



UNIVERSITI PUTRA MALAYSIA

**Trichoderma harzianum AS A GROWTH ENHANCER OF OIL PALM AND
FACTORS AFFECTING ITS MASS PRODUCTION**

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

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the requirement for the degree of Master of Science

***Trichoderma harzianum AS A GROWTH ENHANCER OF OIL PALM AND
FACTORS AFFECTING ITS MASS PRODUCTION***

By

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August 2008

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The oil palm industry is one of the highest users of chemical-based fertilizers and pesticides in Malaysia. This study was conducted to investigate the effect of formulated *Trichoderma* (FA 1132) as an alternative biofertilizer for use in the industry. A nursery trial was conducted at the glasshouse in Universiti Putra Malaysia (UPM), using a total of 45 seedlings. Six treatments were carried out to determine the effect of the formulated *Trichoderma* as a growth enhancer; the first 3 were single applications each of the formulated *Trichoderma* (strain FA 1132), commercial compost and chemical fertilizers respectively. The second consisted of mixed treatments of 1:1 *Trichoderma* formulation with fertilizers and 1:1 of the formulation with commercial compost. Five growth parameters assessed were increased stem girth, frond number, frond length, number of pinnae/longest frond and leaf chlorophyll content. The experiment was arranged in a Randomized Complete Block Design (RCBD) at 3 replicates of 15 seedlings per treatment. Results showed that the best growth enhancer of oil palm seedlings was the treatment with the formulated *Trichoderma*. The same treatments and parameters were used for field trial I at Taman Pertanian Pertanian Universiti (TPU), UPM; a forest clearing area and has never been planted with any crops before. The experiment was conducted in a RCBD at 3 replicates with 9 palms per subplot. Results showed that the application of the *Trichoderma* formulation again was the best growth enhancer of the oil palms compared to other treatments. In Mungka Estate, Segamat, Johor by using the same treatments as Field Trial I, experimental design set up in RCBD at 4 replicate plots of 20 palms per subplot, results showed that the mixed formulation, 1:1 *Trichoderma*

formulation with fertilizers ranked the highest in terms of efficacy as the growth enhancer of oil palms. Field Trial II was actually an ex-oil palm field for second generation planting and may therefore have nutrient deficiency soils. In order to mass produced conidia of FA 1132, a submerged fermentation using potato sucrose broth as a media with 9% of molasses as nutrient supplement was conducted. It was stirred at an impeller speed of 750rpm and a dissolved oxygen tension rate of 75%. The results showed an increment to 4.6×10^9 conidia/ml per hour after 84 hours from 3.2×10^7 conidia/ml. Laboratory studies also conducted to optimize the production of FA 1132 conidia in solid state fermentation with an intention towards the development a suitable medium to replace palm fibers as the solid substrate medium for the production of FA 1132 and better suit for liquid formulation. Results found 500g milled rice at 100% moisture content with 9% molasses as a nutrient supplement and stirred homogenously at day six gave the best conidia counts at 10^7 conidia/ml stock in 14 days.

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

**TRICHODERMA HARZIANUM SEBAGAI AGEN PENGGALAK
PERTUMBUHAN KELAPA SAWIT DAN FAKTOR – FAKTOR YANG
MEMPENGARUHI PENGHASILANNYA SECARA BESAR - BESARAN**

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Industri sawit merupakan salah satu industri yang melibatkan penggunaan bahan kimia yang tinggi. Justeru, kajian ini menguji keberkesanan produk *Trichoderma* (FA 1132) sebagai satu alternatif terhadap penggunaan baja kimia, melalui kajian pada peringkat nurseri dan ladang. Kajian nurseri telah dijalankan di rumah kaca Universiti Putra Malaysia (UPM). Enam kaedah rawatan telah digunakan bagi menentukan produk *Trichoderma* tersebut sebagai penggalak pertumbuhan. Enam rawatan kajian yang dijalankan untuk ialah aplikasi produk *Trichoderma*, kompos komersil dan baja kimia. Rawatan yang seterusnya ialah aplikasi campuran 1:1 produk *Trichoderma* bersama kompos komersil dan 1:1 produk *Trichoderma* bersama baja kimia. Sebanyak 5 parameter iaitu ukur lilit pangkal batang, jumlah pelepas, panjang pelepas, jumlah daun pada pada pelepas yang terpanjang dan analisis korofil. Susunan eksperimen adalah dalam bentuk RCBD iaitu 3 replikat dengan 15 anak pokok sawit bagi satu rawatan. Keputusan eksperimen ini menunjukkan produk *Trichoderma* sebagai agen penggalak pertumbuhan terbaik. Kajian Lapangan I telah dijalankan di Taman Pertanian Universiti (TPU), UPM. TPU, UPM merupakan satu kawasan yang baru dibersihkan dan belum pernah ditanam dengan kelapa sawit. Kesemua rawatan dan parameter bagi Kajian Lapangan I adalah sama seperti eksperimen rumah kaca. Susunan bagi eksperimen ini ialah RCBD dengan 3 replikat dan 9 pokok bagi satu rawatan kajian dalam satu replikat. Keputusan menunjukkan bahawa aplikasi produk *Trichoderma* sekali lagi menunjukkan prestasi sebagai agen penggalak pertumbuhan yang terbaik. Kajian Lapangan II di Ladang Mungka, Segamat, Johor juga menggunakan susunan kajian RCBD, iaitu dengan 20 pokok kelapa sawit untuk satu rawatan dalam satu replikat.. Ladang Mungka merupakan

kawasan penanaman semula generasi kedua kelapa sawit dan berkemungkinan mengalami kekurangan nutrisi. Terdapat 4 replikat kajian telah digunakan dalam kajian ini. Keputusan eksperimen ini mendapati bahawa rawatan campuran 1:1 produk *Trichoderma* bersama baja kimia adalah rawatan terbaik sebagai agen penggalak tumbuhan keseluruhannya bagi peringkat lapangan di Ladang Mungka. Teknik fermentasi terampai dengan menggunakan media kentang bersama 9% tambahan nutrien molas telah dijalankan bagi menghasilkan pengeluaran secara besar-besaran konidia FA 1132. Eksperiment ini dijalankan dengan kadar pusingan alat pengacau di tentukan pada 750rpm serta peratusan oksigen terlarut sebanyak 75%. Keputusan eksperimen menunjukkan pertambahan konidia FA 1132 daripada 3.2×10^7 konidia/ml kepada 4.6×10^9 konidia/ml dalam masa 84 jam selepas fermentasi. Kajian peningkatan pengeluaran konidia *Trichoderma* secara fermentasi substrat pepejal pada peringkat makmal juga telah dijalankan untuk mencari alternatif medium pepejal serabut kelapa sawit bagi penghasilan konidia FA 1132 dan lebih sesuai untuk formulasi cecair. Keputusan menunjukkan bahawa 500g substrat beras hancur bersama 100% kandungan air dengan 9% molas sebagai tambahan nilai nutrient, dengan dikacau secara homogen pada hari yang ke enam, telah menyebabkan peningkatan spora daripada 1.36×10^7 kepada 4.24×10^7 konidia/ml dalam 14 hari.

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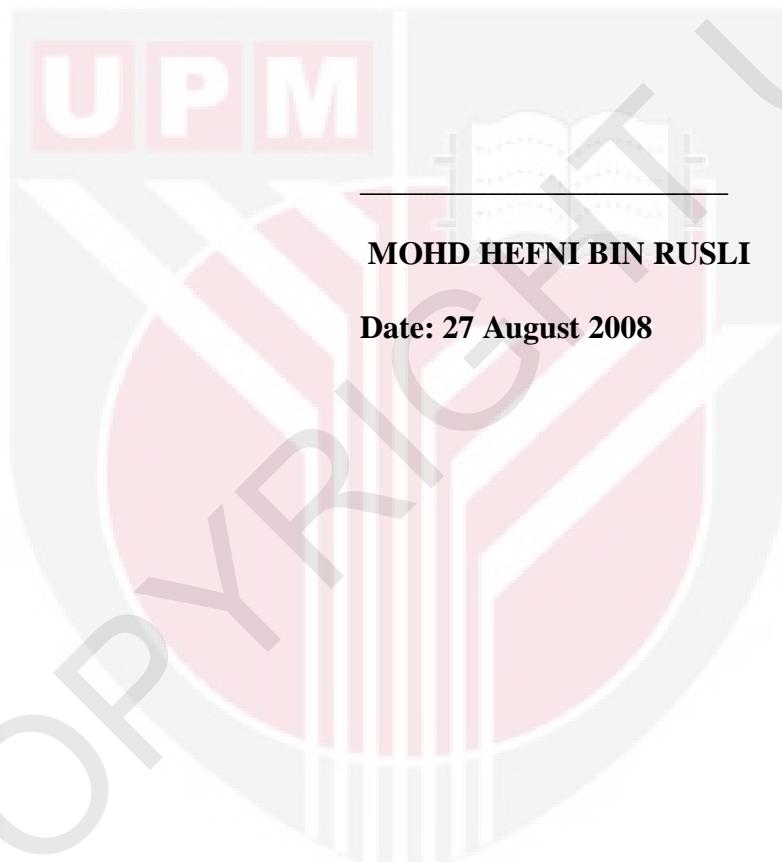
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DECLARATION

I declare that the thesis is my original work except for quotation 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.



MOHD HEFNI BIN RUSLI

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