

**CONTROL OF WEEDY RICE INFESTATION BY ENHANCING RICE
ESTABLISHMENT IN ANAEROBIC DIRECT SEEDING**

By

V. JEYANNY VIJAYANATHAN

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

October 2006

DEDICATION

*Specially dedicated to all my pillars of strength,
my beloved parents, Mr. and Mrs. Vijayanathan
and my sincere friend, Miss S. Lavanya....
For their constant encouragement and inspiration.*

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in
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Chairman : Associate Professor Syed Omar Syed Rastan, PhD

Faculty : Agriculture

Weedy rice or 'padi angin' is a serious threat to the rice industry of Malaysia. Its easy grain shattering characteristics has been reported to reduce rice yield up to 74%. The shift from transplanting techniques to direct seeding of planting rice has increased the weedy rice infestation. Preliminary study had shown that pre-treated rice seeds used in anaerobic seeding technique were able to out compete the growth of weedy rice and simultaneously increase the rice establishment. The objectives of this study were; a) to evaluate different rice seed germination enhancers in anaerobic (water) seeding, b) to evaluate seedling emergence in different water temperatures in anaerobic seeding and c) to evaluate rice

establishment using pre-treated seeds and herbicide in controlling weedy rice in anaerobic seeding. Three rice seed varieties (MRQ 50, MR 167 and MR 219) were given treatments. The treatments tested were rice seeds soaked in water (control, T1); rice seeds coated with calcium peroxide (sodium silicate binding agent), [T2]; seeds treated with 1% peroxide base material [T3], seeds treated with 0.2% dilute acid [T4] and seeds treated with seaweeds [T5]. The seedling emergence was evaluated at three days after sowing (DAS) and the rice seedling growth was evaluated fourteen days after sowing (DAS) in glasshouse trials. The number of emerged seedlings for T3 was significantly higher for MR167 and MR219 compared to control at three DAS. However, there were no significant differences for MRQ 50 for emerged seedlings compared to control. Generally, there were no interaction effects between varieties and treatments tested for seedling height, root length and root surface area. T3 showed a significant increase of 7% for seedling height compared to control. However, the performance of T2 was inferior to the other seed treatments as well as control for all varieties tested. The seedling height, root length and root surface area of rice seedlings of T2 were reduced significantly to 27%, 38% and 90%, respectively compared to control at fourteen DAS. T4 and T5 performed the same as control for seedling height, root length and root surface area.

In a laboratory study, pre-treated rice seeds were sown in soil –filled petri dishes and placed in water bath. Water level was maintained at 5 cm and temperatures were adjusted according to treatments (T1: 30°C, T2: 35°C, T3: 40°C and T4: 45°C). Seedling height increased significantly by 11% at 35°C compared to control (30°C). Water temperature of more than 40°C significantly inhibited the rice seedling emergence and growth.

In a glasshouse trial, the effect of pre-treated cultivated rice seeds and herbicide application on the tiller establishment of cultivated rice and weedy rice in aerobic (wet) and anaerobic (water) seeding were evaluated. There were no significant differences for herbicide effects on weedy rice tillers. However, seedling emergence of weedy rice at 14 DAS and tiller establishment at 45 DAS was significantly reduced in water seeding compared to wet seeding.

In a field trial, pre-treated seeds were sown into divided plots, T1: wet seeding (control) and T2: water seeding and the weedy rice population and rice yield were evaluated at harvest. Water seeding technique significantly reduced weedy rice population almost 52% compared to control at 90 DAS. In this trial, farmer's received a surplus in yield using water seeding technique compared to wet seeding technique as water seeding increased net rice yield by 15% (almost one ton/ha).

The use of pre-treated seeds for the anaerobic direct seeding technique had an advantage on seedling vigor that out competed the weedy rice growth, and increased the rice seeds viability.

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

**KAWALAN SERANGAN PADI ANGIN DENGAN MENINGKATKAN
PERTUMBUHAN PADI DALAM KAEDAH TABUR TERUS DI DALAM
AIR**

Oleh

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Padi angin merupakan ancaman serius terhadap industri beras negara. Biji padi angin yang mudah lerai dilaporkan boleh menyebabkan pengurangan hasil padi sebanyak 74%. Peralihan penanaman daripada sistem mencedung ke tabur terus telah meningkatkan serangan padi angin. Kajian permulaan telah menunjukkan penggunaan benih padi yang telah dirawat mampu menyaingi pertumbuhan padi angin, serta meningkatkan pertumbuhan padi. Objektif kajian ini adalah a) menilai kesan beberapa penggalak percambahan benih padi berbeza dalam kaedah tabur terus di dalam air, b) mengkaji kemunculan anak benih padi dalam suhu air yang berlainan dalam kaedah tabur terus di dalam air, dan c) mengkaji pertumbuhan benih padi yang dirawat dan penggunaan racun rumpai dalam

mengawal padi angin di dalam kaedah tabur terus di dalam air. Tiga varieti padi (MRQ 50, MR 167 dan MR 219) telah dirawat dengan rawatan benih padi. Benih padi direndam dalam air (kawalan, T1), benih padi disalut dengan kalsium peroksida (pelekit natrium silikat) [T2], benih padi yang dirawat dengan 1% bahan bes peroksida (T3), benih padi yang dirawat dengan 0.2% asid cair (T4) dan benih padi yang dirawat dengan rumpai air (T5). Kemunculan anak benih padi telah dikaji pada tiga hari lepas tabur (HLT) dan pertumbuhan anak benih padi telah dikaji 14 HLT di rumah kaca. Bilangan anak benih padi yang melepasi paras air (tiga HLT) untuk T3 adalah lebih tinggi untuk varieti MR167 dan MR219 berbanding kawalan. Tetapi, MRQ 50 tidak menunjukkan perbezaan yang ketara berbanding kawalan. Secara umumnya, tiada kesan interaksi antara varieti dan rawatan untuk ketinggian anak benih, panjang akar dan luas permukaan akar. T3 juga telah menunjukkan peningkatan yang ketara untuk ketinggian anak benih padi sebanyak 7% berbanding kawalan. Walau bagaimanapun, prestasi T2 didapati paling rendah berbanding kawalan dan rawatan benih padi yang lain untuk semua varieti yang diuji. Ketinggian anak benih padi, panjang akar dan luas permukaan akar pada empat belas HLT mengurang secara ketara sebanyak 27%, 38% dan 90% masing-masing berbanding kawalan. Kesan rawatan T4 dan T5 adalah sama seperti kawalan untuk ketinggian anak benih, panjang akar dan luas permukaan akar.

Dalam kajian makmal, benih padi yang telah dirawat telah ditabur dalam piring petri berisi tanah dan diletakkan di dalam 'water bath'. Paras air ditetapkan pada 5 cm dan suhu air disesuaikan mengikut rawatan (T1: 30°C, T2: 35°C, T3: 40°C and T4: 45°C). Ketinggian anak benih meningkat secara ketara (11%) pada suhu 35°C berbanding kawalan. Suhu air melebihi 40°C didapati merencat pertumbuhan anak benih padi.

Di dalam eksperimen rumah kaca, prestasi benih padi yang telah dirawat serta penggunaan racun rumpai terhadap pertumbuhan anak bilah kultivar dan padi angin dalam kaedah aerobik (tabur terus basah) dan anaerobik (tabur terus di dalam air) telah dikaji. Penggunaan racun rumpai tidak memberi kesan terhadap pertumbuhan anak bilah padi angin. Walau bagaimanapun, kemunculan anak benih padi angin dan pertumbuhan anak bilah padi angin pada 45 HLT telah mengurang secara ketara dalam kaedah tabur terus dalam air.

Dalam ujian ladang, benih padi yang telah dirawat telah ditabur dalam dua plot berasingan; T1 : tabur terus basah dan T2; tabur terus di dalam air. Taburan padi angin dan hasil kasar padi telah dinilai. Kaedah tabur dalam air mengurangkan taburan padi angin sebanyak 52% berbanding plot kawalan pada 90 HLT.

Dalam eksperimen ini, petani menerima keuntungan dengan menggunakan kaedah tabur terus di dalam air berbanding amalan biasa (kawalan) dengan peningkatan hasil sebanyak 15% (kira-kira satu ton/ha). Penggunaan benih padi yang dirawat mempunyai kelebihan dari segi pertumbuhan cepat anak benih padi yang dapat menyaingi pertumbuhan padi angin dan meningkatkan kebernasan benih padi.

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I certify that an Examination Committee has met on 18th October 2006 to conduct the final examination of V. Jeyanny Vijayanathan on her Master of Science thesis entitled “Control of Weedy Rice Infestation by Enhancing Rice Establishment in Anaerobic Direct Seeding” in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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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 UPM or other institutions.

V. JEYANNY VIJAYANATHAN

Date:

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