UNIVERSITI PUTRA MALAYSIA

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MASTER OF SCIENCE
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By

NAING MAW LWIN

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

July 2010

DEDICATION

This thesis is special dedicated to

My beloved country, parents and wife

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

SEED MATURITY AND POLLEN SOURCE INFLUENCE ON *DURA* X *PISIFERA* (*Elaeis guineensis* Jacq.) SEED QUALITY

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Chairman: **Mohammad Bin Mohd. Lassim, PhD**

Faculty: **Agriculture**

In this study, the effects of pollen source and seed maturity and size on germinability and vigor of oil palm (*Elaeis guineensis* Jacq.) seeds were investigated. Seeds were obtained from controlled pollinated bunches of selected Deli *dura* with *pisifera* (AVROS) palms. Experimental design used was randomized complete block design (RCBD) with three replications. The treatments were two pollen sources: 8-year and 27-year old palms, six stages of seed maturity: 13, 15, 17, 19, 21 and 23 weeks after pollination (WAP) and three classes of seed size: small, medium and large. For seed germination, 'Dry Heat Treatment Method' was used. Daily data collection was extended up to 60 days starting from first sign of germination.

The seed germination parameters recorded were final cumulative germination percentage (FGP), mean time to complete germination (MTCG), average germination speed (AGS), germination value (GV) and vigor index (VI). Some seed traits of shell thickness and ratio to seed weight (SR), 100-seed weight and moisture

content, dry and fresh weight of kernel and embryo from different maturity treatment levels of both pollen sources were also recorded. Analysis of variance was done with SAS 9.2 software. Means were separated using Tukey's Honestly Significant Difference (HSD) test at 5% level of probability.

The results showed that the oil palm seeds harvested at 21 WAP had both the highest FGP and GV with fastest AGS. It could be defined that 21 WAP was the physiological maturity stage of oil palm seeds because FGP was at its maximum value. There were no statistically significant differences in all parameters of seed germination and vigor between 21 WAP and 23 WAP, whereas 23 WAP had relatively larger VI for consecutive seedling growth. Therefore, 23 WAP could also be defined to be the harvest maturity stage for oil palm seed. In addition, the influence of pollen source on germinability and vigor was significantly different at all maturity stages tested except at 23 WAP. Immature seeds up to 15WAP showed no germination at all.

Seeds which resulted from pollination with pollen from 8-year old palm had higher seed germination potential (FGP) than those seeds produced from pollination with pollen from 27-year old palm at 21 WAP. Similar pattern was observed for MTCG, AGS and GV of seeds. However, seeds produced from pollination with pollen from 27-year old palm possessed superior potential of FGP, MTCG, AGS, GV and vigor (VI) for seedling growth rate at 19 WAP.

Variations in seed size did not seem to significantly affect the germination capacity and vigor. Thus, all sizes of seed could be utilized as commercial planting materials. However, further studies on seed size effect on germination and vigor in relation to other factors especially genetic control is still needed for oil palm seed germination process.

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

PENGARUH KEMATANGAN BIJI BENIH DAN SUMBER DEBUNGA TERHADAP KUALITI BIJI BENIH *DURA* X *PISIFERA*

Oleh

NAING MAW LWIN

Julai 2010

Pengerusi: **Mohammad Bin Mohd. Lassim, PhD**

Fakulti: **Pertanian**

Dalam penyelidikan ini, pengaruh sumber debunga dan kematangan dan saiz biji benih terhadap keupayaan bercambah dan kecergasan biji benih kelapa sawit (*Elaeis guineensis* Jacq.) telah dikaji. Biji benih diperoleh hasil dari pendebungaan terkawal melibatkan Deli *dura* yang terpilih dengan *pisifera* (AVROS). Bentuk eksperimen yang digunakan adalah Rekabentuk Blok Penuh Terawak (RCBD) dengan tiga replikasi. Dua jenis sumber debunga: kelapa sawit berumur 8 dan 27 tahun, enam peringkat kematangan biji benih: 13, 15, 17, 19, 21 dan 23 minggu selepas pendebungaan (MSP) dan tiga kelas saiz biji benih: kecil, sederhana dan besar telah digunakan dalam penyelidikan ini. ‘Kaedah Rawatan Haba Kering’ telah digunakan untuk percambahan biji benih. Data diambil setiap hari bermula apabila biji benih mula menunjukkan tanda percambahan sehingga hari ke-60.

Parameter yang digunakan untuk menilai biji benih adalah peratus akhir percambahan (FGP), purata masa yang diperlukan untuk percambahan lengkap

(MTCG), purata kepantasan percambahan (AGS), nilai percambahan (GV) dan indeks kecergasan (VI). Beberapa ciri khusus biji benih iaitu ketebalan tempurung dan nisbah kepada berat biji benih (SR), berat untuk 100 biji benih dan kandungan kelembapan, berat kering dan basah isi dan embrio daripada tahap kematangan yang berbeza oleh kedua-dua sumber debunga juga direkodkan. Analisis varians dibuat dengan menggunakan perisian SAS versi 9.2. Nilai purata diasingkan menggunakan ujian Tukey's Honestly Significant Difference (HSD) pada 5% tahap kebarangkalian.

Keputusan yang diperolehi menunjukkan bahawa biji benih kelapa sawit yang dituai pada 21 MSP mempunyai nilai tertinggi FGP dan GV dengan kepantasan tertinggi AGS. Maka boleh dianggap bahawa 21 MSP merupakan tahap kematangan fisiologi bagi biji benih kelapa sawit kerana FGP yang dicapai adalah pada tahap maksimum. Berdasarkan kajian statistik, tiada perbezaan signifikan untuk semua parameter percambahan biji benih dan kecergasan di antara 21 MSP dan 23 MSP, dengan 23 MSP mempunyai nilai VI yang lebih tinggi pada setiap masa perkembangan biji benih. Oleh itu, pada 23 MSP biji benih juga boleh dianggap sudah mencapai tahap kematangan bagi penuaian untuk kelapa sawit. Selain itu, pengaruh sumber debunga ke atas keupayaan bercambah dan kecergasan adalah berbeza secara bererti pada semua tahap kematangan yang diuji kecuali pada 23 MSP. Biji benih tidak matang (muda) iaitu sehingga 15 MSP tidak menghasilkan sebarang percambahan.

Pada 21 MSP, biji benih yang dihasilkan dari pendebungaan dengan debunga dari pokok yang berusia 8 tahun mempunyai FGP yang lebih tinggi berbanding biji benih

yang dihasilkan dari pendebungaan dengan debunga dari pokok yang berusia 27 tahun. Pola yang sama dapat dilihat bagi MTCG, AGS dan GV biji benih. Walau bagaimanapun, biji benih yang dihasilkan dari pendebungaan dengan debunga dari pokok yang berusia 27 tahun menunjukkan FGP, MTCG, AGS, GV dan VI yang lebih tinggi untuk kadar perkembangan biji benih pada 19 MSP.

Variasi pada saiz biji benih menunjukkan tiada perbezaan bererti pada kapasiti percambahan dan kecergasan. Oleh yang demikian, biji benih dari pelbagai saiz boleh digunakan sebagai bahan tanaman komersial. Walaubagaimanapun, kajian lebih mendalam mengenai kesan saiz biji benih terhadap percambahan dan kecergasan yang berkait dengan faktor-faktor lain terutamanya kawalan genetik adalah masih diperlukan untuk proses percambahan biji benih kelapa sawit.

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I certify that a Thesis Examination Committee has met on 20 July 2010 to conduct the final examination of Naing Maw Lwin on her thesis entilted "Seed Maturity and Pollen Sources Influence on *Dura* X *Pisifera* (*Elaeis guineensis* Jacq.)Seed Quality" 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.

Members of the Thesis Examination Committee were as follows:

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This thesis was submitted to the Senate of Universiti Putra Malaysia and Has been accepted as fulfilment of the requirement for the degree of Master of Science.

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Date: 2 September 2010

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 other institutions.

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NAING MAW LWIN

Date: 20th July 2010

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