ornamental Horticulture
Faculty of Agriculture
Cairo University
EGYPT**

2017

APPROVAL SHEET

**PHYSIOLOGICAL STUDIES ON PRODUCTION OF
SOLIDAGO AS A POT PLANT**

**Ph. D. Thesis
In
Agric. Sci. (Ornamental Horticulture)**

By

MOHAMED FAWZEY GABER

**B.Sc. Agric. Sci., (Ornamental Horticulture), Fac. Agric. Al-Azhar Univ., 2001
M.Sc. Agric. Sci. (Ornamental Horticulture), Fac. Agric. Al-Azhar Univ., 2010**

Approval Committee

Dr. ANWAR OSMAN GOMAA
Professor of Floriculture and Medicinal Plants, Fac. Agric., Banha Univ.,
Moshtohor

Dr. AFAF MAHMOUD ELSAYED HABIB
Professor of Ornamental Horticulture, Fac. Agric., Cairo University

Dr. EFFAT ISMAIL EL-MAADAWY
Professor and Head of Ornamental Horticulture, Fac. Agric., Cairo University

Dr. ATEF MOHAMED ZAKARIA SARHAN
Professor of Ornamental Horticulture, Fac. Agric., Cairo University

Date: / /

SUPERVISION SHEET

**PHYSIOLOGICAL STUDIES ON PRODUCTION
OF SOLIDAGO AS A POT PLANT**

Ph. D. Thesis

In

Agric. Sci. (Ornamental Horticulture)

By

MOHAMED FAWZEY GABER

B.Sc. Agric. Sci., (Ornamental Horticulture), Fac. Agric. Al-Azhar Univ., 2001

M.Sc. Agric. Sci. (Ornamental Horticulture), Fac. Agric. Al-Azhar Univ., 2010

SUPERVISION COMMITTEE

Dr. ATEF MOHAMED ZAKARIA SARHAN

Professor of Ornamental Horticulture, Fac. Agric., Cairo University

Dr. EFFAT ISMAIL EL-MAADAWY

Professor of Ornamental Horticulture, Fac. Agric., Cairo University

Dr. NAGI MOHAMED HASSAN ARAFA

Head Researcher of Ornamental Plants, Hort. Res. Inst., A.R.C., Giza

Name of Candidate: Mohamed Fawzey Gaber **Degree:** Ph.D.
Title of Thesis: Physiological studies on production of *Solidago* as a pot plant
Supervisors: Dr. Atef Mohamed Zakaria Sarhan
Dr. Effat Ismail El-Maadawy
Dr. Nagi Mohamed Hassan Arafa
Department: Ornamental Horticulture
Approval: 17/10/2017

ABSTRACT

This investigation was carried out at Dept. of Ornamental Hort., Fac. Agric., Cairo Univ., and the applied part was carried out at the Experimental Farm of Hort. Res. Inst., ARC., Giza, Egypt under open field conditions during 2015 and 2016 seasons to study the effect of pinching, bio-fertilization (mixture of Nitrobein and Phosphorein as soil drench) and chemical fertilization (NPK at 0, 1.5 and 3 g/pot as soil drench), foliar spraying with alar (at 0, 500, 1000 and 1500 ppm) and their interactions on vegetative growth, flowering characteristics and chemical composition of goldenrod (*Solidago hybrida*, "Tara") with the aim of producing high quality plants appropriate to be used as flowering pot plants.

There was a great influence had been obtained due to applying different individual, double and tri interaction treatments. The remarkable interaction treatment that produce the best results and which came in agreement with this study objectives was pinching in addition to bio-fertilization plus NPK at 1.5 or 3.0 g/pot + spraying with alar at 500 ppm. Such treatment produced the best results concerning vegetative growth (plant height (cm), stem diameter (mm), herb fresh weight (g), herb dry weight (g), number of suckers/plant and leaf area (cm²)), flowering characteristics (flower stem length (cm), flowering start date (days), flowering stems fresh weight (g), flowering stems dry weight (g) and number of flowering branches/plant) and chemical composition (chlorophyll a, b and carotenoids (mg/g f.w.), N, P and K contents (%), total carbohydrates (%), indoles (mg/100 g f.w.) and phenols (mg/100 g f.w.)).

From an aesthetic point of view, it is recommended to treat goldenrod transplants grown in 14 cm pots with pinching in addition to bio-fertilization plus NPK at 1.5 or 3.0 g/pot + spraying with alar at 500 ppm to produce high quality flowering pot plants.

Key words: *Solidago hybrida*, pinching, NPK fertilizers, bio-fertilizers, Alar, vegetative growth, flowering characteristics, chemical composition.

DEDICATION

I dedicate this work to whom my heart felt thanks, my father, mother, sisters, wife and my baby Suleiman for their patience and help, as well as to all my friends for the support they lovely offered along the period of my post graduation.

ACKNOWLEDGEMENT

First and foremost, I would like to express my gratitude to Allah, my God, for protecting me and being with me and my family, enabling me to do this study and this work, and giving us the life we enjoy. May his guidance be with us and his peace envelops the world.

I wish to express my sincere thanks, deepest gratitude and appreciation to Dr. Atef Mohamed Zakaria Sarhan and Dr. Effat Ismail El-Maadawy, Professors of Ornamental Horticulture, Faculty of Agriculture, Cairo University for suggesting the problem, supervision, continued assistance and their guidance through the course of study and revision of the manuscript of this thesis. Sincere thanks to Dr. Nagi Mohamed Hassan Arafa, Head Researcher of Ornamental Plants, Hort. Res. Inst., A.R.C., Giza for sharing in supervision and revising the manuscript of this thesis. Wish to express my sincere thanks, deepest gratitude and appreciation to my brother Dr. Tarek noor Eldeen Researcher of Ornamental Plants, Hort. Res. Inst., A.R.C., Giza.

CONTENTS

	Page
INTRODUCTION	1
REVIEW OF LITERATURE	7
1. Effect of N, P and K fertilizers	7
2. Effect of bio-fertilization	20
3. Effect of alar (daminozide) SADH	28
4. Effect of pinching	35
MATERIALS AND METHODS	43
RESULTS AND DISCUSSION	48
1. Vegetative growth	48
a. Effect of pinching.....	48
b. Effect of fertilization.....	50
c. Effect of Alar.....	54
d. Effect of interaction between pinching and fertilization.....	57
e. Effect of interaction between pinching and Alar concentrations.....	61
f. Effect of interaction between fertilization and Alar concentrations.....	65
g. Effect of interaction between pinching, fertilization and Alar concentrations.....	70
2. Flowering characteristics	78
a. Effect of pinching.....	78
b. Effect of fertilization.....	82
c. Effect of Alar.....	85
d. Effect of interaction between pinching and fertilization....	88
e. Effect of interaction between pinching and Alar concentrations.....	91
f. Effect of interaction between fertilization and Alar concentrations.....	95
g. Effect of interaction between pinching, fertilization and Alar concentrations.....	99
3. Pigments content in the leaves	108
a. Effect of pinching.....	108
b. Effect of fertilization.....	109
c. Effect of Alar.....	112

d. Effect of interaction between pinching and fertilization.....	114
e. Effect of interaction between pinching and Alar concentrations.....	116
f. Effect of interaction between fertilization and Alar concentrations.....	118
g. Effect of interaction between pinching, fertilization and Alar concentrations.....	120
4. N, P and K contents (%).....	124
a. Effect of pinching.....	124
b. Effect of fertilization.....	126
c. Effect of Alar.....	128
d. Effect of interaction between pinching and fertilization.....	130
e. Effect of interaction between pinching and Alar concentrations.....	132
f. Effect of interaction between fertilization and Alar concentrations.....	134
g. Effect of interaction between pinching, fertilization and Alar concentrations.....	137
5. Total indoles, phenols content (mg/100 g F.W) and carbohydrates percentage %	141
a. Effect of pinching.....	141
b. Effect of fertilization.....	144
c. Effect of Alar.....	146
d. Effect of interaction between pinching and fertilization.....	148
e. Effect of interaction between pinching and Alar concentrations.....	150
f. Effect of interaction between fertilization and Alar concentrations.....	153
g. Effect of interaction between pinching, fertilization and Alar concentrations.....	155
SUMMARY	164
REFERENCES	172
ARABIC SUMMARY.....	

LIST OF TABLES

No.	Title	Page
1.	Chemical composition of Crystal Nasr fertilizer.....	44
2.	Effect of pinching treatments on vegetative growth of goldenrod (<i>Solidago hybrida</i> , "Tara") plants during 2015 and 2016 seasons.....	48
3.	Effect of fertilization treatments on vegetative growth of goldenrod (<i>Solidago hybrida</i> , "Tara") plants during 2015 and 2016 seasons.....	51
4.	Effect of Alar concentrations on vegetative growth of goldenrod (<i>Solidago hybrida</i> , "Tara") plants during 2015 and 2016 seasons.....	55
5.	Effect of interaction between pinching and fertilization treatments on vegetative growth of goldenrod (<i>Solidago hybrida</i> , "Tara") plants during 2015 and 2016 seasons.....	58
6.	Effect of interaction between pinching and Alar concentrations on vegetative growth of goldenrod (<i>Solidago hybrida</i> , "Tara") plants during 2015 and 2016 seasons.....	62
7.	Effect of interaction between fertilization treatments and Alar concentrations on vegetative growth of goldenrod (<i>Solidago hybrida</i> , "Tara") plants during 2015 and 2016 seasons.....	66
8.	Effect of interaction between pinching, fertilization treatments and Alar concentrations on plant height (cm) of goldenrod (<i>Solidago hybrida</i> , "Tara") plants during 2015 and 2016 seasons.....	71
9.	Effect of interaction between pinching, fertilization treatments and Alar concentrations on stem diameter (mm) of goldenrod (<i>Solidago hybrida</i> , "Tara") plants	