

UNIVERSITI TEKNOLOGI MARA

**SINGLE AND COMBINED EFFECTS
OF OIL PALM'S EMPTY FRUIT
BUNCH COMPOST AND
HEXA CONAZOLE ON THE
GROWTH AND YIELD OF SANDY
SOIL GROWN SWEET POTATO
[Ipomoea batatas (L.) Lam.] var.
VITATO**

**BORHAN BIN ABDUL HAYA
@ YAHYA**

Thesis submitted in fulfillment
of the requirements for the degree of
Master of Science

Faculty of Plantation and Agrotechnology

July 2016

ABSTRACT

The orange-fleshed sweet potato variety VitAto is one of the important crops under the East Coast Economic Region (ECER). This crop has been selected to replace tobacco which was widely grown under Beach Ridges Interspersed with Swales (BRIS) soil in Kelantan and Terengganu. Federal Agricultural Marketing Authority (FAMA) is the government agency responsible for the marketing of farmers' agricultural produce. VitAto storage root is currently marketed based on sizes, grades A, B and C which represent big, medium and small respectively with bigger size generally fetching higher prices. Unfortunately, the storage root yield obtained by farmers generally consisted of high proportion of grades B and C and only a few of grade A. To overcome the problem of low VitAto storage root yield obtained by farmers, the application of empty fruit bunch (EFB) compost and hexaconazole (HEX) as a plant growth regulator were explored as treatments to increase yield. Field experiments were conducted for two seasons from October 2012 to June 2013. The effects of these treatments were compared to existing recommended inorganic fertilization practice by examining the following aspects; growth, yield, nutrients and (3 carotene content. These experiments were laid in randomized complete block design (RCBD), replicated four times. Both the EFB and HEX treatments were carried out separately in two different experimental plots during the first season. In the EFB experiment, four treatments were used; control (current practice), EFB alone, a combination of EFB and control with 2:1 ratio and a combination of EFB and control with 1:2 ratio. All these treatments were applied at 7, 28 and 35 days after planting (DAP). The rates of nitrogen (N), phosphorus (P) and potassium (K) in all treatments were synchronized before application. In the HEX experiment, five treatments of various concentrations namely, 0, 10, 20, 30 and 40 ppm were used and given at 20, 40 and 60 DAP. Selected treatments that gave good positive results from both experiments were used in the subsequent third experiment conducted in the second season. This third experiment consisted of four treatments namely; control (current practice), EFB alone and combination treatments of EFB with 10 ppm HEX and the final treatment of EFB with 30 ppm HEX. Combination treatment of EFB with 30 ppm HEX application was shown to give positive results in most of the parameters measured at the maturity stage. The storage root number, fresh weight, dry mass, P-carotene content, K concentration and content were increased by 16.9%, 125%, 34.4%, 18.13%, 69.4% and 75.5% compared to control treatment respectively. Similarly, root to shoot ratio and harvest index were also increased by 15.2% and 58.80% respectively. The EFB compost increased the yield through greater K availability from the compost to plant. In contrast, HEX enhanced the translocation of K into the storage root. The K nutrient enhanced the assimilate translocation from the source to sink organ primarily to storage root probably due to increased sink strength of storage root to attract more assimilates. The high K uptake contributes to high assimilate accumulation in the storage root. The K nutrient also responsible for an increase in the storage root numbers which maximize the marketable storage root as well as storage root total fresh weight. The combination treatment between EFB compost with 30 ppm HEX could be used to substitute or as an alternative to the current practice of the use of inorganic fertilization in VitAto cultivation under BRIS soil.

ACKNOWLEDGEMENT

First of all, I would like to thank the Almighty god, Allah S.W.T for giving me the opportunity to embark and pursue my Master program and completion of my study at the Universiti Teknologi MARA where I have gained so much knowledge and experience. Alhamdulillah.

This thesis is dedicated to my beloved mother, Atimah Tee for her vision and determination in supporting me for my education and for my financial assistance despite being a single mother for over 30 years. This piece of victory is dedicated to you.

My heartfelt gratitude and thanks goes to my supervisor, Dr. Mohd Yusoff Abdullah for almost every possible invaluable help during my study. Thanks to his diligent and continuous support, guidance, patience, supervision, encouragement and inspiration from problem identification to the final thesis write-up.

Profuse thanks to the MARDI Rawang staff especially to Mr. Mustapha Yaakob, Mr. Zainal Abidin Abu Bakar and Mr. Idris Aini and to MARDI Serdang staff especially to Mr. Mohsin Yusof and Mr. Mohd Ramdzan Othman for providing the facilities, research area, knowledge and assistance to me. I also would like to express my gratitude to all laboratory assistance of the Faculty of Plantation and Agrotechnology at Universiti Teknologi MARA, especially to Mr. Adnan Ismail, Mdm. Nurul Hayanti Musa, Miss. Noordinah Abd Latif and Mdm. Norahiza Mohd Soheh for their contributions in teaching me many of the laboratory techniques which have been tremendously useful in completing this thesis.

Special thanks to Seriwati, Anuar and Sabuddin Yahya, Rusmah and Jummiah Tee, Nur Kharunisa Tajarudin and family, Dr. Tsan Fui Ying, Miss. Tham Sui Yin, Mr. Zainuri Mohd Salleh, Falex J. Lankan, Hendrynus Gundadon, Wilton Bichin, Bayu Sundhu Anwar, Mohd Esyam Adip, Omar Arbain Mohd Supir, Nurhana Hasyim, Norima Ahmad, Mohd Efendi Mohd Razali, Mohammad Rahime Ali and others who have either directly or indirectly helped me in executing my study.

TABLE OF CONTENTS

	Page
CONFIRMATION BY PANEL OF EXAMINERS	ii
AUTHOR'S DECLARATION	iii
ABSTRACT	iv
ACKNOWLEDGEMENT	v
TABLE OF CONTENTS	vi
LIST OF TABLES	xvii
LIST OF FIGURES	xxi
LIST OF PLATES	xxiii
LIST OF SYMBOLS	xxiv
LIST OF ABBREVIATIONS	xxvii
CHAPTER ONE: INTRODUCTION	1
1.1 Background of Study	1
1.1.1 Sweet Potato	1
1.1.2 VitAto as a New Variety of Sweet Potato	1
1.1.3 Oil Palm Empty Fruit Bunch	3
1.1.4 Hexaconazole	3
1.1.5 Storage Root Beta-Carotene Content	4
1.2 Problem Statement	4
1.3 Objective of Study	5
1.4 Research Question	5
1.5 Hypotheses	6
1.6 Scope of Study	7
1.7 Limitation of Study	7
1.8 Significance of Study	7
1.9 Conceptual Framework	8

CHAPTER TWO: LITERATURE REVIEW	9
2.1 Sweet Potatoes	9
2.1.1 Background	9
2.1.2 Sweet Potato Area Harvested and Yield Production for Thirty Top Countries in Year 2013	9
2.1.3 The General Trend of Sweet Potato Area Harvested and Yield Production in Malaysia from 2006 to 2013	10
2.1.4 Botanical and Morphological Description of Sweet Potato	11
2.1.4.1 Vegetative Part	12
2.1.4.2 Reproductive Part	13
2.1.4.3 Root System	13
2.1.5 The Use of Various Fertilizers in Sweet Potato Cultivation	15
2.2 VitAto as a New Local Variety of Sweet Potato	19
2.2.1 Nutrient Contents of VitAto	19
2.2.2 Economic Importance and Products Derived from VitAto Storage Root	19
2.2.3 VitAto Cultivation in the East Coast (Kelantan and Terengganu)	20
2.3 Comparison of Beach Ridges Interspersed with Swales (BRIS) and Sandy Tin-Tailing Soil	20
2.4 Oil Palm Empty Fruit Bunch	22
2.4.1 The Uses of Empty Fruit Bunch in Malaysia	22
2.4.2 Nutrient Concentrations and Contents in Empty Fruit Bunch	23
2.4.3 Empty Fruit Bunch Compost (aGricare® Premium Compost)	23
2.5 Plant Growth Regulator	24
2.5.1 Hexaconazole	25
2.5.2 Triazole Compounds	25
2.5.3 The General Effects of Triazole Compounds on Plants	25
2.5.4 The Effects of Various Triazole Compounds on Selected Root Crop Species	26
2.5.5 The Effects of Other Plant Growth Regulators on Selected Root Crop Species	26
2.6 Source and Sink	31
2.6.1 Dry Mass Production and Partitioning	31