DETERMINATION OF FERTILIZATION RATES AND MULCHING TO IMPROVE GROWTH OF RRIM 3001 RUBBER CLONE IN NON-TRADITIONAL RUBBER AREAS

By

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

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DEDICATION

This thesis is dedicated to Allah, Lord of the Whole Universe, His Messenger, his beloved companions and all other followers of the truth till the day of resurrection.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in Fulfilment of the requirement for the Degree of Master of Science

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Chairman: Assoc. Prof. Wan Noordin Wan Daud, PhD
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The hectarage of rubber has decreased year by year. Thus, future planting has been pushed to the problem soils which are class III, IV and V soils. The objectives of this study are to evaluate the growth and physiological traits of RRIM 3001 planted in non-traditional area which is Gajah Mati and Jabil series, to measure the optimum rate of fertilizer of RRIM 3001 planted in these soils and to evaluate the effect of mulching practices as soil amelioration in Batang Merbau series on soil nutrient content and growth of RRIM 3001. In experiment 1, the study was conducted at Kampung Chin Chin and Kampung Kelubi, Jasin, Melaka. This study consists of high productive rubber clone, RRIM 3001 also known as "Klon 1 Malaysia" treated with four levels of fertilizer rates at three months intervals for a period of one year. The fertilizer rates were divided into four levels, T1 (0 g/tree per year), T2 (480 g/tree per year), T3 (720 g/tree per year) and T4 (960 g/tree per year). The fertilizer used in this study is NPK Yellow (15:15:6:4). The second experiment was implemented at Ladang Komoditi, Jasin, This study also consists of RRIM 3001 treated with five levels of fertilizer rates, T1 (0 g/tree per year), T2 (480 g/tree per year), T3 (720 g/tree per year), T4 (480 g/tree per year plus mulching) and T5 (720 g/tree per year plus mulching) by applying the NPK Yellow fertilizer (15:15:6:4) at three months intervals for a period of one year. One type of mulching system had been practiced namely Ecomat, processed oil palm fibre material (Ecofibre Bhd Malaysia) and the size of ecomat is 1.0 m x 1.0 m x 9mm. The experimental set up was a random completely block design (RCBD) with three replications. The study duration was one year period. In experiment 1, the result obtained

showed there were significant interactions between depth and fertilizer treatment in both of type of soil series, Gajah Mati and Jabil series. In terms of the total plant height and girth increment, there were significant difference between Gajah Mati and Jabil series where Gajah Mati showed better performance compared to Jabil series. This is attributed to the drainage status of the soil which is Gajah Mati is well drained whereas Jabil is poorly drained. From the result in experiment 2, it showed there were significant interactions between depth and fertilizer treatment in Batang Merbau series. The fertilizer treatment of T5 showed the best performance in term of height and girth conditions compared to the other treatments. As conclusion, the data of growth of RRIM 3001 planted on Gajah Mati and Jabil series showed that applying adequate rate of fertilizer is dependent on the type of soil. It indicates that the current rate of fertilizer that was recommended is inadequate and hence extra dosage of fertilizer maybe necessary. In terms of plant girth, it was shown that applying fertilizer up to the rate of 658 g/tree per year responded to quadratic model with the maximum of 10.3 cm/year on Gajah Mati compared to Jabil, 715 g/tree per year which gave the maximum girth of 8.4 cm/year. In this study, it indicates that the recommended rate of fertilizer is inadequate and hence extra dosage of fertilizer maybe necessary. The effect of mulching practices give favourable effect on the growth of RRIM 3001 based on girth, soil nutrient and cholorophyll content. This study shows the deficiency of Potassium (K) in foliar analysis. The new formulation of fertilizer especially the ratio of Potassium should be increased on non-traditional area specifically. From this study, it can be recommended that for non-traditional area especially on Jabil, Gajah Mati and Batang Merbau series, fertilizer use should contain higher K compared to the NPK Yellow (15:15:6:4).

Abtrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk Ijazah Master Sains

PENENTUAN KADAR PEMBAJAAN DAN SUNGKUPAN UNTUK MEMBAIK PULIH PERTUMBUHAN KLON RRIM 3001 DI KAWASAN BUKAN TRADISI TANAMAN GETAH

Oleh

MUHAMMAD ZAHIDIN BIN RAZMAN

April 2015

Pengerusi : Prof. Madya Wan Noordin Wan Daud, PhD
Fakulti : Pertanian

Cabaran dan isu utama yang dihadapi oleh Malaysia adalah kawasan tanaman getah yang semakin berkurangan. Pada tahun 2007, jumlah kawasan tanaman getah adalah seluas 1.284 juta hektar dibandingkan dengan seluas 1.023 juta hektar pada tahun 2011, di mana sebanyak 18% lebih rendah daripada tahun 2011. Ekoran daripada jumlah kawasan tanaman getah yang semakin berkurangan, satu polisi kerajaan telah dibentuk dalam usaha memenuhi keperluan sector industri hiliran di Malaysia. Terdapat lima stratergi yang telah dikenalpasti iaitu untuk meningkatkan kawasan tanaman getah seluas 40,000 hektar per tahun, untuk menambah keluasan kawasan tanaman baru seluas 20,000 hektar per tahun, menggunakan klon berpenghasilan tinggi, mempromosikan mekanisasi dan automasi dan meningkatkan penggunaan teknologi terkini dalam teknologi penuaian hasil. Objektif dalam kajian ini adalah untuk menilai tumbesaran dan ciri fisiologi klon RRIM 3001 yang ditanam di kawasan bukan tradisi berdasarkan siri tanah yang berbeza, untuk mengkaji kadar pembajaan yang optimum bsgi klon RRIM 3001 yang ditanam di kawasan bukan tradisi dan untuk menilai kesan sungkupan dalam usaha membaik pulih tanah di kawasan bukan tradisi melalui kandungan nutrien tanah dan tumbesaran klon RRIM 3001. Kajian bagi eksperimen 1 dijalankan di Kampung Chin Chin dan Kampung Kelubi, Jasin, Melaka. Kajian ini melibatkan klon berpenghasilan tinggi, RRIM 3001 yang dikenali sebagai "Klon 1 Malaysia" yang dirawat dengan empat kadar pembajaan. Kadar pembajaan terbahagi kepada empat kadar iaitu T1 (0 gram per pokok per tahun), T2 (480 gram per pokok per tahun), T3 (720 gram per pokok per tahun) dan T4 (960 gram per pokok per tahun). Jenis baja yang digunakan adalah Baja Kuning (15:15:6:4). Kajian kedua telah dilaksanakan di Ladang

Komoditi, Jasin, Melaka. Kajian ini juga melibatkan klon RRIM 3001, dirawat dengan lima rawatan iaitu T1 (0 gram per pokok per tahun), T2 (480 gram per pokok per tahun), T3 (720 gram per pokok per tahun), T4 (480 gram per pokok per tahun + sungkupan) dan T5 (720 gram per pokok per tahun + sungkupan) dengan menggunakan Baja Kuning (15:15:6:4). Satu jenis sungkupan yang digunakan adalah Ecomatt yang diproses oleh fiber kelapa sawit (Ecofibre Bhd Malaysia) dan saiznya adalah 1.0 m x 1.0 m x 9mm. Kajian ini adalah berdasarkan reka bentuk rawak blok lengkap (RCBD). Tempoh kajian adalah selama satu tahun. Keputusan kajian yang diperolehi dalam eksperimen 1 menunjukkan bahawa terdapat perbezaan yang bererti dalam hubungkait antara kedalaman dan rawatan di kedua-dua jenis siri tanah, siri Gajah Mati dan Jabil. Terdapat perbezaan bererti dalam pertambahan ketinggian dan ukurlilit pokok di antara Gajah Mati dan Jabil di mana Gajah Mati menunjukkan prestasi yang lebih baik berbanding Jabil. Ini disebabkan status saliran air dalam tanah di mana Gajah Mati mempunyai saliran yang baik manakala Jabil pula mempunyai saliran air yang kurang baik. Daripada keputusan kajian eksperimen 2, terdapat perbezaan yang bererti antara hubungkait kedalaman dan rawatan kajian di siri Batang Merbau. Rawatan T5 menunjukkan prestasi yang terbaik dari segi ketinggian dan juga ukur lilit pokok jika dibandingkan dengan rawatan lain. Sebagai kesimpulan, data tumbesaran klon RRIM 3001 yang ditanam di siri tanah Gajah Mati dan Jabil, menunjukkan bahawa kadar pembajaan adalah bergantung kepada jenis siri tanah. Kajian ini menunjukkan bahawa kadar pengesyoran pembajaan adalah masih tidak mencukupi dan memerlukan kadar yang lebih daripada kadar pengesyoran. Kesan sungkupan telah memberi kesan yang baik terhadap tumbesaran klon RRIM 3001 berdasarkan ukur lilit pokok, kandungan nutrien tanah dan kandungan klorofil. Kajian analisis daun juga menunjukkan kekurangan kandungan Kalium (K). Satu formulasi baru bagi baja terutamanya dari segi kandungan Kalium dalam baja perlu ditingkatkan terutamanya di kawasan bukan tradisi. Daripada kajian ini, ia boleh dicadangkan bahawa kandungan baja yang digunakan terutamanya di kawasan bukan tradisi seperti Siri Jabil, Gajah Mati dan Batang Merbau perlu mengandungi kandungan Kalium (K) yang lebih tinggi berbanding baja NPK Kuning (15:15:6:4).

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LIST OF ABBREVIATIONS

ANOVA	Analysis of variance
C.E.C	Cation Exchange Capacity
Cmol	Centi mol
EPP	Entry Project Points
g	Gram
ha	Hectare
Kg	Kilogram
LTC	Latex Timber Clone
LSCT	Large Scale Clone Trial
MRB	Malaysian Rubber Board
MRRDB	Malaysian Rubber Research and Development
MRELB	Malaysian Rubber Exchange and Licensing Board
Mg	Magnesium
NKEA	National Key Economic Area
N.P.K	Nitrogen Phosphorus Potassium
pH	Concentration of H+
ppm	Parts per million
RCBD	Randomized Complete Block Design
RRIM	Rubber Research Institute of Malaysia
SSCT	Small scale clone trial
TARRC	Tun Abdul Razak Research Centre
USDA	United State Department of Agriculture

CHAPTER 1

INTRODUCTION

1.1 Introduction

Malaysia rubber industry spans the entire value chain from upstream plantations to downstream of manufacturing activities. Rubber is the second most important commodity in Malaysia. Malaysia faces competition from two neighbouring rubber producing countries – Indonesia and Thailand. Initial analysis by the Malaysian Rubber Board (MRB) data in July 2010 estimated that the rubber industry could contribute RM31.1 billion in incremental GNI in 2020 (Suarni, 2012).

It was then decided in 2010 that the rubber industry would be given special focus under the ETP due to its downstream strengths and potential, and also the fact that it provided income for over 400,000 smallholders with a conceptual target growth rate of six per cent per annum towards 2020. Acknowledging the significance of the rubber industry and its contributions to the income of rubber smallholders, a subsequent lab was conducted by PEMANDU and the MRB in November 2010 along with key industry players. Four Entry Points Projects (EPPs) were identified in the lab to further develop the rubber industry for Malaysia. These are:

i) **EPP 1 :** Increasing average national rubber productivity to 2,000 kg/ha/year by 2020

ii) **EPP 2 :** Ensuring the sustainability of the upstream rubber industry

iii) **EPP 3 :** Increase world market share of latex gloves to 65 per cent by 2020.

iv) **EPP 4 :** Commercialising Ekoprena and Pureprena (Green Rubber)

Non-Traditional areas are known to be as new planting areas where rubber was never planted before. The lands are suitable for agriculture and lumber activities. Individual new plantings for smallholders are almost non-existent today, except is isolated cases of pocket land alienation. Recently most of the new plantings are carried out in large scale by the government and agencies. Financial resources for such development come from government grants, commercial financial institutions, the World Bank and the Asian Development Bank.

Most tropical soils have long been considered to be problem soils. Due to their low pH and low fertility status, these soils have been considered to be marginal for agricultural production compared to temperate soils. Even though these soils have special management problems, the successful cultivation of rubber countries such as Malaysia, Indonesia, Ivory Coast and Costa Rica have shown that these soils can be used for agricultural production and which hence need special management techniques and practices to have economically sustainable agricultural productivity. These marginal or problem soils include the highly weathered soils which is very low cation exchange capacity, skeletal soils with stones and gravels at shallow depths and sandy soils which is have deep soils with sandy textures (Paramananthan, 2007).

This study was conducted to assess the implementation of rubber planting in new planting areas which are generally not suitable for rubber plantation due to the following reasons. The reasons pertaining to the unsuitability are high pH compared to traditional area, high water table and the structure of clay soil which is impermeable. These limitations can be the factors which adversely affect rubber growth and productivity. Therefore, there must be solutions or alternative approaches of rubber planting in the non-traditional area to improve the growth through rate of fertilizer and mulching application.

1.2 Objectives

i. To evaluate the growth and physiological traits of RRIM 3001 planted in non-traditional area on Gajah Mati series, Jabil series and Batang Merbau series.

ii. To determine the optimum rate of fertilizer for growth of RRIM 3001 in non-traditional area.

iii. To evaluate the effect of mulching practices as soil amelioration in non-traditional area on soil nutrient content and growth of RRIM 3001.

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