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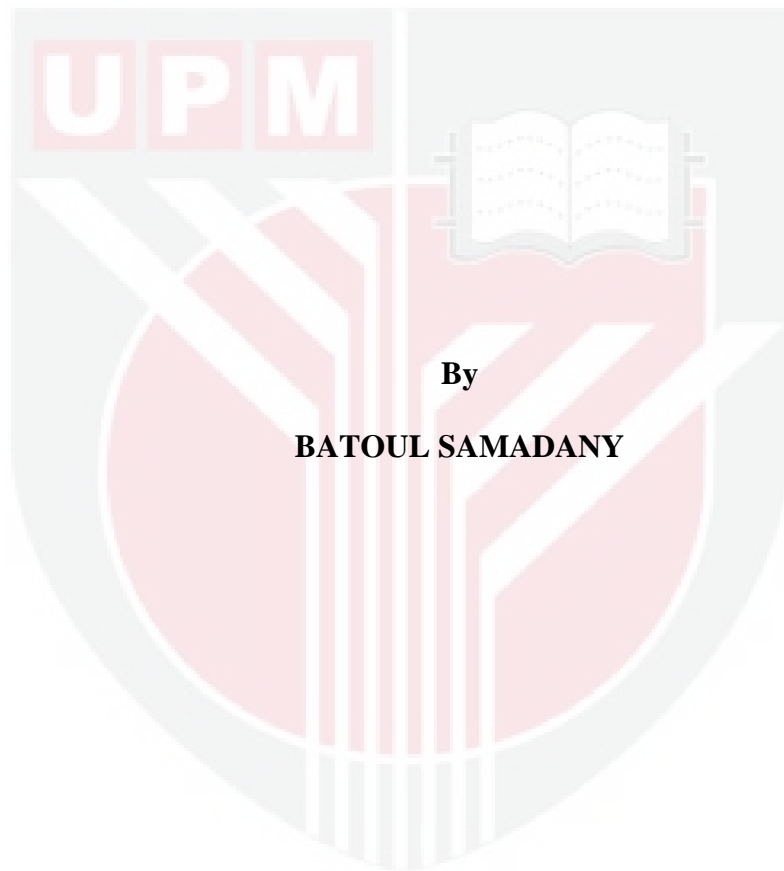
**EFFECTIVNESS OF COVER CROP SPECIES IN OIL PALM  
WEED MANAGEMENT**

**BATOUL SAMADANY**

**FP 2013 24**



**EFFECTIVNESS OF COVER CROP SPECIES IN OIL PALM WEED  
MANAGEMENT**



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

**June 2013**

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## **DEDICATION**

**To the soul of my beloved mother and father, who taught me how to live**

**and**

**To my husband, Majid and my sons, Ali and Erfan, that without their patience and support,**

**this would not have been possible**



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

## **EFFECTIVNESS OF COVER CROP SPECIES IN OIL PALM WEED MANAGEMENT**

By

**BATOUL SAMADANY**

**June 2013**

**Chairman: Professor Abdul Shukor Juraimi, PhD**

**Faculty: Agriculture**

Sustainable oil palm cultivation is gaining popularity in Malaysia. Currently alternative strategies to chemical herbicides for weed control have received widespread attention. Hence field experiments were designed to compare the effect of cover crops on the response of oil palms and weeds. Six ground cover treatments viz. *Axonopus compressus*, *Calopogonium caeruleum* + *Centrosema pubescens*, *Mucuna bracteata*, *Pueraria javanica* + *Centrosema pubescens*, weeded and unweeded were evaluated. Initial weed composition revealed two dominant weed species viz. *Borreria latifolia* and *A. compressus*. *A. compressus*, *M. bracteata* and other legume cover crops achieved 100% coverage at 3, 6 and 9 months after planting, respectively. Cover crops and unweeded treatments produced comparable vegetation biomass. Cover crops were found to be effective in controlling weeds. The unweeded treatment favored *Paspalum conjugatum* and *A. compressus* as the dominant species. In the *A. compressus* and *C. caeruleum* + *C. pubescens* the associated weed species with highest dominance was *Asystasia gangetica*, while the weeds *A. compressus* and *A. gangetica* were associated with *M.*

*bracteata* and *P. javanica* + *C. pubescens*. In the weeded treatment *B. latifolia* was dominant. The *A. compressus* treatment had the lowest species richness and diversity. The *A. compressus* treatment showed yield difference with weeded plot at between 18 to 24 months after planting. The cover crops did not influence nutrient levels or photosynthesis rate of oil palm relative to the un-weeded and weeded. The *M. bracteata* treatment increased K and Ca in the soil. Results of smothering effects of cover crops on *P. polystachion* and *A. gangetica* revealed that *A. gangetica* was a weaker competitor than *P. polystachion*. Legume cover crops had a higher relative yield when grown in mixtures with *A. gangetica* than in the monoculture. The superior competition of legume cover crops was due to the higher canopy height and high leaf area index. With *P. polystachion*, the dry weight per plant, leaf area and shoot numbers increased as its proportion decrease in the mixture. The competitive ability of *A. compressus* against *A. gangetica* was investigated under contrasting sunlight intensity. Suppression of *A. gangetica* by *A. compressus* occurred under full sunlight, irrespective of plant density, but this ability was reduced under shade as density decreased. The possibility of allelopathic effects of cover crop litter on *A. gangetica* and *P. polystachion* was tested. Cover crop litter leachates decreased the germination and seedling length of *A. gangetica* and *P. polystachion*. The cover crops leachates also delayed the germination of *A. gangetica*. The effect of litter leachate-amended soil on root and shoot length, dry weight and chlorophyll concentration of *A. gangetica* and *P. polystachion* seedlings revealed that they were not sensitive to the leachate amended soils of cover crop. Study on the fate of cover crop litter phenolics in the soil showed that the phenolic compounds in cover crop litter is unstable in the soil system for a considerable period of time.

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

**KEBERKESANAN TANAMAN SPECIES PENUTUP BUMI TERHADAP  
PENGURUSAN RUMPAI KELAPA SAWIT**

Oleh

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**Jun 2013**

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Penanaman kelapa sawit secara lestari semakin popular di Malaysia. Pada masa ini strategi alternatif kepada racun rumpai kimia untuk kawalan rumpai telah mendapat perhatian meluas. Oleh itu, uji kaji lapangan telah direkabentuk untuk membandingkan kesan tanaman penutupbumi terhadap respon kelapa sawit dan rumpai. Enam jenis penutup bumi iaitu *Axonopus compressus*, *Calopogonium caeruleum* + *Centrosema pubescens*, *Mucuna bracteata*, *Pueraria javanica* + *Centrosema pubescens*, Kawalan rumpai, dan tanpa merumpai telah dinilai. Komposisi rumpai awal mendapati dua spesies rumpai dominan iaitu *Borreria latifolia* dan *A. compressus*. *A. compressus*, *M. bracteata* dan lain-lain tanaman kekacang penutup bumi mencapai 100% litupan masing-masing pada 3, 6 dan 9 bulan selepas menanam. Tanaman penutup bumi dan rawatan tanpa merumpai menghasilkan biojisim tumbuhan setanding. Tanaman penutup bumi didapati berkesan mengawal rumpai. Rawatan tanpa merumpai menggalakkan pertumbuhan *Paspalum conjugatum* dan *A.compressus* sebagai spesies yang dominan. *A. compressus*

dan *C. caeruleum* + *C. pubescens* spesies rumpai pada rawatan yang paling dominan ialah *Asystasia gangetica*, manakala rumpai *A. gangetica* dan *A. compressus* adalah berkait dengan plot rawatan *M. bracteata* dan *P. javanica* + *C. pubescens*. Dalam rawatan merumpai *B. latifolia* adalah dominan. Plot rawatan *A. compressus* mempunyai kekayaan dan kepelbagaian spesies terendah. Rawatan *A. compressus* menunjukkan perbezaan hasil dengan rawatan merumpai pada 18-24 bulan selepas menanam. Tanaman penutup bumi tidak mempengaruhi tahap nutrien atau kadar fotosintesis yang ketara relatif kepada kawalan tanpa merumpai dan merumpai. Rawatan *M. bracteata* meningkatkan K dan Ca dalam tanah. Keputusan kajian persaingan tumbuhan penutup bumi keatas *P. polystachion* dan *A. gangetica* menunjukkan *A. gangetica* adalah pesaing yang lebih lemah berbanding *P. polystachion*. Kekacang penutup bumi mempunyai hasil relatif yang lebih tinggi apabila ditanam dalam campuran, bersama *A. gangetica* berbanding dalam keadaan monokultur. Kekacang penutup bumi dapat bersaing dengan lebih baik disebabkan oleh kanopi yang lebih tinggi dan indeks luas daun yang tinggi. Bagi *P. polystachion*, berat kering per pokok, luas daun dan bilangan pucuk meningkat selari dengan pengurangan bilangan pokok dalam campuran. Keupayaan bersaing *A. compressus* melawan *A. gangetica* telah dikaji dibawah intensiti cahaya berbeza. Tekanan keatas *A. gangetica* oleh *A. compressus* berlaku dalam keadaan cahaya matahari penuh, tanpa mengira kepadatan pokok, tetapi keupayaan ini berkurangan dalam keadaan lindungan apabila kepadatan pokok berkurangan. Satu percubaan untuk mengkaji kemungkinan kesan alelopati sampah tumbuhan penutup bumi keatas *A. gangetica* dan *P. polystachion* telah dilakukan. Sisa larut tanaman penutup bumi didapati mengurangkan peratusan percambahan dan panjang anakbenih *A. gangetica* dan *P. polystachion*. Sisa larut tanaman penutup bumi juga didapati melambatkan



percambahan benih *A. gangetica*. Kesan sisa larut resapan-ubahsuai tanah ke atas panjang akar dan pucuk, berat kering dan kepekatan klorofil benih *A. gangetica* dan *P. polystachion* menunjukkan bahawa *A. gangetica* dan *P. benih polystachion* tidak sensitif terhadap rawatan tersebut. Kajian kesan fenolik tanaman penutup bumi dalam tanah menunjukkan sebatian fenolik dalam sisa tanaman penutup bumi tidak kekal stabil dalam sistem tanah untuk tempoh yang agak lama.



## ACKNOWLEDGEMENTS

In the name of Almighty ALLAH, who provided me with the strength, wisdom and will to complete my doctoral study.

I would like to express my heartfelt appreciation and sincere gratitude to my supervisor Professor Dr. Abdul Shukor Juraimi for his invaluable supervision, his patience and enthusiasm, constructive criticisms and continuous encouragement throughout the study.

I am much grateful and indebted to Associate Professor Dr. Mohd Rafii Bin Yusop, Associate Professor Dr. Sheikh Awadz Sheikh Abdullah and Associate Professor Dr. Anuar Abd. Rahim, members of the supervisory committee, for their constructive suggestions and insightful comments in all phases of this research project. I express my deep sense of respect to all of the lecturers and professors in the Department of Crop Science for their valuable suggestions and constructive comments.

I would like to thank UPM for providing research facilities to conduct my Ph. D study. I consider it an honor to work with all the administrative and technical staffs of the Department of Crop Science, Field 2 and 15 UPM and Department of Land Management Faculty of Agriculture.

I would like to thank Mr. Mohd Yunos Bin Abdul Wahab for his assistance in glasshouse and field works. My condensed thanks also go to Mr. Haji Mohd Shahril Ab. Rahman, Mr. Za'bah Hassan and Mr. Haris Ahmad, that I will never forget the warm and kind help they extended to me in the field works. Special thanks to Hamidah and Yunos for their kind contribution to the Bahasa Melayu abstract of this thesis.

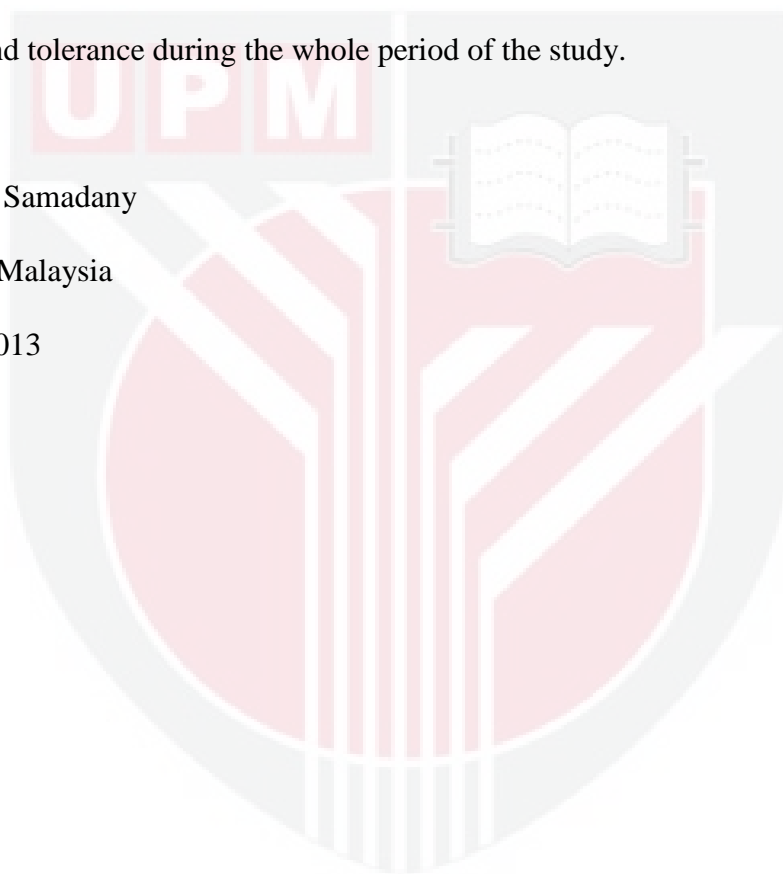
I sincerely acknowledge the Iranian Research Institute of Plant Protection (IRIPP) for financial support to conduct my PhD study and for providing deputation and other supports to commence my study overseas. It gives me much pleasure to express heartfelt gratitude and sincere appreciation to all fellow colleagues for keeping contact with the voice or words, and also for their inspiration, moral support and kind advices to strive to reach the goal.

I am indebted to my family members, relatives and in-laws for their support, deep love and tolerance during the whole period of the study.

Batoul Samadany

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement of the degree of Doctor of Philosophy. The members of the Supervisory Committee were as follows:

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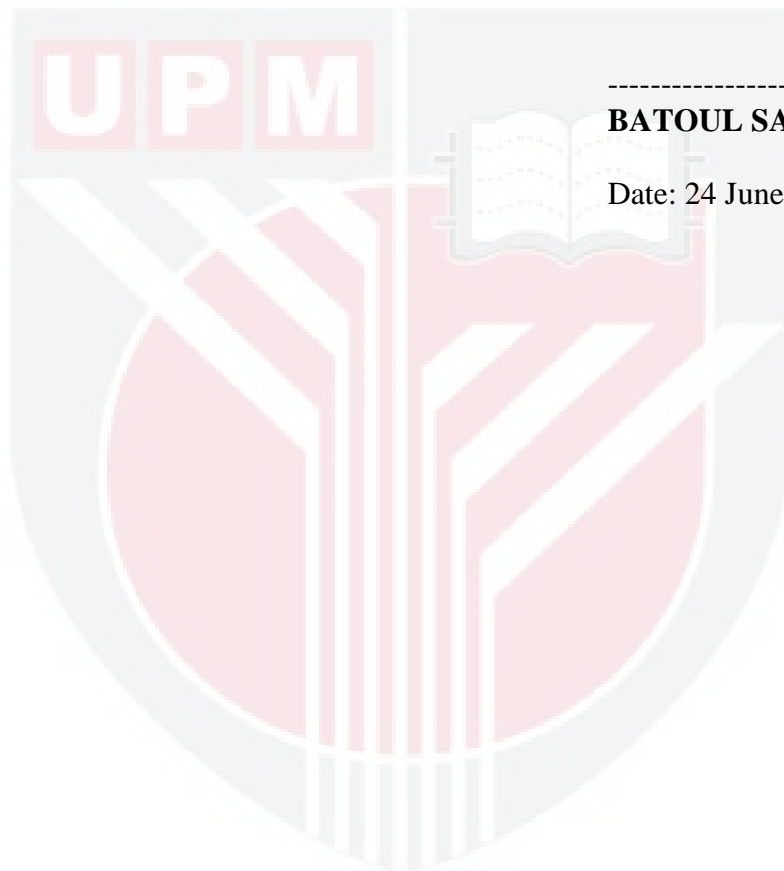
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## DECLARATION

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 Universiti Putra Malaysia or other institutions.



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**BATOUL SAMADANY**

Date: 24 June 2013

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