UNIVERSITI PUTRA MALAYSIA

USE OF AGROWASTE AS SOILLESS MEDIUM FOR MOLINERIA LATIFOLIA VAR. MEGACARPA (LEMBA) AND RHODOMYRTUS TOMENTOSA (AITON) HASSK. (KEMUNTING) IN URBAN LANDSCAPE

SARAH BAHARUDIN

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By

SARAH BAHARUDIN

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia in Fulfillment of the Requirements for the Degree of Masters of Science

May 2015

DEDICATION

This thesis is dedicated to:

My beloved parents
Baharudin Mohd Hanipah
And
Allahyarhamah Rohaya Din

My husband
Nazrul Hilmi Mohammad

My Parents In-law
Mohammad Hamid
And
Salmi Yaacob

Sisters and Brothers
Nadiah Baharudin
Najwa Baharudin
Saufi Baharudin
Mohd. Khuzaieri Mudzamer
Amin Kamil Mohammad
Nik Norazlin Nik Abdullah
Nurul Izzati Mohammad
Mohd Noor Azam Zamri
Waris Amir Mohammad
Munirah Izzah Mohammad

Niece and Nephew
Adam Haikal
Intan Khayla

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirements for the degree of Master of Science

USE OF AGROWASTE AS SOILLESS MEDIUM FOR *MOLINERIA LATIFOLIA* VAR. MEGACARPA (LEMBA) AND *RHODOMYRTUS TOMENTOSA* (AITON) HASSK. (KEMUNTING) IN URBAN LANDSCAPE

By

SARAH BAHARUDIN

May 2015

Chairman : Associate Professor Thohirah Lee Abdullah, PhD
Faculty : Agriculture

Tremendous amount of biomass waste leads to waste disposal problems and environmental problems. Therefore, it is necessary to carry out research to obtain substantial data with regards to growing ornamental plants in this new combination of soilless media compared to normal topsoil and other soil-based mixtures. Most ornamental plants are exotic or imported species.

Large numbers of native and local plants species in Malaysia are still under-utilized as landscape and ornamental plants. There is a need to reintroduce the species to nursery industry. Soilless media can be used to evaluate growth and establishment of native ornamental plants.

The present study was conducted to investigate the effects of agrowaste in soilless growing medium on growth and flowering of 2 local species of ornamentals: *Molineria latifolia* var. Megacarpa (lemba) and *Rhodomyrtus tomentosa* (kemunting) for urban landscape use.

The first objective was to formulate suitable light weight soilless media using locally available renewable resources such as oil palm waste compost as the main component and cocopeat, vermiculite, biochar (charred rice husk and empty fruit bunch) and sewage sludge as additives. Secondly, to determine the effects of selected soilless media formulations on growth and flowering performances of the species. Thirdly, to determine public preferences on the species grown in soilless media as potential landscape plants for the future.

The study recommended two soilless formulations for the species. 90% EFB Compost + 10% rice-husk biochar (10 CRH) to be used to grow *Molineria latifolia* var. Megacarpa and 90% EFB Compost + 10% EFB biochar (10 EBC) to grow *Rhodomyrtus tomentosa*. Both media are recyclable, low-cost, readily available, easy to handle, lightweight and produce uniform plant growth thus making it a preferable

planting medium. The study can also be concluded that the two native test plants have high potentials to become urban landscape plants of the future.

Keywords: Soilless growing media formulation, Landscape preferences, Native plants, Urban landscape plants, *Molineria latifolia* var. Megacarpa (lemba), *Rhodomyrtus tomentosa* (kemunting)

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

KEGUNAAN SISA BUANGAN PERTANIAN SEBAGAI MEDIUM BUKAN TANAH BAGI *MOLINERIA LATIFOLIA* VAR. MEGACARPA (LEMBA) DAN *RHODOMYRTUS TOMENTOSA*(AITON) HASSK. (KEMUNTING) DALAM LANDSKAP BANDAR

Oleh

SARAH BAHARUDIN

Mei 2015

Pengerusi : Prof Madya Thohirah Lee Abdullah, PhD
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Sisa biomas telah membawa begitu banyak masalah pelupusan dan masalah alam sekitar. Penyelidikan adalah perlu untuk mendapatkan data berkaitan dengan penanaman tanaman hiasan dengan menggunakan media bukan tanah berbanding tanah dan campuran berasaskan tanah.

Kebanyakan tanaman hiasan adalah spesies eksotik atau diimport. Sebilangan besar daripada spesies tumbuhan asli dan tempatan di Malaysia masih kurang digunakan sebagai tanaman landskap dan hiasan. Ini adalah perlu untuk memperkenalkan semula spesies kepada industri nurseri. Media bukan tanah boleh digunakan untuk menilai pertumbuhan dan perkembangan tanaman hiasan tempatan.

Kajian ini telah dijalankan untuk menyiasat kesan sisa buangan pertanian dalam sesuatu medium bukan tanah terhadap pertumbuhan dan pembungaan 2 spesies tanaman hiasan tempatan: *Molineria latifolia* var. Megacarpa (Lemba) dan *Rhodomyrtus tomentosa* (Kemunting) untuk kegunaan landskap bandaran.

Objektif pertama adalah untuk merumuskan media bukan tanah yang ringan dan sesuai dengan menggunakan sumber tempatan yang boleh diperbaharui dan sedia ada seperti kompos sisa kelapa sawit sebagai komponen utama dan cocopeat, vermikulit, biochar (sekam padi hangus dan tandan buah kosong) dan kumbahan enapcemar sebagai bahan tambahan. Kedua, adalah untuk menentukan kesan formulasi media bukan tanah yang terpilih ke atas pertumbuhan dan pembungaan spesies. Ketiga, adalah untuk menentukan pendapat orang awam terhadap spesies yang ditanam dalam media bukan tanah ini sebagai tumbuhan landskap yang berpotensi di masa hadapan.

Kajian ini menetapkan dua formula yang disyorkan bagi spesies. 90% EFB Kompos + 10% beras sekam biochar (10 CRH) digunakan untuk menanam *Molineria latifolia* var. Megacarpa dan 90% EFB Kompos + 10% EFB biochar (10 EBC untuk menanam

Rhodomyrtus tomentosa. Media boleh dikitar semula, berkos rendah, mudah didapati, mudah untuk dikendalikan, ringan dan menghasilkan pertumbuhan tumbuhan seragam menjadikannya medium tanaman yang baik. Kajian ini juga dapat menyimpulkan bahawa kedua-dua spesies yang dikaji mempunyai kebarangkalian yang tinggi untuk menjadi tumbuhan landskap bandar di masa hadapan.

Kata kunci: Formulasi media bukan tanah, Landskap pilihan, Tumbuh-tumbuhan tempatan, Tumbuh-tumbuhan landskap bandar, *Molineria latifolia* var. Megacarpa (lemba), *Rhodomyrtus tomentosa* (kemunting)

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I certify that a Thesis Examination Committee has met on **5th May 2015** to conduct the final examination of **Sarah Binti Baharudin** on her thesis entitled **"Use of Agrowaste as Soilless Medium for *Molineria Latifolia* var. Megacarpa (Lemba) and *Rhodomyrtus tomentosa* (Aiton) Hassk. (Kemunting) in Urban Landscape**" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U. (A) 106] 15 March 1998. The committee recommends that the student be awarded Master of Science.

Members of the Thesis Examination Committee were as follows:

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfillment of the requirement for Master of Science. The members of the Supervisory Committee were as follows:

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Name of Member of
Supervisory Committee : Mustafa Kamal Mohd Shariff, PhD

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LIST OF ABBREVIATIONS

ANOVA	Analysis Of Variance
BD	Bulk Density
BOD	Biochemical Oxygen Demand
CCP	Cocopeat
Cmol	Centimol
COD	Chemical Oxygen Demand
CRH	Charred Rice Husk
DAT	Day After Transplant
EBC	Empty Fruit Bunch Biochar
EC	Electrical Conductivity
EFB	Empty Fruit Bunches
EFBC	Empty Fruit Bunch Compost
GHG	Green House Gas
LAR	Leaf Area Ratio
LWR	Leaf Weight Ratio
MPOB	Malaysia Palm Oil Board
Mt	Metric Tonne
OC	Organic Carbon
OM	Organic Matter
OPB	Oil Palm Biomass
OPF	Oil Palm Fronds
OPT	Oil Palm Trunks
POME	Palm Oil Mill Effluent
PTG	Peatgro

R:S	Root to Shoot Ratio
RSG	Relative Seed Germination
SOM	Soil Organic Matter
SWS	Sewage Sludge
TE	Trace Element
TOC	Total Organic Carbon
VRM	Vermiculite

CHAPTER 1

INTRODUCTION

Background of Study

Agrowaste refers to waste generated from plants and animals such as plant fibers, leaves, hulls, and manures. Although not classified as hazardous, wastes produced from palm oil crops make up a vast volume of waste materials. Renewable wastes have the potential to be used as raw materials in composting due to their high nutrient composition particularly potassium (K) which is essential for plant growth (flowering and fruiting) (Mohammad, 2012). Oil palm wastes are in the form of fibers, shells and empty bunches discharged from mills. The potential of oil palm wastes being turned into compost and soilless growing media is very high and demands are increasing (Tay, 1991).

Problem Statement

The most common substrate for soilless culture is prepared with peat, due to its high physical and chemical stability or low degradation rate. The cost of high quality peat for horticultural use, together with the declining availability of peat in the near future due to environmental constraints, especially in countries without peat moss resources, make it necessary to look for alternative materials (Abad *et al*., 2001).

As a consequence, composted organic wastes are increasing in value commercially because organic matter (OM) and nutrients from the organic wastes are recycled (Abad *et al*., 2002; Nappi and Barberis, 2003). There is evidence in the literature which shows that, like peat, composts possess similarity in texture, plant growth regulators and properties which suppress soil-borne plant pathogens (Atiyeh *et al*., 2001) and an excellent substitute for peat.

Composts used as substrates must have a high degree of maturity and adequate physical and chemical properties, such as particle size, porosity, water-holding capacity, air capacity, electrical conductivity (EC) and pH which are more important than the concentrations of nutrients itself, because the latter can be added by fertilization (Gomez-Limon, 1999). Composts often require leaching or mixing with nutrient-poor materials in order to become better and more suitable substrates with better physico-chemical properties for container grown vegetables and flowers making them a must to for optimum formulation in terms of texture and structure

Justification

Rising cost of chemical fertilizers and environmental constraints have led to increase in production of EFB compost and other agrowaste by-products. Tremendous amount of agrowaste and biomass waste have also, led to waste disposal and environmental problems. Therefore, it is necessary to carry out

research to overcome agrowaste disposal problems by obtaining substantial data with regards to growing of ornamental plants in soilless media formulation compared to normal topsoil and other soil-based mixtures.

The present study was conducted to determine the best soilless media formulation consisting of the various waste by-products mixed in different ratios. The results of the study on the selected formulations was tested on two local plant species namely *Molineria latifolia* var. Megacarpa (Lemba) and *Rhodomyrthus tomentosa* (Kemunting). The study establishes the optimum formulation for best growth and flowering performances for the species.

The last part of the study was a preference study on the selected species potential as urban landscape plants. A survey method on preferences among landscape and horticulture professionals and students on the two selected plants as urban landscape plants was used.

Objectives

1. To determine the best formulation of soilless growing media for planting of *Molineria latifolia* var. Megacarpa. and *Rhodomyrtus tomentosa*.

2. To determine the effects of the selected growing media formulations on growth and flowering performances of *Molineria latifolia* var. Megacarpa. and *Rhodomyrtus tomentosa*.

3. To determine preferences on use of *Molineria latifolia* var. Megacarpa and *Rhodomyrtus tomentosa* grown in soilless media as potential urban landscape plants of the future among landscape and horticulture professionals and students.

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