



UNIVERSITI PUTRA MALAYSIA

***GROWTH PERFORMANCE OF ACACIA SPECIES AND *Eurycoma longifolia*
JACK MIXED PLANTING ON BRIS SOILS***

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JACK MIXED PLANTING ON BRIS SOILS**

By

DASRUL ISKANDAR B. DARUS

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

JULY 2012



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Dedicated to

My late grandparents

**HJ ABU BAKAR B. HJ SAAD
HJ AHMAD B. HJ SHAFIE
HJH CHE ZAHARAH BT. CHE LAH
HJH SOM BT. HJ ISMAIL**



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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 PERFORMANCE OF ACACIA SPECIES AND *Eurycoma longifolia* JACK MIXED PLANTING ON BRIS SOILS

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July 2012

Chairman: Associate Professor Mohamad Azani Alias, PhD

Faculty: Forestry

A study was undertaken to assess i) the growth performance of four years-old *Acacia mangium*, *A. auriculiformis* and *Acacia* hybrid trees on two different BRIS (Beach Ridges Interspersed with Swales) soil series, ii) the growth performance of three years old *Eurycoma longifolia* Jack trees mixed planting with *Acacia* spp on BRIS soil and iii) to study the soil nutrient, light penetration (gaps) and litterfall of the mixed *Acacia* spp. and *Eurycoma longifolia* stands planted on BRIS soil.

The growth performances of *A. mangium*, *A. auriculiformis*, *Acacia* hybrid and *Eurycoma longifolia* trees mixed planting on two different BRIS soil series were considered satisfactory. Generally, the average height of four-year-old *A. mangium* trees planted on Rhu Tapai soil series was measured 13.60 m taller than *Acacia* hybrid and *A. auriculiformis*, 12.84 m and 12.44 m respectively. On Rhu Dua soil series, the average height of *A. mangium* trees was also the tallest (12.83 m), followed by *A. auriculiformis* (11.69 m) and *Acacia* hybrid (11.65 m). In term of diameter growth, the average

diameter of *A. mangium* trees on Rhu Tapai soil series was 11.10 cm, bigger than the average diameters of *Acacia* hybrid (10.82 cm) and *A. auriculiformis* (10.31 cm).

Average heights of *Eurycoma longifolia* trees planted on Rhu Tapai and Rhu Dua soil series were 0.78 m and 0.85 m tall respectively. While the averages root collar diameters of trees were 14.76 mm and 14.80 mm. The average root lengths and root dry weights of *Eurycoma longifolia* trees planted on Rhu Tapai and Rhu Dua soil series were 0.30 m and 0.33 m and 11.48 gm and 11.88 gm respectively.

The soil pH values for both study sites were ranged from 4.7 to 5.5. The total N, P and Ca values in Rhu Tapai plots were higher than Rhu Dua. The average values of total N from top soil and sub soil samples taken from Rhu Tapai soil series were 0.7% and 0.5% respectively and 0.4% and 0.2% for Rhu Dua soils series. The average values of total P in Rhu Tapai soil series were recorded higher, ranged from 8.6 ppm (top soil) to 11.7 ppm (subsoil) than Rhu Dua soil series ranged from 1.4 ppm (top soil) to 2.3 ppm (sub soil).

The average litterfall productions in Rhu Tapai were relatively higher than Rhu Dua, measuring 23.9 metric tons / ha / year and 20.5 metric tons / ha/ year respectively. However, among the study plots in Rhu Tapai showed variation in the average annual litterfall production, with the minimum value of 18.2 metric tons and the maximum value of 30.5 metric tons / ha / year.

Whereas, for Rhu Dua study plots there were a small variation in the average litterfall collection. Nevertheless, the production of litterfall of *Acacia* species and *Eurycoma longifolia* in both study sites were much higher compared than reports on *Acacia* plantations in India, Malaysia and Congo by O'Connell and Sankaran (1997) and litterfall production by *Acacia mangium* trees planted on infertile soil in Malaysia (Wan Rashidah *et al.*, 1999).

The canopy of Rhu Tapai stand was more open than Rhu Dua with average canopy openness of 4.43% and 3.10% respectively. In general, the canopy openness in both study sites is much bigger than tropical natural forest which is less than 1.0%. However, for rubber and oil palm plantations the averages canopy openness are much bigger, 15% at the tree age of six to seven years (Wilson and Ludlow, 1990).

The results obtained from this study are very important for future reforestation programme on BRIS soils. The ability of *A. mangium*, *A. auriculiformis*, *Acacia* hybrid and *Eurycoma longifolia* to grow on BRIS soils will definitely help local farmers to involve in herbal industry and to produce general utility timbers and fuel wood for their own consumption.

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

**PRESTASI PERTUMBUHAN TANAMAN CAMPURAN ACACIA SPESIES
DAN *Eurycoma longifolia* JACK DI ATAS TANAH BRIS**

Oleh

DASRUL ISKANDAR BIN DARUS

Julai 2012

Pengerusi: Profesor Madya Mohamad Azani Alias, PhD
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Satu kajian telah dijalankan untuk menilai i) prestasi pertumbuhan pokok berumur empat tahun iaitu *Acacia mangium*, *A. auriculiformis* dan *Acacia hybrid* pada dua siri tanah BRIS (Beach Ridges Interspersed with Swales), ii prestasi pembesaran untuk pokok *Eurycoma longifolia* yang berumur tiga tahun yang ditanam di bawah dirian *Acacia* spp dan iii) untuk mengkaji nutrisi tanah, penembusan cahaya dan sarap hutan yang mengandungi campuran dari *Acacia* spp dan *Eurycoma longifolia*. Kedua – dua spesis ini ditanam atas tanah BRIS.

Pertumbuhan pokok *A. mangium*, *A. auriculiformis*, *Acacia hybrid* dan *Eurycoma longifolia* pada dua siri tanah bris yang berbeza dianggap memuaskan. Secara umumnya, Bagi dirian *A. mangium* yang berumur 4 tahun di Rhu Tapai ianya lebih tinggi ukurannya 13.60 m dari *A. auriculiformis* dan *Acacia Hybrid* dengan ketinggian masing-masing 12.84 m dan 12.44 m. Bagi di tanah Rhu Dua pula, *A. mangium* mempunyai ketinggian yang paling tinggi sekali (12.83 m) dan diikuti *A.auriculiformis*

(11.69 m) dan *Acacia hybrid* (11.65 m). Bagi pertumbuhan diameter pula, diameter purata *A. mangium* pada Rhu Tapai adalah 11.10 cm, lebih besar daripada diameter purata *Acacia hybrid* (10.82 cm) dan *A. auriculiformis* (10.31 cm). Keputusan yang sama juga didapati di Rhu Dua.

Ketinggian purata bagi *Eurycoma longifolia* yang ditanam di Rhu Tapai dan Rhu Dua adalah 0.78 m dan 0.85 m. Manakala purata diameter kolar akar masing-masing adalah 14.76 mm dan 14.80 mm. Purata bagi panjang akar dan berat akar kering *Eurycoma longifolia* Jack yang ditanam di Rhu Tapai dan Rhu Dua adalah 0.30 m dan 0.33 m berserta 11.48 gm dan 11.88 gm.

Nilai pH tanah bagi kedua-dua tapak kajian adalah di antara 4.7 - 5.5. Jumlah nilai N, P dan Ca di plot Rhu Tapai adalah lebih tinggi berbanding dengan Rhu Dua. Jumlah purata nilai N di sampel bahagian tanah atas dan tanah bawah yang diambil dari siri tanah Rhu Tapai adalah 0.7 % dan 0.5 % masing-masing dan 0.4 % dan 0.2 % untuk tanah siri Rhu Dua. Nilai jumlah purata P di siri tanah Rhu Tapai mencatatkan bacaan yang lebih tinggi, berjulat dari 8.6 ppm (tanah atas) 11.7 ppm (tanah bawah) daripada tanah siri Rhu Dua iaitu dari 1.4 ppm (tanah atas) kepada 2.3 ppm (tanah bawah).

Purata pengeluaran sarap di Rhu Tapai secara relatif lebih tinggi daripada Rhu Dua, iaitu masing - masing sebanyak 23.9 metrik tan/ ha/ tahun dan 20.5 metrik tan/ ha/ tahun. Walau bagaimanapun, antara plot kajian di Rhu Tapai telah menunjukkan variasi dalam pengeluaran sarap purata tahunan, dengan nilai minimum sebanyak 18.2 metrik tan/ ha/ tahun dan nilai maksimum

sebanyak 30.5 metrik tan/ ha/ tahun. Sementara itu, untuk plot kajian di Rhu Dua terdapat perubahan kecil dalam koleksi purata sarap. Walau bagaimanapun, pengeluaran sarap bagi *Acacia* spesies dan *Eurycoma longifolia* dalam kedua-dua tapak kajian adalah lebih tinggi berbanding dengan laporan mengenai ladang *Acacia* di India, Malaysia dan Congo (O'Connell dan Sankaran, 1997) dan pengeluaran sarap oleh *Acacia mangium* yang ditanam di tanah subur di Malaysia (Wan Rashidah et al., 1999).

Bagi kanopi di Rhu Tapai adalah lebih terbuka daripada Rhu Dua masing masing dengan purata pembukaan kanopi 4.43 % dan 3.10 %. Secara umum, keterbukaan kanopi di kedua-dua kawasan kajian adalah lebih besar daripada hutan tropika semula jadi yang kurang daripada 1.0 %. Walau bagaimanapun, bagi di ladang-ladang getah dan kelapa sawit purata keterbukaan kanopi adalah lebih besar iaitu 15 % pada usia pokok enam hingga tujuh tahun (Wilson dan Ludlow, 1990).

Keputusan yang telah diperolehi daripada kajian ini adalah sangat penting untuk program penanaman semula hutan di masa hadapan di tanah BRIS. Keupayaan *A. mangium*, *A. Auriculiformis*, *Acacia* hybrid dan *Eurycoma longifolia* tumbuh hidup di tanah BRIS pasti akan membantu petani tempatan untuk melibatkan diri dalam industri herba dan menghasilkan bahan api kayu untuk kegunaan sendiri.

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I certify that a Thesis Examination Committee has met on 20th July 2012 to conduct the final examination of Dasrul Iskandar Bin Darus on his thesis entitled "Growth Performance of *Acacia* Species and *Eurycoma longifolia* JACK Mixed Planting on Beach Ridges Interspersed with Swales (BRIS) SOILS" in accordance with 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 in Forestry.

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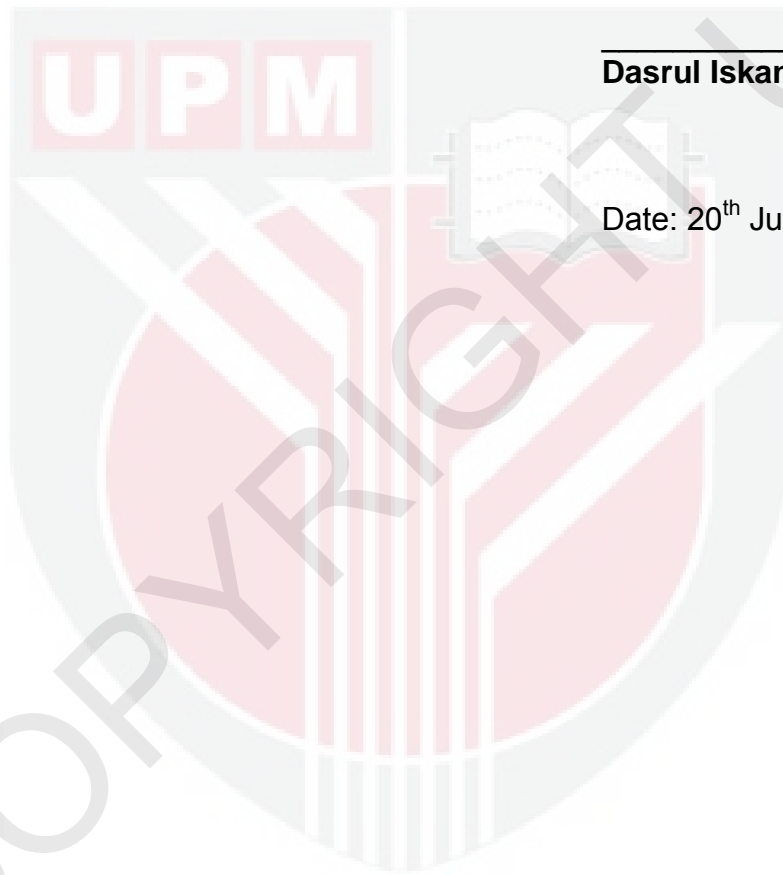
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DECLARATION

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 at any other institution.

Dasrul Iskandar Darus

Date: 20th July 2012



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