



UNIVERSITI PUTRA MALAYSIA

***EFFECT OF PACLOBUTRAZOL ON LODGING RESISTANCE, GROWTH
AND YIELD OF DIRECT SEEDED RICE***

BAMBANG SURYA ADJI SYAHPUTRA

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RESISTANCE, GROWTH AND YIELD OF
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BAMBANG SURYA ADJI SYAHPUTRA

**DOCTOR OF PHILOSOPHY
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**EFFECT OF PACLOBUTRAZOL ON LODGING RESISTANCE, GROWTH
AND YIELD OF DIRECT SEEDED RICE**

By

BAMBANG SURYA ADJI SYAHPUTRA

**Theses Submitted to the School of Graduate Studies, Universiti Putra Malaysia,
In Fulfillment of the Requirements for the Degree of Doctor of Philosophy**

June 2012

DEDICATION

To my mother, Hj. Siti Nurjannah, and my wife Neni Ekowati Januariana for their, support, sacrifices and encouragement throughout my study,

and my children,

Zahra Tsurayya Winarti

Khairunissa Dwi febriani

Muhammad Alfisyahrin

for their do'a, motivation, inspiration, love and making my life meaningful.



Abstract of theses presented to the Senate of Universiti Putra Malaysia in
Fulfillment of the requirements for the degree of Doctor of Philosophy

**EFFECT OF PACLOBUTAZOL ON LODGING RESISTANCE, GROWTH
AND YIELD OF DIRECT SEEDED RICE**

By

BAMBANG SURYA ADJI SYAHPUTRA

June 2012

Chairman: Assoc Prof. Uma Rani Sinniah, PhD

Faculty : Institute of Tropical Agriculture

The study was initiated to observe the effects of paclobutrazol (PBZ) as foliar spray on growth, lodging resistance and yield of direct seeded rice. The study consisted of two field experiments and one glasshouse experiment. The field trials were conducted in MADA, Kedah and IADA, Seberang Perak, Perak over two rice growing seasons. The first field trial was designed to obtain the optimum paclobutrazol concentration for increased lodging resistance in one variety of field grown rice, namely MR 219. Paclobutrazol at varying concentrations (0, 100, 200, 400 and 600 mg/L) was applied to rice plants at panicle initiation stage (56 DAS). In the second trial, the best concentration obtained in experiment 1 was used to obtain best time of application. Plants were sprayed at one week before (B) Panicle initiation (PI), during (D) PI and one week after (A) PI. The third experiment was conducted at glass house Ladang 2 UPM to understand the relationship between bending resistance and the ability to withstand wind speeds using a wind tunnel. The results of the first experiment with variety MR219 showed a significant reduction in plant height both at two weeks after application (2WAA) and at harvest with 400 and 600 mg/L having shorter

plants compared to control. The culm and internode length was shorter due to retardation of the lower internodes in plants treated with 400 mg/L. Culm histology revealed that, following the increase in PBZ concentration, parenchyma cell shape changed from rounded to hexagonal with reduced intercellular space. The above changes increased bending resistance significantly with 400 and 600 mg/L of PBZ. Flag leaf area was reduced but chlorophyll content was higher for treatments with 400 and 600 mg/L. Yield and yield components showed that fresh and dry weight was significantly increased at 400 and 600 mg/L compared to control. Panicle length, panicle/m² and weight of 1000 grains were not significantly different for all treatment compared to control plant. It was concluded that the optimum concentration of PBZ was 400 mg/L as minimal differences were observed between 400 and 600 mg/L.

In the second experiment with variety MR 219 in Kedah, plant height, culm length and flag leaf area was significantly reduced for treatment B and D. Bending resistance and chlorophyll concentration was increased for all treatment (B, D and A) at $p < 0.05$ respectively. Internodes length was not significantly different in treatment A compared to control plant for uppermost and second internode, but was significantly different in treatment B and D compared to control plant. Yield and yield components increased for all treatment (B, D and A) compared to control plant. Similar response was obtained in two locations over two seasons. PBZ application is better done at one week before PI.

The third experiment was conducted to understand the relationship between the plant architecture and resistance to wind using a wind tunnel. Upon exposure to wind at 120 km/hour for 5 minutes, the plants were kept in glasshouse for 24 hours, variety MR 219 treated with 400 mg/L Paclobutrazol was 10 to 16% lodged while plants treated with 100

mg/L, 200 mg/L and untreated plants had 60-70%, 40-50% and 90% lodging respectively. PBZ at a concentration of 400 mg/L applied one week before PI was found to be optimum for reduction in plant height and culm height, increase bending resistance and yield with similar effect in both location and for both seasons suggesting its effect to be stable across different environmental conditions.



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

**KESAN PACLOBUTRAZOL PADA KETAHANAN REBAH, PERTUMBUHAN
DAN HASIL PADI DENGAN SISTEM TANAM TABUR TERUS**

Oleh

BAMBANG SURYA ADJI SYAHPUTRA

June 2012

Pengerusi : Profesor Madya. Uma Rani Sinniah, PhD

Fakulti : Institut Pertanian Tropika

Kajian ini telah dilaksanakan untuk melihat kesan penyemburan paclobutrazol (PBZ) sebagai aplikasi foliar terhadap tumbesaran, ketahanan rebah dan hasil padi menggunakan sistem tabur terus. Kajian ini terdiri daripadadua penanaman di sawah padi dan satu percubaan di dalam rumah kaca. Kajian di sawah padi telah dilaksanakan di MADA, Kedah dan IADA, Seberang Perak, Perak untuk dua musim. Kajian pertama bertujuan untuk mendapatkan kepekatan optimum PBZ bagi meningkatkan ketahanan rebah menggunakan satu varieti padi iaitu MR 219. Penyemburan PBZ dengan kepekatan berbeza (0, 100, 200, 400 dan 600 mg/L) melalui daun dilakukan pada peringkat permulaan panikal, untuk varieti MR 219 adalah 56 hari setelah tabur (HST). Dalam kajian kedua, kepekatan optima dari kajian pertama digunakan untuk menguji kesan masa penyemburan. Pokok padi disembur pada masa satu minggu sebelum (B) permulaan panikal (PI), semasa (D) PI dan satu minggu selepas (A) PI. Kajian ketiga telah dijalankan di rumah kaca untuk memahami hubungan antara ketahanan rebah dan keupayaan untuk menahan kelajuan angin pada tanaman padi dengan menggunakan terowong angin.

Hasil percubaan yang pertama bagi varieti MR 219 menunjukkan bahawa terdapat pengurangan yang signifikan pada ketinggian pokok pada dua minggu selepas penyemburan (2WAA) dan pada masa tuai antara 400 dan 600 mg/L berbanding dengan kawalan. Panjang batang dan panjang ruas padi juga lebih rendah terutamanya pada ruas di pangkal pokok bagi rawatan 400 mg/L. Histologi batang menunjukkan dengan meningkatnya kepekatan PBZ, bentuk sel parenchyma berubah dari bulat ke bentuk bersegi dengan ruang antara sel yang semakin kecil. Perubahan di atas meningkatkan ketahanan rebah secara signifikan untuk rawatan 400 dan 600 mg/L. Luas daun pengasuh menurun tetapi terdapat peningkatan pada kepekatan klorofil untuk rawatan. Hasil tuaian dan komponen hasil menunjukkan bahawa berat basah grain/m² dan berat kering adalah signifikan pada 400 dan 600 mg/L berbanding kawalan. Panjang panikal, panikal/m² dan berat 1000 biji tidak signifikan untuk semua kepekatan PBZ dibandingkan dengan kawalan. Kesimpulannya ialah bahawa kepekatan PBZ yang paling sesuai adalah 400 mg/L kerana perbezaan yang tidak signifikan di antara 400 dan 600 mg/L.

Dalam kajian yang ke-II varieti MR 219 di Kedah, menunjukkan bahawa ketinggian tanaman, ketinggian batang dan keluasan daun pengasuh berkurang secara signifikan pada rawatan B dan D. Ketahanan rebah dan kepekatan klorofil meningkat untuk semua rawatan (B, D dan A) pada $p < 0,05$. Panjang ruas tidak berbeza pada rawatan A berbanding kawalan bagi ruas yang paling atas dan kedua, tetapi berbeza secara signifikan pada rawatan B dan D berbanding kawalan. Hasil tuaian dan komponen hasil meningkat pada semua rawatan (B, D dan A) berbanding kawalan. Respon yang sama diperolehi pada kedua-dua lokasi untuk dua musim. Oleh itu, masa penyemburan PBZ yang sesuai adalah satu minggu sebelum PI.

Kajian dijalankan untuk memahami hubungkait antara bentuk tanaman dengan daya tahan rebah menggunakan terowongan angin. Pendedahan terhadap angin pada kelajuan 120 km / jam selama 5 minit, diikuti dengan penyimpanan selama 24 jam dalam rumah kaca, menunjukkan bahawa varieti MR 219 yang disemur dengan kepekatan PBZ 400 mg/L telah rebah sekitar 10 hingga 16%, manakala kepekatan 100 mg/L, 200 mg/L dan kawalan menunjukkan 60-70%, 40-50% dan sehingga 90% rebah. PBZ dengan kepekatan 400 mg/L adalah kepekatan yang paling sesuai untuk mengurangkan ketinggian tanaman, panjang batang, ketahanan rebah dan dapat meningkatkan hasil. Kesan paclobutrazol sama di kedua-dua lokasi dan kedua-dua musim menunjukkan bahawa kesannya stabil untuk keadaan alam sekitar yang berbeza.

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I certify that an Examination Committee has met on.....to conduct the final Examination of Bambang Surya Adji Syahputra on his Doctor of Philosophy thesis entitled “effect of paclobutazol on lodging resistance, growth and yield of direct seeded rice” 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 Doctor of Philosophy. Member of the Thesis Examination Committee are as follow:

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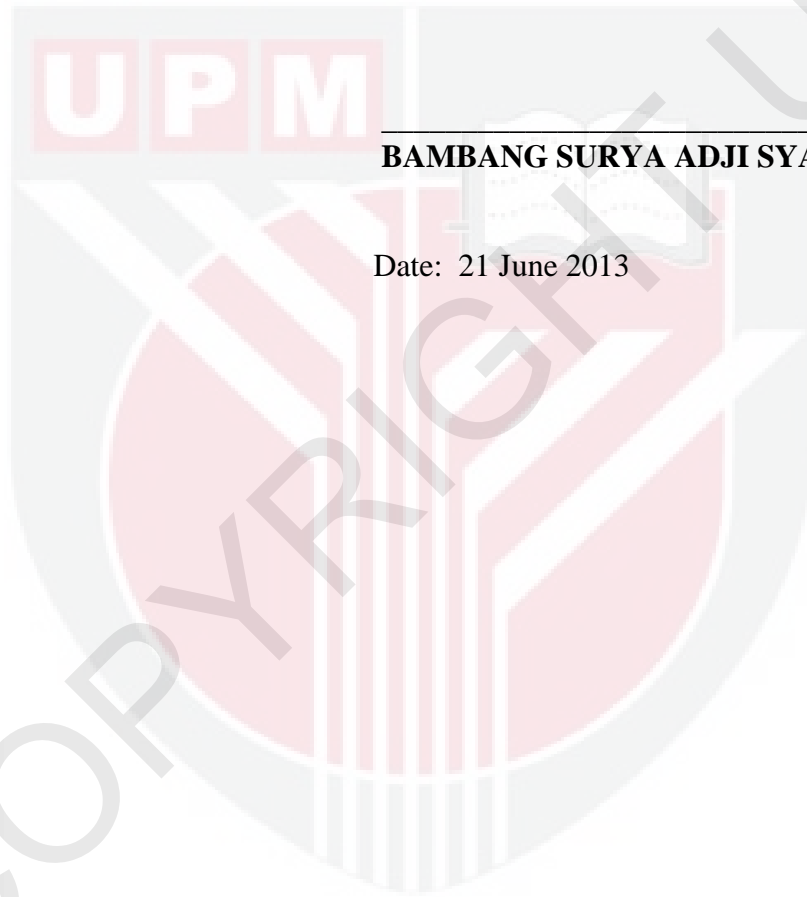
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DECLARATION

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 institution.



BAMBANG SURYA ADJI SYAHPUTRA

Date: 21 June 2013



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