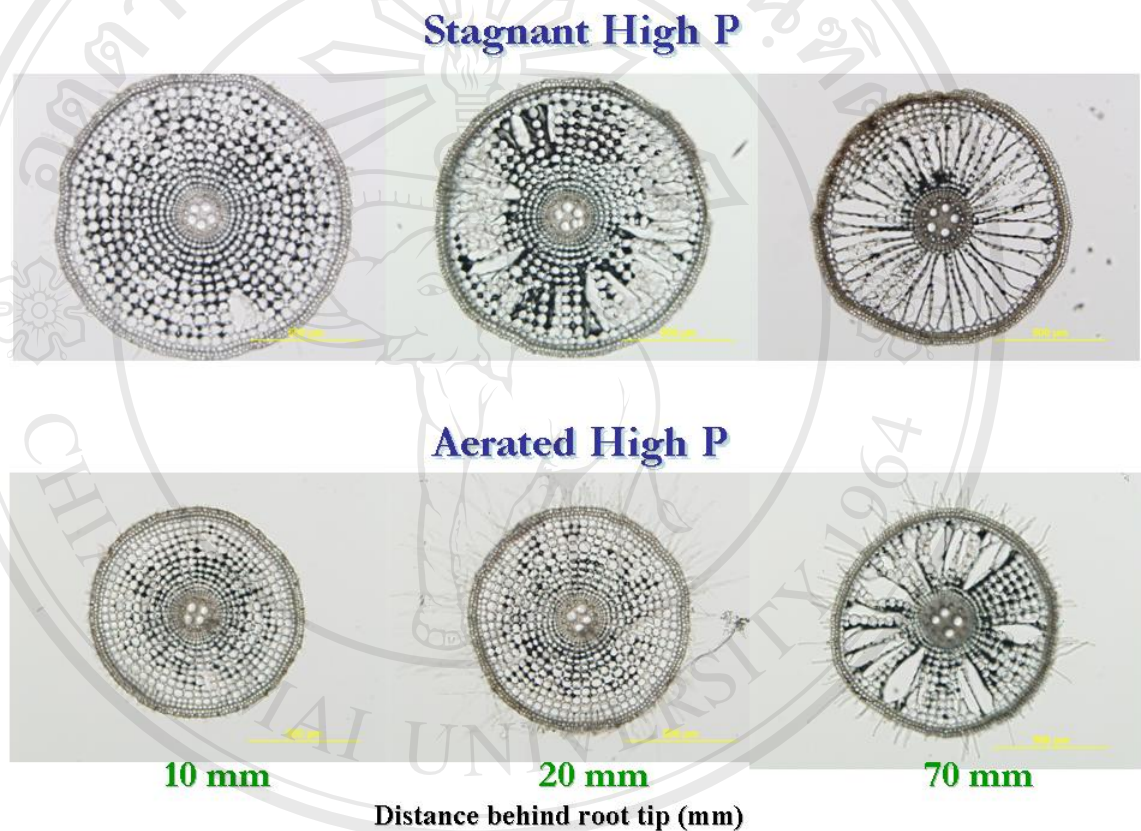
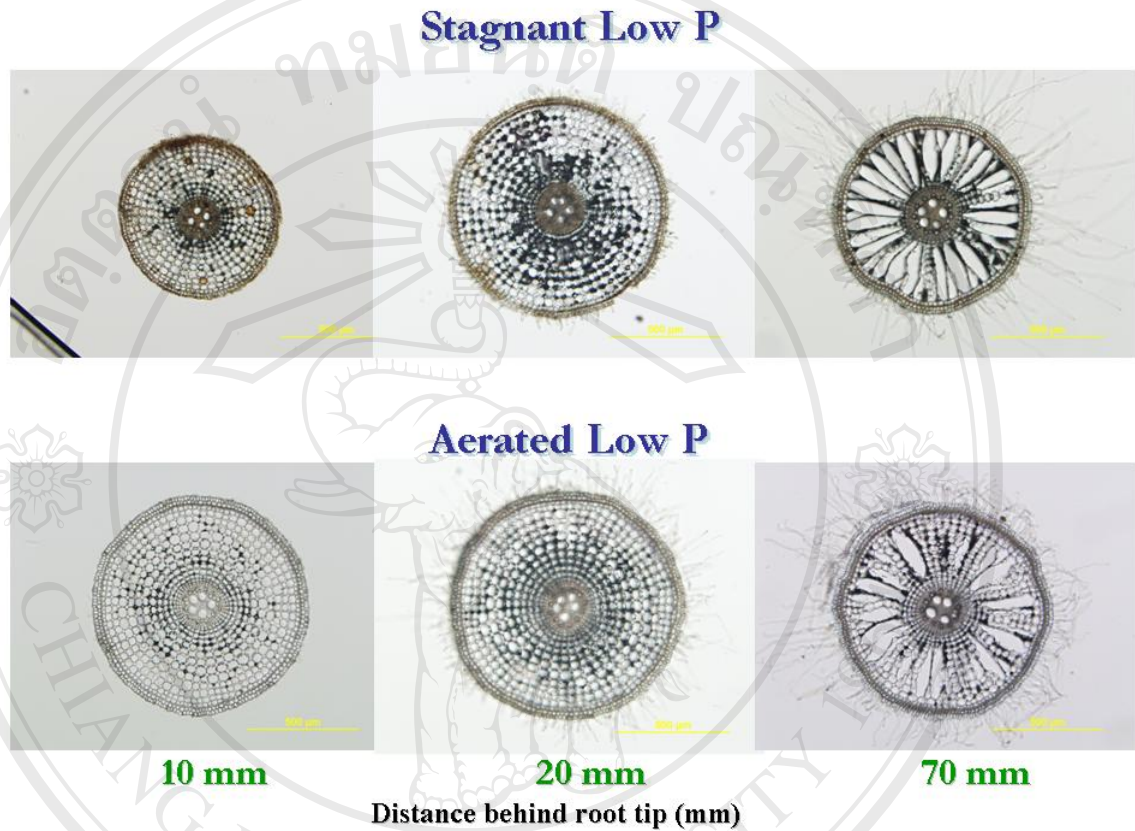


Appendix

Appendix A: Aerenchyma development at 10, 20 and 70 mm from the tip of rice root when grown in aerated and stagnant solution at high P supply (200 μ M).

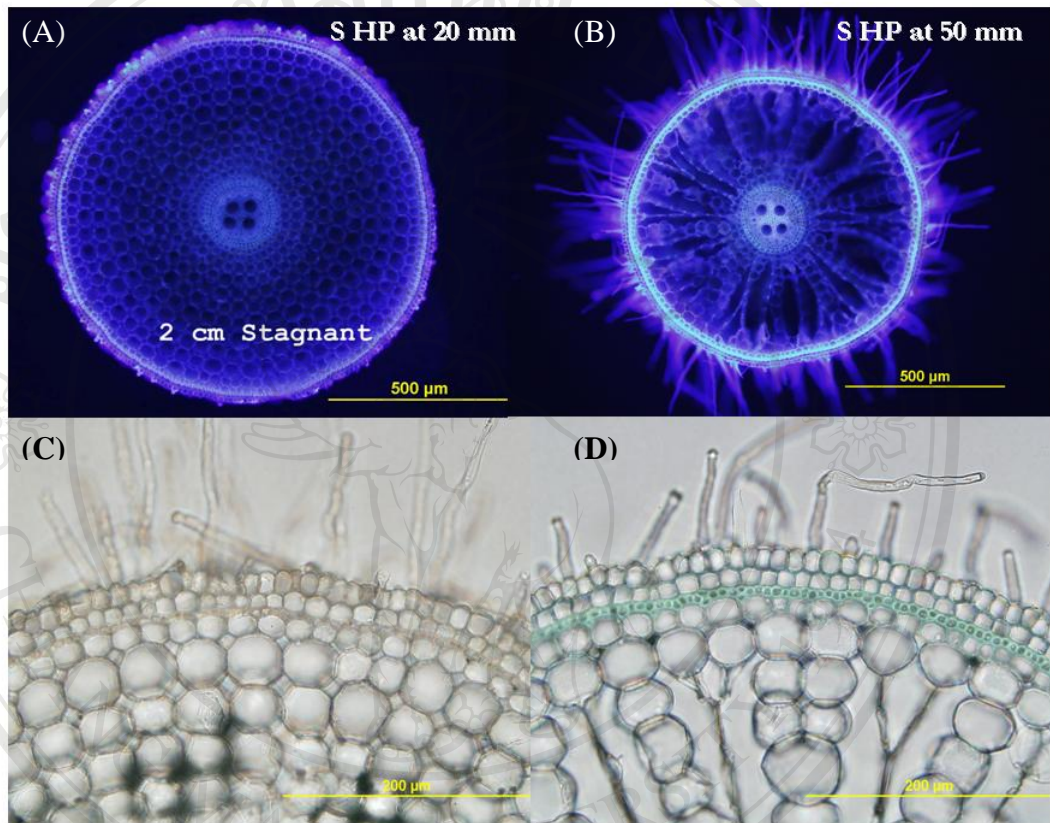


Appendix B: Aerenchyma development at 10, 20 and 70 mm from the tip of rice root when grown in aerated and stagnant solution at low P supply (1.6 μ M).



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Appendix C: Typical transverse sections of rice root comparing the autofluorescence of the walls in the outer cell layers when scan under fluorescence microscope and root sections when scan under compound microscope.

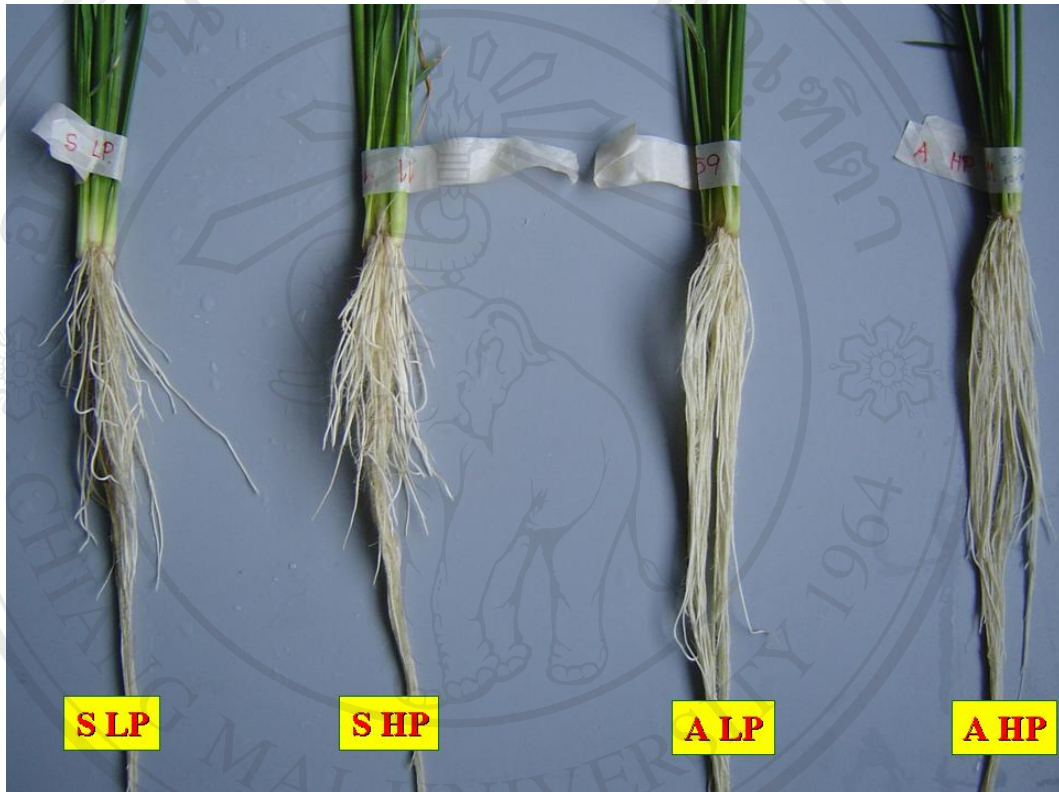


A and C: Root section at 20 mm from the tip of rice in stagnant nutrient solution with high P supply.

B and D: Root section at 50 mm from the tip of rice in stagnant nutrient solution with high P supply.

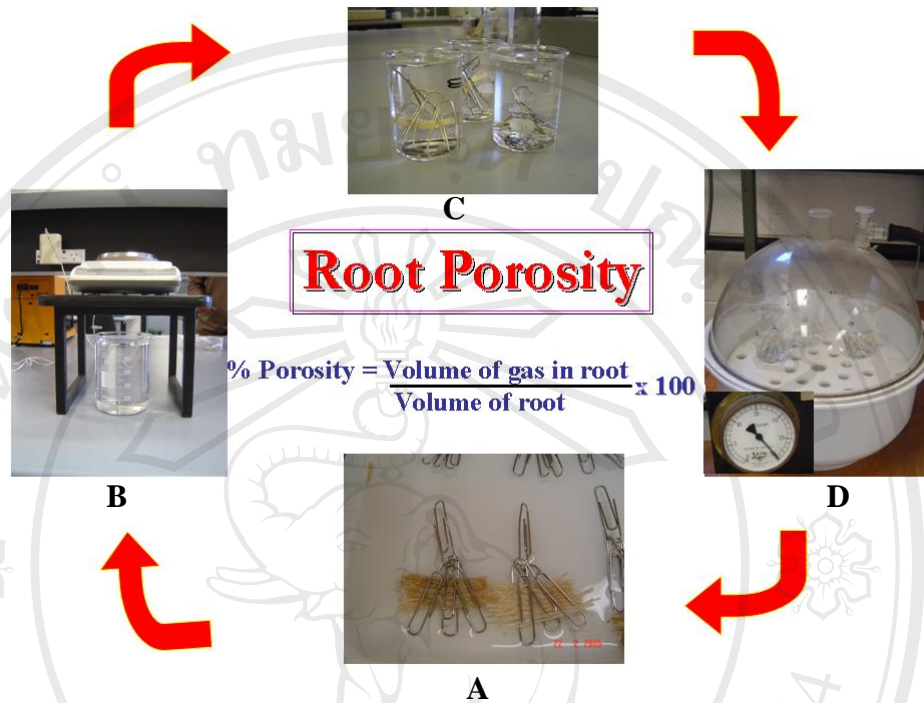
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Appendix D: Root production of Australian rice (cv. Amaroo) after transition to treatments (Stagnant with low P supply, SLP; Stagnant with high P supply, SHP; Aerated with low P supply, ALP; and Aerated with high P supply, AHP) for four days.



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Appendix E: Root porosity (%) measurement



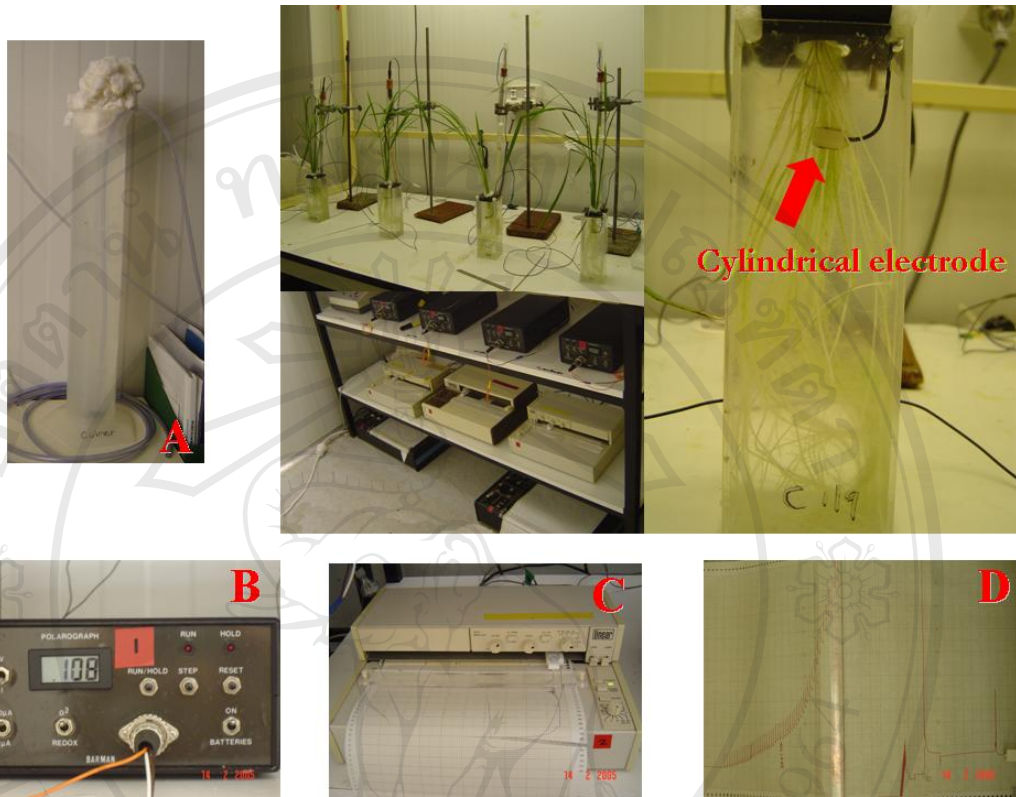
A: Roots of one plant were cut into 50 mm segment and held by clips.

B: Root segments and clips were weighed in water for measuring root buoyancy before vacuum infiltration.

C: Root segments and clips were fit in beaker of water.

D: Beakers with root segments were put in the desiccators and vacuum (1 ATM) for 5 min with three times. Then the root segments and clips were weigh after vacuum infiltration of the gas spaces in the roots with water (Raskin, 1983), using the equations modified by Thomson *et al.* (1990).

Appendix F: Equipment for radial oxygen loss from roots measurement



A: Agar solution (0.1 % w/v) with 5.0 mol m^{-3} KCl and 0.5 mol m^{-3} CaSO₄, flushing with N₂ for 12 hrs before contained in measured chamber.

B: Polarograph for monitoring the current.

C: Linear chart recorder

D: Current –voltage curve

Appendix G: Growth data of three Australian rice cultivar when grown in aerated and stagnant nutrient solution at 50, 100, 200 and 400 μM P for two weeks (Chapter 5 experiment 3).

Condition	P levels	Cultivar	Root	Shoot	No.	No.	RDW (g plant ⁻¹)	SDW (g plant ⁻¹)
			Length (cm)	Length (cm)	Leaf	Root		
Aerated solution	50	Langi	16.2	46.7	4	18	0.016	0.068
		Amaroo	16.5	49.7	4	20	0.025	0.090
		Kyeema	13.3	49.5	4	19	0.023	0.073
	100	Langi	19.7	46.9	4	17	0.025	0.082
		Amaroo	16.3	46.9	4	20	0.026	0.091
		Kyeema	16.2	52.8	4	18	0.028	0.089
	200	Langi	16.5	47.2	4	18	0.022	0.081
		Amaroo	14.8	47.1	4	21	0.020	0.079
		Kyeema	15.3	48.7	4	18	0.021	0.073
	400	Langi	17.6	49.3	4	18	0.026	0.088
		Amaroo	16.1	44.3	4	18	0.023	0.079
		Kyeema	16.9	51.4	4	17	0.024	0.086

Appendix G: continued

Condition	P levels	Cultivar	Root	Shoot	No.	No.	RDW (g plant ⁻¹)	SDW (g plant ⁻¹)
			Length (cm)	Length (cm)	Leaf	Root		
Stagnant solution	50	Langi	14.2	45.5	4	17	0.016	0.076
		Amaroo	14.1	50.6	4	23	0.023	0.100
		Kyeema	12.8	51.2	4	21	0.023	0.094
	100	Langi	12.8	47.4	4	20	0.020	0.071
		Amaroo	13.9	49.5	4	20	0.025	0.089
		Kyeema	13.3	52.4	4	21	0.026	0.095
	200	Langi	13.6	44.0	4	20	0.017	0.070
		Amaroo	12.2	44.2	4	20	0.018	0.072
		Kyeema	11.7	47.8	4	20	0.015	0.066
	400	Langi	12.5	50.0	4	20	0.020	0.084
		Amaroo	12.0	49.0	4	22	0.021	0.085
		Kyeema	12.2	50.5	4	21	0.024	0.090

Curriculum Vitae

Name: Miss Nednapa Insalud

Birth: 23 December 1978

Academic record:

Qualification	Area of concentration	Year	Institution
Ph.D candidate	Plant nutrition*	2001-2006**	Chiang Mai University
B.Sc. (Agriculture)	Plant Pathology	2000	Chiang Mai University
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* Examination on 1st August 2006

Workshops and trainings:

2001 CMU Rice Biotech Workshop: Molecular Markers for Biodiversity and Evolution Studies at Faculty of Agriculture, Chiang Mai University, Thailand (26 July 2002)

Atomic Absorption Spectrophotometer and UV-VIS Spectrophotometer workshop at Faculty of Agriculture, Chiang Mai University, Thailand (19 August 2002)

CMU Rice Workshop II: Microscopy and Histology in Agricultural Research at Faculty of Science and Faculty of Medical, Chiang Mai University, Thailand (25-26 November 2002)

2003 Post-Graduated Workshop in Honing Skills in Writing and Speaking by Dr. Lee Altier from California State University (Chico), U.S.A. at Faculty of Agriculture, Chiang Mai University, Thailand (6–13 June 2003)

Hydroponics Rice Experimentation Workshop at Faculty of Agriculture, Chiang Mai University, Thailand (7 November - 26 December 2003)

2004 Writing Research Proposal workshop at Department of Agronomy, Faculty of Agriculture, Chiang Mai University, Thailand (19-30 January 2004)

Participant in seminar on root/soil interactions and their significance for root functioning by Prof.Dr. Perter Gregory, former staff member of CSIRO Plant Industry at Rossiter Seminar Room, CSIRO, Floreat, Perth, WA, Australia (28 June 2004)

Root Aeration Workshop by Prof. Dr. William Armstrong and Dr. Jean Armstrong at The University of Western Australia, Australia (13-17 September 2004)

Awards and Scholarships

1. Scholarship: Royal Golden Jubilee Ph.D. Award from Thailand Research Fund (2000-2006)

2. Best oral presentation: Insalud N., Bell W. R., Colmer T. D., and Rerkasem B. Physiological and Morphological Responses of Rice to Limited Phosphorus Supply in Aerated and Stagnant Solution Culture. 20-22 April 2005. RGJ Congress VII. Pattaya, Thailand.

3. Best oral presentation: Insalud N., Bell W. R., Colmer T. D., and Rerkasem B. Physiological and Morphological Responses of Rice to Limited Phosphorus Supply in Aerated and Stagnant Solution Culture. 26-27 October 2005. The 2005 Technical Meeting of the Senior Research Scholars' Projects in Field Crops. Rayong, Thailand.

4. Chiang Mai University Medal for Outstanding student (1999)

5. Chiang Mai University Medal for Outstanding student (2000)

Publications and Presentations:

Insalud N., Bell W. R., Colmer T. D., and Rerkasem B. 2006. Morphological and physiological responses of rice (*Oryza sativa* L.) to limited phosphorus supply in aerated and stagnant solution culture. *Annals of Botany* (In press in November issue).

Insalud N., Bell W. R., Colmer T. D., and Rerkasem B. 2006. Physiological and Morphological Responses of Rice to Limited Phosphorus Supply in Aerated and Stagnant Solution Culture. A paper presented in Ph.D RGJ Congress VII. Pattaya, Thailand, 20-22 April 2006. (Oral presentation)

Insalud N., Bell W. R., Colmer T. D., and Rerkasem B. 2005. Physiological and Morphological Responses of Rice to Limited Phosphorus Supply in Aerated and Stagnant Solution Culture. A paper presented in The 2005 Technical

Meeting of the Senior Research Scholars' Projects in Field Crops. Rayong, Thailand, 26-27 October 2005. (Oral presentation)

Insalud N., Bell W. R., Colmer T. B., and Rerkasem B. 2005. Physiological and Morphological Responses of Rice to Limited Phosphorus Supply in Aerated and Stagnant Solution Culture. A paper presented in International Symposium: Diversity, Management, Protection and Utilization of Local Rice Germplasm. Chiang Mai, Thailand, 1-2 August 2005. (Poster presentation)

Insalud N., Rerkasem B., and Bell W. R. 2004. Response of Rice Cultivars to Aerobic Conditions. A paper presented in of 4th Crop Science Congress. Convention & Exhibition Centre, Queensland, Australia, 26 September - 1 October 2004. (Poster presentation)

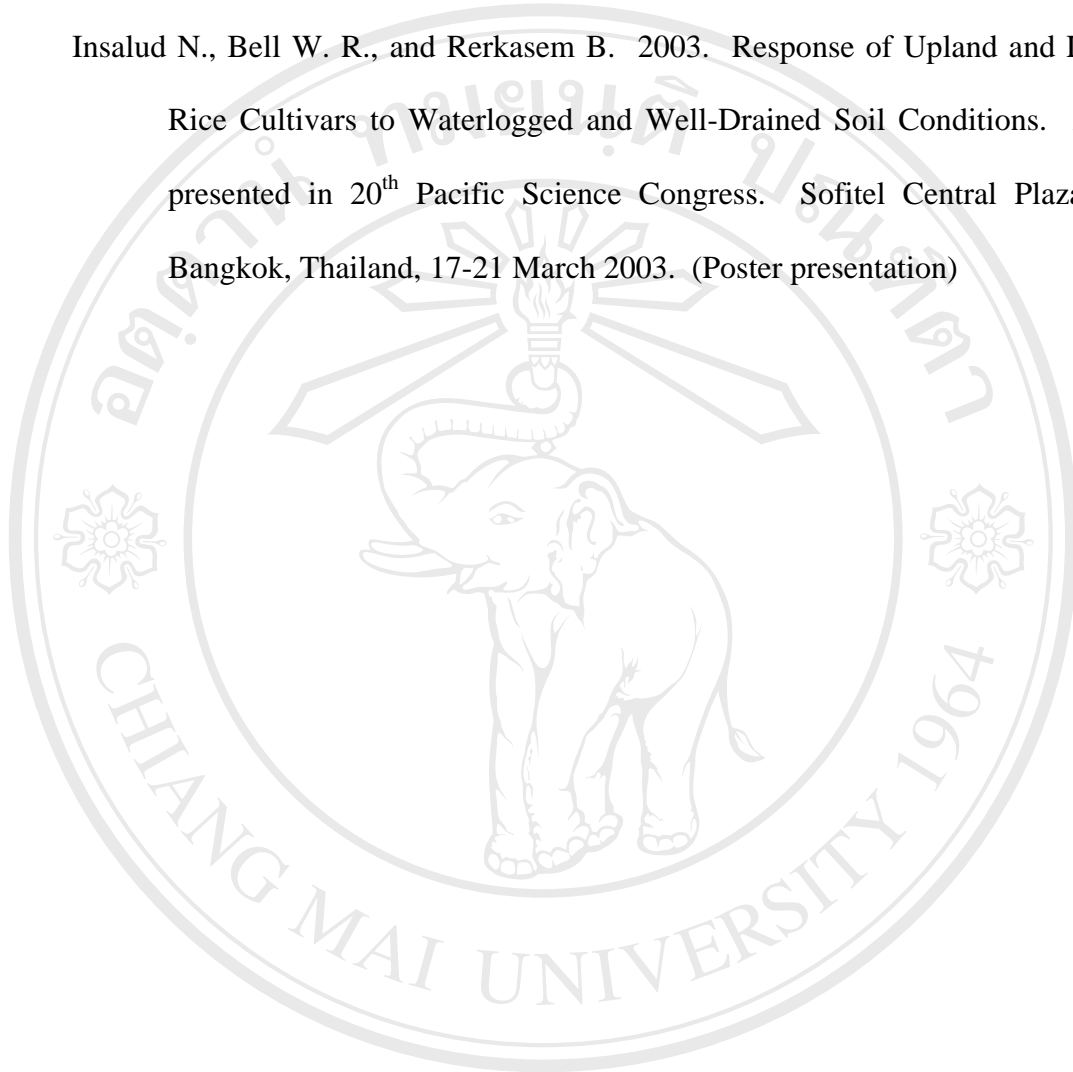
Insalud N., Rerkasem B., and Bell, W. R. 2004. Overlapping Responses of Upland and Lowland Rice Cultivars to Flooded and Well-Drained Soil Water Conditions. A paper presented in of 8th Conference of the International Society for Plant Anaerobiosis. UWA, Western Australia, Australia, 21-24 September 2004. (Poster presentation)

Insalud N., Rerkasem B., and Bell W. R. 2003. Response of Upland and Lowland Rice Cultivars to Waterlogged and Well-Drained Soil Conditions. Agricultural Journal of Chiang Mai University (Special Volume). 281-290. (in Thai)

Insalud N., Bell W. R., and Rerkasem B. 2003. Response of Upland and Lowland Rice Cultivars to Waterlogged and Well-Drained Soil Conditions. A paper presented in Joint Crop Science the Senior Research Scholars' Projects CMU

Agronomy Ph.D Meeting. Faculty of Agriculture, Chiang Mai University, Thailand, 9–11 May 2003. (Oral presentation)

Insalud N., Bell W. R., and Rerkasem B. 2003. Response of Upland and Lowland Rice Cultivars to Waterlogged and Well-Drained Soil Conditions. A paper presented in 20th Pacific Science Congress. Sofitel Central Plaza Hotel, Bangkok, Thailand, 17-21 March 2003. (Poster presentation)



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