INCREASING THE YIELD OF UPLAND RICE IN IDLE LAND THROUGH NUTRIENT AND WEED MANAGEMENT

By

HARTINEE BINTI ABBAS

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirement for the Degree of Master of Agricultural Science

March 2006

“DEDICATION”

To beloved Abah and Mak

Tn. Haji Abbas bin Abdullah
Pn. Hajjah Zaini binti Ismail, P.J.K

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

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Chairman: Associate Professor Mohamed Hanafi Musa, PhD

Faculty: Agriculture

Recently, demand for high quality and fragrant rice has increased markedly due to affluent and health conscious consumers in Malaysia. Research on upland rice had been neglected because of low yield, despite the many good characteristics of upland rice, such as fragrance and long grains size. Furthermore, it has the advantage of cultivation on dry land without accumulation of water. Therefore, a large track of idle land in Malaysia can be developed for upland rice cultivation. This study involves the documentation of upland rice that produce high grain yield and the soil physico-chemical characteristics of idle land. A glasshouse experiment was conducted using Bukit Tuku soil (Aquic Kandiudult) and three selected upland rice varieties (Ageh, Kendinga and Strao) for determination of the optimum levels of N, P, and K fertilizer based on biomass and nutrient partitioning from the earlier survey. The experiment was carried out independently using five levels each of N, P and K with three replicates and arranged in a complete randomized design (CRD). A field trial was conducted on an idle land located in Kampung Kubang Bemban, Kuala Nerang, Kedah to

evaluate the weed management practices for selected rice varieties and levels of nutrients obtained in the glasshouse study. In the field survey, 35 different upland rice seeds were collected from 17 upland rice fields in Malaysia. The plant and panicle numbers and yields of upland rice varieties ranges from 10 to 18 plants $hill^{-1}$, 7 to 14 panicles $hill^{-1}$ and 21 to 50 g yields $hill^{-1}$, respectively. Both upland rice and forest (as a control) soils were acidic, low in N content and CEC at 0-20 and 20-40 cm depths. Higher Fe content was observed in the soils; a major limitation for upland rice growth. The nutrient contents of idle land were low and higher in Al content. In the glasshouse trial, the yields of upland rice varieties ranged from 7 to 22 g $hill^{-1}$ (Ageh), 6 to 18 g $hill^{-1}$ (Kendinga) and 9 to 22 g $hill^{-1}$ (Strao) depending on fertilizer types and levels. The optimum fertilizer rate for each variety was determined using different response models. Quadratic (QR) and linear (LR) response models tend to overestimate the fertilizer rates compared to LR and QR with plateau (P) response models. The fertilizer rates were 112 kg N ha^{-1}, 78 kg P_2O_5 ha^{-1} and 158 kg K_2O ha^{-1} for Ageh (QRP); 138 kg N ha^{-1} (LRP), 87 kg P_2O_5 ha^{-1} (QR), 119 kg K_2O ha^{-1} (QRP) for Kendinga; and 125 kg N ha^{-1} (QR), 85 kg P_2O_5 ha^{-1} (LRP) and 127 kg K_2O ha^{-1} (LR) for Strao. In the field, there was heavy weed infestation in the unweeded (control) plot. Dazomet was the most effective for controlling weeds for up to 5 months after planting. Due to severe water deficit during this experiment, only estimated yield of Strao rice variety were recorded. Dazomet application at 15 x 15 cm planting distance showed higher yields (7.7 tonnes ha^{-1}) compared to 30 x 30 cm planting distance (2.5 tonnes ha^{-1}). Based on this study, the upland rice can be grown successfully on low land areas, such as on idle land in Peninsular Malaysia.

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

MENINGKATKAN HASIL PADI HUMA DI TANAH TERBIAR MELALUI PENGURUSAN NUTRIEN DAN RUMPAI

Oleh

HARTINEE BINTI ABBAS

Mac 2006

Pengerusi: Profesor Madya Mohamed Hanafi Musa, PhD

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Kini, permintaan terhadap beras berkualiti tinggi dan beraroma semakin bertambah disebabkan peningkatan taraf hidup dan kesedaran terhadap kepentingan kesihatan di kalangan rakyat Malaysia. Penyelidikan padi huma sering diabaikan kerana hasilnya rendah walaupun padi huma mempunyai ciri yang baik, seperti beraroma dan saiz bijirin yang panjang. Malahan, ia boleh ditanam di tanah yang tidak ditakungi air. Oleh itu, jumlah tanah terbiar yang banyak di Malaysia boleh diusahakan untuk penanaman padi huma. Kajian ini merangkumi dokumentasi varieti padi huma berhasil tinggi dan ciri fizik dan kimia tanah terbiar. Kajian rumah kaca melibatkan penggunaan tanah Bukit Tuku (Aquic Kandiudult) dan tiga varieti padi huma (Ageh, Kendinga dan Strao) untuk menentukan kadar optimum baja N, P dan K berdasarkan kepada biomas dan pemecahan nutrien yang diperolehi dari tinjauan awal. Ia termasuk lima kadar baja N, P, dan K dengan tiga replikasi setiap satu dan disusun mengikut rekabentuk rawak penuh (CRD). Kajian lapangan dijalankan di kawasan tanah terbiar Kampung Kubang Bemban, Kuala Nerang, Kedah untuk menilai pengurusan kawalan rumpai bagi varieti padi huma terpilih dan kadar baja dari

kajian rumah kaca. Melalui tinjauan lapangan, sebanyak 35 benih padi huma yang berbeza telah berjaya dikumpulkan dari 17 lokasi di Malaysia. Bilangan pokok, tangkai dan hasil padi huma adalah di antara 10 hingga 18 pokok serumpun^{-1}, 7 hingga 14 tangkai serumpun^{-1} dan 21 hingga 50 g hasil serumpun^{-1}. Tanah padi huma dan hutan (kawalan) adalah berasid, rendah kandungan N, dan KPK pada kedalaman 0-20 dan 20-40 cm. Kandungan Fe tanah yang tinggi merupakan faktor penghad terhadap pertumbuhan padi huma. Kandungan nutrien tanah terbiar adalah rendah kecuali kandungan Al. Hasil padi huma adalah di antara 7 hingga 22 (Ageh), 6 hingga 18 (Kendinga) dan 9 hingga 22 g serumpun^{-1} (Strao) mengikut jenis dan kadar baja. Kadar optima baja setiap varieti ditentukan dengan menggunakan beberapa model tindakbalas. Model tindakbalas kuadratik (QR) dan linear (LR) cenderung memberi anggaran kadar baja yang melampau jika dibandingkan dengan model tindakbalas LR dan kuadratik(QR) plateau (P). Kadar baja untuk varieti Ageh, Kendinga dan Strao ialah 112 kg N ha^{-1}, 78 kg P_2O_5 ha^{-1} dan 158 kg K_2O ha^{-1} (QRP); 138 kg N ha^{-1} (LRP), 87 kg P_2O_5 ha^{-1} (QR), 119 kg K_2O ha^{-1} (QRP); dan 125 kg N ha^{-1} (QR), 85 kg P_2O_5 ha^{-1} (LRP) dan 127 kg K_2O ha^{-1} (LR). Kajian pengurusan rumpai di ladang mendapati bilangan rumpai di petak kawalan (tidak merumpai) adalah tinggi. Dazomet di dapati paling efektif bagi pengawalan rumpai sehingga 5 bulan tempoh penanaman. Kemarau semasa kajian ini dijalankan menyebabkan hanya anggaran hasil varieti Strao direkodkan. Penggunaan dazomet pada jarak 15 x 15 cm menunjukkan hasil yang tinggi (7.7 tan sehektar) dibandingkan dengan jarak 30 x 30 cm (2.5 tan sehektar). Berdasarkan kajian ini, padi huma boleh ditanam dengan jayanya di kawasan dataran tanah rendah, seperti tanah terbiar di Semenanjung Malaysia.

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I certify that an Examination Committee has met on 28th March 2006 to conduct the final examination of Hartinee Binti Abbas on her Master of Agricultural Science thesis entitle "Increasing the Yield of Upland Rice in Idle Land through Nutrient and Weed Management" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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

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DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

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HARTINEE BINTI ABBAS

Date:

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