



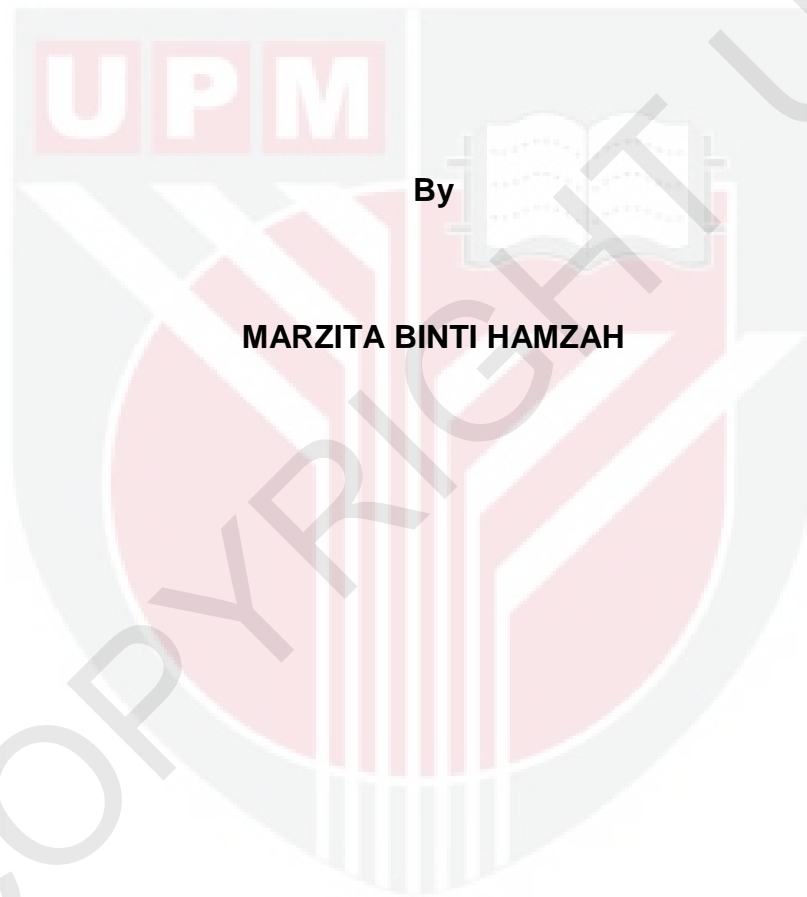
UNIVERSITI PUTRA MALAYSIA

***GROWTH AND PHYSIOLOGICAL RESPONSES OF OIL PALM
SEEDLINGS TO TWO SOURCES OF POTASSIUM***

MARZITA BINTI HAMZAH

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**GROWTH AND PHYSIOLOGICAL RESPONSES OF OIL PALM SEEDLINGS
TO TWO SOURCES OF POTASSIUM**



By

MARZITA BINTI HAMZAH

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Thesis Submitted to the School of Graduate Studies, Universiti Putra
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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Master of Science

**GROWTH AND PHYSIOLOGICAL RESPONSES OF OIL PALM
SEEDLINGS TO TWO SOURCES OF POTASSIUM**

By

MARZITA BINTI HAMZAH

May 2012

Chair: Associate Prof. Hawa Jaafar, PhD

Faculty: Agriculture

A study was conducted to determine the effects of different sources of potassium on the physiological characteristics of oil palm seedlings. Three month old oil palm seedlings of Deli Yangambi and Deli Avros were raised in polybags filled with Serdang series soils. The treatments were applied one month after stabilizing the crop. The treatments comprised of two sources of potassium, potassium chloride (MOP) and potassium sulfate (SOP), applied at four different rates (0, 50, 100 or 150 g K₂O/seedling). The three factor experiment comprising of two progenies, and two K sources at four levels each, was carried out in a glasshouse and arranged in a randomized complete block design with three replications. The objectives of this experiment were to determine the effect of different sources and rates of potassium on the growth

and physiological responses of young oil palm seedlings and to determine interactions between palm progenies and potassium sources and rates. Preliminary analysis prior to application of treatments included soil analysis, fertilizer analysis, crop physiological analysis and nutrient analysis. Monthly physiological and growth measurements included net photosynthesis, stomatal conductance, relative chlorophyll content, transpiration rate, water use efficiency, plant height, leaf area, and total biomass. Growth parameters, physiological responses and nutrient status were significantly influenced by the interaction of progenies, potassium sources and rates. RGR increased 18% when treated with SOP compared to MOP at the rate of 100 g K₂O/seedling. Net photosynthesis was 17% higher in Deli *Yangambi* and 6% higher in Deli *Avros* when treated with MOP at the rate of 100 g K₂O/seedling. Results showed positive associations among the parameters. Stomatal densities at the abaxial surface had significant correlations with frond numbers ($r = 0.5315$), leaf area ($r = 0.6822$), basal diameter ($r = 0.6399$) and water use efficiency (0.5711). Stomatal conductance was positively correlated with water use efficiency ($r = 0.5151$) and transpiration rate ($r = 0.5374$). Positive relationships was observed between nutrients such as total nitrogen and total potassium ($r = 0.8910$). Nutrient uptake was affected by stomata conductance, as revealed by the positive association between total phosphorus ($r = 0.6663$) and total magnesium ($r = 0.7842$) with stomata conductance. In conclusion, SOP at the rate of 150 g K₂O/seedling was the best source to increase vegetative growth of young oil palm seedlings. With respect to progeny Deli *Avros* was the more responsive progeny to the potassium treatments compared to Deli *Yangambi*.

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

**PERTUMBUHAN DAN TINDAKBALAS FISILOGI BAGI ANAK
BENIH KELAPA SAWIT TERHADAP DUA SUMBER
POTASSIUM.**

Oleh

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Kajian yang dilakukan adalah untuk mengkaji kesan sumber potasium yang berbeza terhadap pertumbuhan dan tindakbalas fisiologi anak benih sawit. Anak benih sawit berusia tiga bulan yang berbeza dari segi progeni iaitu Deli Yangambi dan Deli Avros ditanam dalam polibeg yang mengandungi tanah siri Serdang. Rawatan dimulakan sebulan selepas anak benih tersebut serasi dengan persekitaran rumah kaca. Dua jenis potasium digunakan iaitu potasium klorida (MOP) dan potasium sulfat (SOP) dengan empat kadar yang berbeza (0, 50, 100, 150 g anak K_2O /anak benih). Kajian dilakukan dengan menggunakan tiga faktor iaitu dua progeni dan dua jenis potassium pada empat kadar yang

berbeza, eksperimen dilakukan dalam rumah kaca. Objektif kajian untuk mengenalpasti kesan penggunaan sumber potassium yang berbeza pada kadar berbeza ke atas pertumbuhan dan tindakbalas fisiologi anak benih sawit serta mengenalpasti interaksi antara progeni, sumber potassium dan kadar potassium. Analisis primer ialah analisis tanah, baja, nutrien dan fisiologi tumbuhan. Data pertumbuhan dan fisiologi diukur setiap bulan. Terdapat interaksi antara progeni, sumber dan kadar potassium terhadap pertumbuhan dan tindakbalas fisiologikal serta status nutrien. RGR bertambah sebanyak 18% apabila anak pokok kelapa sawit dirawat dengan SOP berbanding MOP pada kadar 100 g K₂O/anak benih. Fotosintesis 17% bagi Deli Yangambi dan 6% bagi Deli Avros yang dirawat dengan MOP pada kadar 100 g K₂O/anak benih. Densiti stomata bagi permukaan atas pelepah menunjukkan hubungan dengan bilangan pelepah ($r = 0.5315$), luas permukaan daun ($r = 0.6822$), diameter batang ($r = 0.06399$) dan keefisienan penggunaan air ($r = 0.5711$). Stomata konduktan mempunyai hubungan positif dengan keefisienan penggunaan air ($r = 0.5151$) dan kadar transpirasi ($r = 0.5374$). Hubungan positif turut dilihat seperti jumlah nitrogen dengan jumlah potassium ($r = 0.8910$). Pengambilan nutrient oleh anak benih kelapa sawit turut memberi kesan kepada stomata konduktan, ditunjukkan oleh hubungan positif antara jumlah phosphorus ($r = 0.6663$) dan jumlah magnesium ($r = 0.7842$) dengan stomata konduktan. Kesimpulannya, SOP pada kadar 150 g K₂O/anak benih adalah sumber potassium yang dapat meningkatkan RGR. Deli Avros lebih menunjukkan tindakbalas terhadap kadar potassium berbanding Deli Yangambi.

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I certify that a Thesis Examination Committee has met on 10 May 2012 to conduct the final examination of Marzita Binti Hamzah on her thesis entitled "**Growth and physiological responses of oil palm seedlings to two sources of potassium**" 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 the Master of Science.

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DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or any other institution.



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Date: 10 May 2012

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