UNIVERSITI PUTRA MALAYSIA

FERTILIZER MANAGEMENT AND NUTRIENT USE BY SAGO PALM *(METROXYLON SAGU)* ON PEAT AND MINERAL SOILS

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By

ADEBIYI OJO TIMOTHY VINCENT

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfillment of the Requirement for the Degree of Doctor of Philosophy

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DEDICATION

This thesis is dedicated to:

Datuk Seri Dr Mahathir Mohamad, the Prime Minister of Malaysia, for his leadership quality and for being a visionary and realist to the core. He exemplified a leader with human heart and fear of GOD and he loves the well being of Malaysians. His government "good policies" stimulated a robust economy and create considerable middle class Malaysians.

The Prime Minister's political teammates especially the Deputy Prime Minister of Malaysia, Datuk Seri Abdullah Badawi, who through their continued support and loyalty to the country made the Prime Minister's visions to be achievable.

The Malaysians; despite their religio-cultural diversities prefer to harmonize their differences in the spirit of "Malaysia Boleh" to evolve a powerful and an economic vibrant nation.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Doctor of Philosophy

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Chairperson: **Professor Zaharah Abd Rahman, Ph.D.**

Faculty: **Agriculture**

Earlier research on the use of fertilizer nitrogen (N), phosphorus (P) and potassium (K) to enhance the growth performance of Sago Palms (*Metroxylon sp.*) on peat could not produce any positive result despite peat being reported to be nutrient deficient. This study was carried out with the main aim of evaluating the N, P and K fertilizer use by young sago palms grown on peat and mineral soils.

The nutrient sorption study on mineral and peat soils showed that both soils interacted weakly with ammonium and potassium ions respectively. The potential buffering capacity (b-value) of the peat for ammonium and potassium ions is 6.61 and 34.09 respectively while the respective b-value of the mineral soil for the ions is 1.62 and 6.23. The mineral soil showed strong affinity for phosphate ion (P-sorption index: 1442.2; b-value for the first slope: 962.8) while

the peat soil exhibited no interaction with the ion (b-value: -0.46). Evidences from the controlled experiments showed that the poor sorption ability of peat for ammonium, potassium and phosphate ions enhances the nutrient leaching and diffusion movements within the peat medium.

Results from Experiment 5.1 in which the effect of soil type applied with three rates of N, P or K showed that soil type has significant effect on P uptake and the subsequent palm performance. The poor sorption ability of peat for phosphate ion caused P-toxicity in the palms while the palms grown on the mineral soil are not affected. For the palms grown on the mineral soil, leaflets P concentrations with the increasing rate of P applied are 0.112, 0.118 and 0.133% (Std. error: 0.004) and the corresponding dry matter yields are 339.3, 374.6 and 431.1 g/plant (Std. error: 55.1). For the palms grown on the peat soil, leaflets P concentrations are 0.237, 0.340 and 0.403% (Std. error: 0.095) and the corresponding dry matter yields are 123.9, 41.2 and 36.3 g/plant (Std. error: 22.6). Effect of P-toxicity on peat was shown by significant decline in plant height, girth size and dry matter yield with the increasing rates of P applied. It is evident in both experiments that high rate of P application was too excessive for sago palms growing in potted peat soil; a rate as low as 0.1 g P/plant at a time was adequate.

Abstrak tesis dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

PENGURUSAN BAJA DAN KEGUNAAN NUTRIEN OLEH POKOK SAGU (*METROXYLON SAGU*) DI TANAH GAMBUT DAN MINERAL

Oleh

ADEBIYI OJO TIMOTHY VINCENT

Februari 2003

Pengerusi: **Profesor Zaharah Abd Rahman, Ph.D.**

Fakulti: **Pertanian**

Kajian terdahulu mengenai penggunaan baja nitrogen (N), fosforus (P) dan kalium (K) untuk meningkatkan pertumbuhan pokok sagu (*Metroxylon sp.*) di tanah gambut tidak menunjukkan sebarang keputusan yang positif, sungguhpun tanah gambut dilaporkan kekurangan nutrien. Kajian ini dijalankan dengan objektif utama menilai penggunaan baja N, P dan K oleh pokok sagu muda yang ditanam di tanah gambut dan tanah mineral.

Kajian serapan nutrien oleh tanah mineral dan tanah gambut menunjukkan bahawa kedua-dua jenis tanah berinteraksi lemah dengan ion ammonium dan ion kalium. Kapasiti keupayaan penampan (nilai-b) bagi ion ammonium dan ion kalium bagi tanah gambut ialah 6.61 dan 34.09, manakala keupayaan penampan (nilai-b) bagi tanah mineral untuk ion-ion tersebut ialah 1.62 dan 6.23. Tanah mineral menunjukkan afiniti kuat terhadap ion fosfat (Indeks

serapan-P: 1442.2; nilai-b untuk kecondongan pertama: 962.8) sementara tanah gambut pula menunjukkan tiada interaksi dengan ion tersebut (nilai-b: -0.46). Bukti dari eksperimen kawalan menunjukkan keupayaan serapan lemah terhadap ion ammonia, kalium dan fosfat oleh tanah gambut, dan dengan itu meningkatkan proses larutresap dan menyebarkan-nya didalam medium tanah gambut.

Keputusan dari kajian kesan jenis tanah yang diberikan tiga kadar N, P dan K menunjukkan kesan yang bermakna terhadap pengambilan P dan seterusnya pertumbuhan pokok. Keupayaan serapan unsur P yang lemah oleh tanah gambut menyebabkan ketoksikan-P di dalam pokok, manakala tumbuhan di tanah mineral tidak mengalami sebarang kesan. Untuk pokok yang ditanam pada tanah mineral, kepekatan P dalam daun meningkat dengan bertambahnya; kadar P iaitu 0.112, 0.118 dan 0.133% dan hasil berat kering yang sejajar, iaitu 339.3, 374.6 dan 431.1 g/pokok. Bagi pokok yang ditanam di tanah gambut, kepekatan ion P dalam daun ialah 0.237, 0.340 dan 0.403% dan berat kering pokok yang sejajar ialah 123.9, 41.2 dan 36.3 g/pokok. Kesan ketoksikan P pada tanah gambut telah menyebabkan penurunan yang bererti bagi ketinggian pokok, saiz lilitan batang dan hasil berat kering dengan meningkatnya kadar baja P yang diberi. Ini telah membuktikan bahawa kadar pemberian P yang tinggi adalah terlalu tinggi untuk tanaman sago yang ditanam pada tanah gambut dalam pasu. Kadar serendah 0.1 g P/pokok pada satu-satu masa adalah mencukupi.

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