



**COOPERATIVE RESEARCH CENTRE
FOR SUSTAINABLE RICE PRODUCTION**

ANNUAL REPORT 2004/2005



**Established and supported under the
Australian Government's Cooperative Research Centres Program**

PART D

SPECIFIED PERSONNEL

The roles and commitments of the specified personnel as at 30 June 2005 are:-

<i>SPECIFIED PERSONNEL</i>			
Name	Participant	% Time	Role
Dr L Lewin	Rice CRC/NSW DPI	100	Director, researcher Program 3
Dr E Humphreys	CSIRO Land and Water	60	Leader, Program 1
Prof G Batten	Charles Sturt University	30	Leader, Program 2
Dr E Dennis	CSIRO Plant Industry	20	Leader, Program 3
Mr D Welch	SunRice	30	Leader, Program 4
Dr P Eberbach	Charles Sturt University	20	Leader, Program 5
Dr S Khan	CSIRO Land and Water	95	Key researcher, Program 1
Mr HG Beecher	NSW DPI	35	Key researcher, Programs 1 and 2
Dr B Sutton	University of Sydney	30	Key researcher, Program 2
Dr John Angus	CSIRO Plant Industry	10	Key researcher, Program 2
Mr P Williams	SunRice	30	Key researcher, Programs 2 and 4
Assoc Prof G Cox	University of Sydney	20	Key researcher, Programs 2 and 5
Dr N Darvey	University of Sydney	20	Key researcher, Program 3
Mr A Dunn	Charles Sturt University	15	Key researcher, Program 5

Revised at 28/5/04 and submitted to CRC Secretariat

Explanatory Notes:

There are no changes since the 2003/2004 Annual Report.

LIST OF PUBLICATIONS AND PATENTS

Publications in Refereed Journals

- Ash, G.J. and Cother E.J. (2004).** Variation in lanceleaved waterplantain (*Alisma lanceolatum*) in south eastern Australia. *Weed Science* 52, 413-417.
- Castro, J.V., Y Van Berkel, K., Russell, G.T. and Gilbert, R.G. (2005).** General solution to the band-broadening problem in polymer molecular weight distributions. *Aust. J. Chem.* 2005, 58, 178-181.
- Castro, J.V., Dumas, C., Chiou, H., Fitzgerald, M.A. and Gilbert, R.G. (2005).** Mechanistic information from analysis of molecular weight distributions of starch. *Biomacromolecules* (in press).
- Castro, J.V., Ward, R.M., Gilbert, R.G. and Fitzgerald, M.A. (2005).** Measurement of the molecular weight distribution of debranched starch. *Biomacromolecules* (in press).
- Chiou, H., Fellows, C.M., Gilbert, R.G. and Fitzgerald, M.A. (2005).** Study of rice-starch structure by dynamic light scattering in aqueous solution. *Carbohydrate Polymers* (2005) 1-11 (in press).
- Christen, E.W., Chung, S-O. and Quayle, W.C. (2005).** Simulating the rice herbicide molinate in rice paddies using the RICEWQ model. *Agric. Water Management* (submitted).
- Cliquet, S., Ash, G.J. and Cother, E.J. (2004).** Production of chlamyospores and conidia in submerged culture by *Rhynchosporium alismatis*, a mycoherbicide for *Alismataceae* in rice crops. *Biocontrol Science and Technology* 14, 801-810.
- Dunn, B.W., Batten, G.D., Dunn, T.S., Williams, R.L. and Subasinghe, R. (2005).** Nitrogen fertilizer alleviates the disorder straighthead in Australian rice. *Australian Journal of Experimental Agriculture* (submitted).
- Humphreys, E., Lewin, L.G., Khan, S., Beecher, H.G., Lacy, J.M., Thompson, J.A., Batten, G.D., Brown, A., Russell, C.A., Christen, E.W. and Dunn, B.W. (2005).** Integration of approaches to increasing water use efficiency in rice-based systems in south east Australia. *Field Crops Research* (in press).
- Humphreys, E., Meisner, C., Gupta, R., Timsina, J., Beecher, H.G., Tang Yong Lu, Yadvinder-Singh, Gill, M.A., Masih, I., Zheng Jia Guo and Thompson, J.A. (2004).** Water savings in rice-wheat systems. *Plant Production Science* (in press).
- Jahromi, F.G., Ash, G.J. and Cother, E.J. (2004).** Factors affecting disease development by *Rhynchosporium alismatis* in starfruit (*Damasonium minus*), a weed of rice. *Biocontrol Science and Technology* 14, 281 - 290.

Khan S. (2004). Integrating hydrology with environment, livelihood and policy issues – the Murrumbidgee Model. Special Volume on *Hydrology for the Environment Life and Policy*. *Water Resources Development* Vol. 20, No. 3: 415-429.

Khan S. (2004). Solutions for irrigation salinity. *Australian Journal of Water Resources* (accepted).

Pitt, W.M., Ash, G.J. and Cother, E.J. (2005). A preliminary population structure analysis of *Plectosporium alismatis*, a potential biocontrol agent for *Alismataceae* weeds in Australian rice crops. *Canadian Journal of Plant Pathology*, 26(1): (in press).

Pitt, W.M., Cother, E.J., Cother, N.J. and Ash, G.J. (2004). Infection process of *Plectosporium alismatis* on host and non-host species in the *Alismataceae*. *Mycological Research* 108, 837-845.

Pitt, W.M., Goodwin, S.B., Ash, G.J., Cother, N.J. and Cother, E.J. (2004). *Plectosporium alismatis* comb. nov., a new placement for the *Alismataceae* pathogen *Rhynchosporium alismatis*. *Mycological Research* 108, 775-780.

Seal, A.N., Haig, T. and Pratley, J.E. (2004). Evaluation of putative allelochemicals in rice root exudates for their role in the suppression of arrowhead root growth. *J. Chem. Ecol.* 30(8), pp. 1645-1660.

Seal, A.N, Pratley, J.E., Haig, T. and Lewin, L.G. (2004). Screening rice varieties for allelopathic potential against arrowhead (*Sagittaria montevidensis*), an aquatic weed infesting Australian Riverina rice crops. *Aust. J. Agric. Res.*, 55(6), pp. 673-680.

Seal, A.N, Pratley, J.E., Haig, T. and An, M. (2004). Identification and quantitation of compounds in a series of allelopathic and non-allelopathic rice root exudates. *J. Chem. Ecol.* 30(8), pp. 1629-1644.

Timsina, J. and Humphreys, E. (2005). Performance of CERES Rice and CERES Wheat models in rice-wheat systems: a review. *Agricultural Systems* (submitted).

Timsina, J. and Humphreys, E. (2005). Applications of CERES Rice and CERES Wheat models in rice-wheat systems: a review. *Agricultural Systems* (submitted).

Van Niel, T.G. and McVicar, T.R. (2004). Determining temporal windows of crop discrimination with remote sensing: a case study in south-eastern Australia. *Computers and Electronics in Agriculture*, 45, 91-108.

Van Niel, T.G., McVicar, T.R. and Datt, B. (2005). On the relationship between training sample size and data dimensionality: Monte Carlo analysis of broadband multi-temporal classification. *Remote Sensing of Environment* (submitted).

Gavin Ash (ex PhD student) provided reference material for the following publication:

Zare, R., Gams, W. and Schroers, H.J. (2004). The type species of *Verticillium* is not congeneric with the plant-pathogenic species placed in *Verticillium* and it is not the anamorph of “*Nectria*” *inventa*. *Micol. Res.* 108 (5): 576-582.

Published Conference Papers

Akbar, S. and Khan, S. (2004). Saving irrigation channel losses: Comparative hydrologic economic analysis of reducing on-farm and off-farm conveyance losses. *In Proceedings “ANCID 2004 Conference”*, South Australia, October 2004.

Akbar, S. and Khan, S. (2005). Saving losses from irrigation channels - technical possibilities vs common pool realities, restoring the balance. “Irrigation 2005”, Townsville, Qld, May 2005 (*accepted*).

Akbar, S., Khan, S., Allen, D. and Dunn, B.W. (2004). Understanding seepage water losses from on-farm channels and drains using geophysical techniques. *In Proceedings “Australian Irrigation 2004 Conference”*, Adelaide, S.A., May 2004. (<http://www.irrigation.org.au/>)

Akbar, S., Khan, S. and Hirsi, I. (2004). Saving irrigation channel losses, optimising channel performance.” *In Proceedings “ANCID Conference 2004”*, South Australia, October 2004, p33.

Allen, D. and Merrick, N.P. (2005). Towed geo-electrode arrays for analysis of surface water groundwater interaction. *In Proceedings “SAGEEP symposium”*, Atlanta, USA, April 2005.

Allen, D. and Merrick, N.P. (2004). Surface water/groundwater interaction investigation using a towed geo-electric array. *In Proceedings “To Bourke and Back - Society for Engineering in Agriculture (SEAg) 2004 conference”*, Bourke, NSW, September 2004.

Batten, G.D. (2004). NIR and world food production. *In Proceedings of “12th International Diffuse Reflectance Conference”*, Chambersburg, Pennsylvania, USA, August 2004 (*invited paper*).

Batten, G.D. (2004). Forestry and the environment: challenges for near infrared spectroscopy. Pp 749-755 *In AMC Davies and A Garrido-Varo (Eds) Near Infrared Spectroscopy: Proceedings of the 11th International Conference (NIR Publications, Chichester)*.

Batten, G.D., Ciavarella, S. and Blakeney, A.B. (2004). Analysis of plant constituents using near infrared spectroscopy: intercorrelation effects. Pp389 – 392. *In AMC Davies and A Garrido-Varo (Eds) Near Infrared Spectroscopy: Proceedings of the 11th International Conference (NIR Publications, Chichester)*.

Chartres, C. and Khan, S. (2004). Managing land productivity reductions in rainfed and irrigated systems - the Australian experience. Contribution to a SIWI CSD study for water, production and consumption patterns for food, and ecological sustainability, November 2004.

Creighton, C., Meyer, W. and Khan, S. (2004). Farming and land stewardship. Case study - Australia’s innovations in sustainable irrigation. *In Proceedings “12th Australian Agronomy Conference”*, Brisbane, Qld, September 2004.

Khan, S. (2004). Solutions for irrigation salinity. *In Proceedings “1st Engineering Solutions Conference”, Perth, W.A., November 2004.*

Khan, S., Abbas, A., Robinson, D., Blackwell, J., Akbar, S. and Tariq, K. (2004). System approach to water saving, on-farm improvements.” *In Proceedings “ANCID Conference 2004”, South Australia, October 2004, p113.*

Khan, S. and O’Connell, N. (2004). Challenges for salinity management in irrigated agriculture: meeting targets through on-farm actions. *In Proceedings “GRDC Irrigation Update”, Moama, Vic., August 2004.*

Khan, S., Rana, T. and Blackwell, J. (2004). Can irrigation be sustainable? *In Proceedings “4th International Crop Science Conference”, Brisbane, Qld, September 2004 (invited paper).*

Neeson, R. (2005). Improving system sustainability in riverina organic rice production. *In Proceedings “IFOAM Organic World Congress 2005”, Adelaide, S.A., August 2005 (submitted).*

Ram, H., Yadvinder-Singh, Timsina, J., Humphreys, E., Dhillon, S.S., Kumar, K. and Kler, D.S. (2005). Performance of upland crops on beds in north-west India. *In “Evaluation and performance of permanent raised bed systems in Asia and Australia” (Eds. C. Roth, A.R. Fischer and C. Meisner). In Proceedings of an International Workshop, Griffith, NSW, March 2005, ACIAR, Canberra (in press).*

Wassens, S. and Watts, R.J. (2004). Habitat occupancy and movement patterns of the Southern Bell Frog (*Litoria raniformis*) in response to flooding. *In Proceedings “Ecological Society of Australia”, Adelaide, S.A., December 2004.*

Technical Reports

Akbar, S. (2004). Project 1107 - Assessing the effect of compaction using different impactors on seepage from on-farm channels and drains. Rice CRC Progress Report. (<http://www.ricecrc.org>)

Akbar, S. (2004). Project 4635 - Seepage measurement component of hydrologic, economic ranking of water saving options in the irrigated areas. Final Report, Pratt Water Group.

Allen, D.A. (2004). Comparison of electrical conductivity ribbon images surveyed in 2003 and 2004 of strata beneath the Murray River, in the vicinity of Mildura. National Centre for Groundwater Management Report No. 2004/3 for the NSW Department of Infrastructure Planning and Natural Resources.

Batten, G. and Campbell, L. (2005). Minerals for sustainable grain yield and grain quality. Rice CRC Final Report (*submitted*).

Christen, E.W., Quayle, W.C. and Chung, S-O. (2005). Modelling the fate of molinate herbicide in rice paddies of South Eastern Australia using RICEWQ. CSIRO Technical Report (*submitted*).

- Darvey, N. (2005).** Improved protocols for isolated microspore culture of rice. Application of molecular approaches to rice improvement. Rice CRC Final Report (*submitted*).
- Dolferus, R. (2005).** Molecular basis of cold-induced pollen sterility in rice. Rice CRC Final Report (*submitted*).
- Hennicke, O. (2005).** Development of rice milling in-line process control. Rice CRC Final Report.
- Hughes, P. (2005).** Bloodworm resistant rice. Rice CRC Final Report (*submitted*).
- Humphreys, E. (2005).** Quantifying and maximising the benefits of crops after rice. Rice CRC Final Report.
- Khan, S. (2005).** Hydro-climatic and economic evaluation of seasonal climate forecasts for risk based irrigation management. Rice CRC Final Report (*submitted*).
- Khan, S., Akbar, S., Rana, Y., Abbas, A., Robinson, D., Dassanayke, D., Hirsi, I., Blackwell, J., Xevi, E. and Carmichael, A. (2004).** Hydrologic economic ranking of water saving options Murrumbidgee Valley. Report to Pratt Water - water efficiency feasibility project.
- Khan, S., Best, L. and Wang, B. (2004).** Surface groundwater interaction model of the Murrumbidgee Irrigation Area (Development of the Hydrogeological Databases). Rice CRC Technical Report.
- Khan, S., Hafeez, M., Beddek, R., Paydar, Z. and Blackwell, J. (2004).** Tracking unaccounted flows in the Lowbidgee using a hydrological and remote sensing approach. Report to Pratt Water - water efficiency feasibility project.
- Khan, S., Rana, T., Beddek, R., Blackwell, J., Paydar, Z. and Carroll, J. (2004).** Whole of catchment water and salt balance to identify potential water saving options in the Murrumbidgee catchment. Pratt Water - water efficiency feasibility project.
- Khan, S., Robinson, D., Beddek, R., Wang, B., Dharma, D. and Rana, T. (2004).** Hydro-climatic and economic evaluation of seasonal climate forecasts for risk based irrigation management. CSIRO Land and Water Technical Report 5/04.
<http://www.clw.csiro.au/publications/technical2004/tr5-04.pdf>
- Khan, S. and Short, L. (2004).** Assessing the impact of rainfall variability on watertables in Irrigation Areas. Rice CRC technical report.
- Khan, S. and Zirilli, J. (2005).** Water and salt balance of the Coleambally Irrigation Area - CSU consultancy report to Coleambally Irrigation Cooperative Limited.
- Khan, S. and Zirilli, J. (2005).** Cropping options to maintain watertables and salinity levels for spatially variable regional groundwater flow capacities - CSU draft consultancy report to Coleambally Irrigation Cooperative Limited.

McVicar, T. (2005). Remote sensing of irrigated crop types and its application to regional water balance estimation. Rice CRC Final Report.

Pathak, H., Timsina, J., Humphreys, E., Godwin, D.C., Bijay-Singh, Shukla, A.K., Singh, U. and Matthews, R.B. (2004). Simulation of rice crop performance and water and N dynamics, and methane emissions for rice in north-west India using CERES Rice model. CSIRO Land and Water Technical Report 23/04.

Reinke, R. (2005). Screening reproductive-stage cold tolerance for the NSW rice improvement program. Rice CRC Final Report (*submitted*).

Sigmund, B. (2005). Grain quality in the pre-milling phase. Rice CRC Final Report (*submitted*).

Sigmund, B. (2005). Sustainable fumigation practises. Rice CRC Final Report (*submitted*).

Seal, A.N. (2005). Allelopathy and weed competition. Rice CRC Final Report.

Subasinghe, R. and Bechaz, K. (2005). Cold physiology at the plant level. Rice CRC Final Report (*submitted*).

Thompson, J. (2005). Strategies for improving the water use efficiency of rice. Rice CRC Final Report (*submitted*).

Van Niel, T.G. and McVicar, T.R. (2004). A user's guide for identifying rice paddocks using GIS and remote sensing at Coleambally Irrigation Area, NSW. CSIRO Land and Water Client Report, Canberra, Australia, pp.53.

Wang, B., Khan, S. and O'Connell, N. (2004). A GIS approach to quantify impact of flooding on shallow watertable levels in the Wakool Irrigation District. CSIRO Land and Water Technical Report 22/04. <http://www.clw.csiro.au/publications/technical2004/tr22-04.pdf>

Wang, B., Khan, S. and O'Connell, N. (2004). Quantifying impact of rainfall on shallow groundwater table in the Wakool Area. CSIRO Land and Water Technical Report 21/04. <http://www.clw.csiro.au/publications/technical2004/tr21-04.pdf>

Quayle, W. (2005). The persistence of pesticides in floodwaters and how this is influenced by water management and layout. Rice CRC Final Report (*submitted*).

Trade Magazines

Angus, J. and Russell, C. (2004). Predrilled nitrogen for rice. Farmers Newsletter, No.167, Winter 2004.

Neeson, R. and Koenig, T. (2004). Improved yields of organic rice. Farmers Newsletter, No.167, Winter 2004.

Quayle, W.C. (2004). New combinations reduce pesticide impacts. Farmers Newsletter, No.167, Winter 2004.

Published Thesis

Chiou, H. (2005). Structure-Property relationship of rice starch. PhD thesis, University of Sydney.

Eamens, A.L. (2003). Evaluation of gene and enhancer trapping systems in rice for cereal biotechnology. PhD thesis, Charles Sturt University.

Farrell, T.C. (2004). Genotypic response to low temperature during reproductive development in rice (*Oryza sativa L.*). PhD thesis, University of Queensland.

Lanoiselet, V.M. (2005). Leaf sheath diseases of rice caused by *Rhizoctonia* species in south-eastern Australia. PhD thesis, Charles Sturt University.

Oliver, S.N. (2004). Identification and characterisation of genes affected by cold treatment of rice anthers. PhD thesis, Charles Sturt University.

Weir, K.M. (2005). Isolation and characterisation of pesticide degrading enzymes. PhD thesis, Charles Sturt University.

Authorship of Books or Chapters of Books

Batten, G. and Katupitiya, A. (2004). Wealth from water: A regional perspective. pp 49-58. In: *Wealth from Water*, Wagga Wagga Chamber of Commerce and Charles Sturt University, (2004). G. Batten and J. Kent (Eds.).

Cother, E.J. (2004). The importance of microbial culture collections in plant microbiology. pp 271-286. In: *Plant Microbiology*, Michael Gillings and Andrew Holmes, (Eds.), Garland Science/BIOS Scientific Publishers, Abingdon.

Lacy, J., Batten, G., Williams, R., Beecher, H.G., Kealey, L. and Neeson, R. (2005). Crop nutrition. In: *Production of Quality Rice in South Eastern Australia*. Chapter 6; NSW Agriculture/RIRDC. L.M. Kealey (Ed.) (*submitted*).

Lewin, L.G., Williams, R., Subasinghe, R. and Reinke, R. (2005). The rice plant. In: *Production of Quality Rice in South Eastern Australia*. Chapter 3; NSW Agriculture/RIRDC. L.M. Kealey (Ed.) (*submitted*).

* = non CRC

COMMUNICATION STRATEGY

Research of Rice CRC participants has been disseminated through many channels, including the Annual Report, CRC website, research reports, media releases, newsletters, presentations, workshops, conferences, seminars and interaction with visitors.

The Rice CRC has strong linkages with its partners who each have their own extension team. CSIRO and NSW DPI are particularly active in disseminating information on a day to day basis via interaction of their staff with end users. (*Refer also to “Commercialisation, Technology Transfer, Utilisation” and “Education and Training” chapters*). Through Sub-Programs 1.5 and 5.3, NSW DPI extension agronomists have continuously been kept informed of progress within Rice CRC programs. This extension system within the rice industry has operated very effectively prior to the CRC and been enhanced during the CRC, and will continue to pass on outcomes from CRC research after the CRC finishes on 30 June, 2005.

Oral presentations at Seminars, Workshops, Conferences

(To avoid duplication, oral presentations which were also submitted as papers and published in conference proceedings have not been listed here as they are already listed in the “List of Publications and Patents” section.)

Many CRC project staff presented information on their work at seminars, workshops and conferences during 2004/2005. For example -

- * “Water Saving in Rice Wheat Systems”, 4th International Crop Science Congress, Brisbane, Qld (E Humphreys) (*invited paper*);
- * “Global climate change and water resources - Australian and Pakistan perspective”, Global Climate Impacts Studies Centre, Islamabad, Pakistan, December 2004 (S Khan);
- * “Improving irrigation water efficiency and environmental flows through better climate forecasts”, CSIRO Climate Science Annual Meeting, Melbourne, Victoria, October 2004 (S Khan);
- * “Rice-wheat systems in Australia”, International seminar on rice-wheat cropping systems, Griffith, NSW, October 2004 (G Beecher);
- * “Modelling rice-wheat systems”, International seminar on rice-wheat cropping systems, Griffith, NSW, October 2004 (J Timsina);
- * “Career perspective – rice breeding”, RACI Cereal Chemistry Division and The Wheat Breeders Assembly combined conference, Canberra, ACT, September 2004 (L Lewin);
- * Aarhus University, Aarhus, Denmark, April 2005 (D Allen);
- * Review of Land & Water Management Plan, Coleambally Irrigation Cooperative Limited (S Khan);
- * Senate enquiry on Rural Water, July 2004 Senate, References RRA&T 667 (S Khan);
- * “Surface-groundwater and intra-aquifer interactions: how can we ensure sustainable development of Murrumbidgee aquifers?”, School of Science and Technology, Charles Sturt University, Wagga Wagga (S Khan);

- * “Water for all for ever – seeking solutions for a sustainable future:”, School of Science and Technology, Charles Sturt University, Wagga Wagga, October 2004 (S Khan);
- * “Future investments in sustainability and areas of investments for R&D for smart land and water management options”, Murrumbidgee Irrigation Board, Griffith, October 2004 (S Khan);
- * “Wakool Stage-III groundwater pumping”, Wakool Working Group and Murray Irrigation Board (S Khan);
- * “Water law and community approach to watertable and salinity management” and “SWAGMAN models”, PSC420 students, CSU, Wagga Wagga, November 2004 (S Khan);
- * presentations to “The Business of Saving Water”, Pratt Water Murrumbidgee Project - collaborative venture funded jointly by the NSW and Commonwealth Governments under the National Action Plan for Salinity & Water Quality and by Pratt Water Ltd (S Khan);
- * presentation at 13th Regional Technical Coordination Committee Meeting of the Rice-Wheat Consortium, February 2005, Dhaka, Bangladesh (E Humphreys);
- * participation in IRRI workshop to write the chapter “Rice, Food and Water” in the international “Comprehensive Assessment of Water in Agriculture” project, June 2005 (E Humphreys and S Khan);
- * presentations on work in Project 1403a (Risk-based spatial modelling to identify regional soil salinity trends in irrigation areas) at a salinity workshop, Coleambally, June 2005 (L Best).

Presentations at the Rice CRC’s 2005 Symposium held in Griffith in February included:-

- * Wheat after rice (J Timsina);
- * Rice on beds (G Beecher);
- * Straighthead: Past, Present and Future (G Batten);
- * Whole farm economic analysis (R pal Singh);
- * Impact of rice farming systems on soil organic matter (H Gill);
- * Precision soil sampling and assessment (B Dunn);
- * Precision agriculture and nitrogen (J Angus);
- * Potential for growth and nitrogen prediction (S Ciavarella);
- * Invertebrate ecology and management in the Rice CRC (M Stevens);
- * Rice: molecular structure and better food quality (R Gilbert);
- * New rice foods (D Welch);
- * Understanding rice quality and quality students (C Blanchard);
- * Minerals and rice (G Batten);
- * Chilling tolerance research in the CRC for Sustainable Rice Production (B Sutton and R Dolferus);
- * Field based screening (K Bechaz);
- * Putting cold tolerance into varieties (P Snell);
- * Postgraduate experience (T Farrell);
- * My postgraduate experience with the Rice CRC (V Lanoiselet);
- * Another Rice CRC student (B Dal Broi);
- * Undergraduate training (S Sivapalan);
- * School and community education (R Troidahl).

John Lacy and John Thompson gave presentations at the Rice CRC Symposium’s field trip to Graham Menzies’ property at Willbriggie. Topics included the use of imaging, crop monitoring, mid season drainage and establishment issues.

The Rice CRC 2005 Symposium included a Workshop on “Hydrology for sustainable rice-based cropping systems”. Presentations included:-

- * Hydrology for sustainable rice-based cropping systems – introduction (S Khan);
- * SWAGMAN Farm for making cropping option decisions (T Rana and J Zirilli);
- * Separating impacts of irrigation, rainfall and floods (A Abbas and M Hafeez);
- * Quantifying seepage losses through channels and shallow groundwater imaging (D Allen);
- * Seepage losses from analysis to on-ground actions (S Akbar);
- * Predicting water allocations (S Khan);
- * Multi-criteria decision making, nodal network optimisation (E Xevi);
- * Using water balance models in a regional context (Z Paydar);
- * Pulling it all together (S Khan).

The Rice CRC held an international cold workshop in Canberra in July 2004. Presentations included:-

- * Water temperature and water height effects on canopy temperature in a Uruguayan rice field (A Roel);
- * Effects of spikelet temperature, root temperature and nitrogen status on spikelet sterility in rice (T Gunawardena);
- * How to improve reproductive cold tolerance of rice in Australia (T Farrell);
- * Modelling chilling injury in rice using CERES Rice ver. 4.1 (J Timsina);
- * Mechanisms of cold tolerance in rice at seedling and reproductive stages (T Gunawardena);
- * PREDA: a prototype of a rice cold damage early warning system at high latitudes (R Confalonieri);
- * Perceptions of rice cold damage by farmers, advisers and researchers – The 2004 experience (L Lewin);
- * Temporal and spatial analysis of water temperature impact on California rice production (R Mutters);
- * Forecasting Australian rice yield in relation to cold damage (J Angus);
- * Rice breeding for cold tolerance in Southern Brazil (R Pereira da Cruz);
- * Genetic control of cold tolerance derived from Eastern European rice cultivars HSC55 and Plovdiv 22 (R Williams);
- * Screening for rice cold tolerance: low temperature effects on flowering (K Fox);
- * Varietal improvement utilizing cold tolerance genes of Dongxiang Wild Rice (H He);
- * Screening for low temperature tolerance at the reproductive stage in rice: difficulties inducing floret sterility (J Smith, R Reinke, S Fukai, K Fischer);
- * Economic analysis of developing cold-tolerant varieties of rice in Australia (R Singh);
- * Rice breeding for cold tolerance in Uruguay (P Blanco);
- * Mechanism of chilling induced pollen failure in rice (M.E. Mamun);
- * Illuminating anthers with electrons and lasers: The cell biology of chilling damage in rice (L Cantrill);
- * Molecular biology of rice cold tolerance (S Oliver);
- * Molecular biology of rice cold tolerance (R Dolferus);
- * Diverse mechanisms of low temperature stress tolerance in rice plants (K Okuno);
- * Low temperature changes proteome of male gametophyte development in rice (N Imin);
- * Chromosomal location of QTLs controlling low temperature induced male sterility in temperate japonica rice (X Zhao).

CSIRO Land & Water at Griffith hosted an ACIAR Permanent Raised Beds workshop in March 2005 which included some presentations related to CRC work:-

- * Economic assessment of lateral permanent raised beds for rice-based farming systems in Australia– an analytical framework (R Singh and G Beecher);
- * Soil water dynamics and crop performance in rice-wheat on permanent beds in Indo-Gangetic plains in India (SS Kukal, Yadvinder-Singh, E Humphreys, SS Dhillon & Bijay-Singh);
- * Performance of non-rice crops and alternative cropping systems of permanent raised beds in the Indo-Gangetic plains of north-west India (H Ram, Yadvinder-Singh, DS Kler, K Kumar, E Humphreys & J Timsina);
- * Permanent raised beds in irrigated farming systems in the Murrumbidgee/Murray Valleys of NSW (HG Beecher, JA Thompson, BW Dunn & SK Matthews).

Papers Presented at Conferences

(To avoid duplication, oral presentations which were also submitted as papers and published in conference proceedings have not been listed here as they are already listed in the “List of Publications and Patents” section.)

Conference Posters

Akbar, S., Khan, S., Allen, D. and Abbas, A. (2004). “EM technologies for targeting seepage water loss from irrigation supply channels”. 2nd Asian regional conference ICID, Moama, NSW, March 2004, (CD, <http://www.ancid.org.au/>)

Oliver, S.N., Van Dongen, J., Geigenberger, P., Saini, H.S., Blanchard, C.L., Roffey, P.E., Dennis, E.S. and Dolferus, R. (2004). “Cold induced sterility in rice is associated with a disruption in sugar metabolism and increase in ABA levels.” International Conference on Arabidopsis Research, Berlin, Germany, July 2004.

Quayle, W.C. and Westra, S. (2004). “Pesticide risk assessment for rice crops. A case study using the Pesticide Impact Ranking Index (PIRI).” Contaminants and Ecological Risk Assessment workshop, Adelaide, South Australia, April 2004.

Visitors

Visitors during 2004/2005 have included:-

Name/Organisation
Dr Hiroyuki Shiratsuchi & Mr Hisashi Kitagawa, National Agricultural Research Centre, Japan
Chris Stevens & Glen Petrie, Kellog
Prof Sang-OK Chung, Dept Agric Engineering, Kyungpook National Univ, Taegu, South Korea
Dr Renata Pereira da Cruz, Instituto Rio Grandense do arroz, Cachoeirinha, Brazil

Prof Takeshi Horie, Kyoto University, Japan
Weeds And Water Conference” field tour delegates
Ms Sachiko Senoo, Japan
Dr Jan Pen and Dr Christophe Reuzeau, CropDesign, Belgium
Dr Xike Zhang, DPI&F, Qld & Mr Jae-Hong Lee, Research Scientist, Gyeonggi Province Agric. Research & Extension Services, South Korea
Steering Committee, International Challenge Program on Water and Food to the Murray Irrigation Area
Leeton Girl Guides
Mie Agricultural university, Japan
Mr Bert Berghuis – NSW Premier’s Teachers Scholarship recipient, Environmental Studies Year 11 Agriculture students, St Stanislaus College, Bathurst NSW
Columbian visitors
Year 12 Agriculture students, St Joseph’s College, Hunter’s Hill NSW
Hokkaido Seinambu Kaigai Kensyu Japanese tour
Cambodian visitor
Sundowner Tours, Queensland
Sorachi Japanese Tour
Shisui Machi Nogyo Inkai Japanese tour
Year 10 Science students, Yanco Agricultural High School NSW
Zenno Shigaa Japanese tour
Year 8 Agriculture students, Kildare Catholic College, Wagga Wagga NSW
5 Japanese tourist groups in February 2005
Tochiren Aus Shisatsu Japanese tour
Allambie Day Service, Leeton
Yanco Public School
A’Sway Japanese tour
Mr Yang, Korea
Year 12 Agriculture students, St Francis de Sales College, Leeton NSW
Nogyoshisatysu Japanese tour

Overseas Visits by Rice CRC Staff

(See also “Collaboration” chapter)

Overseas visits by CRC staff included:-

- Sandra Oliver, Berlin, Germany, July 2004.
- Ric Cother and Gavin Ash, Korea, August 2004.
- David Allen, Denmark and the USA, April 2005.
- Shahbaz Khan, Pakistan, December 2004.
- Shahbaz Khan, Pakistan, Nepal and Bangladesh, March 2005.
- Shahbaz Khan, China, August, 2004.
- Shahbaz Khan, Germany, February 2005.
- Shahbaz Khan, China, July 2004.
- Liz Humphreys, Jagadish Timsina, John Blackwell, Geoff Beecher, John Thompson, Darryl Gibbs and Nick Ellwood, India, September 2004.
- Liz Humphreys, India and Pakistan, February 2005.

- Liz Humphreys, Dhaka, Bangladesh, February 2005.
- Liz Humphreys, Indonesia, November 2004.

Field Days

The Centre manned displays and gave presentations at:-

- Rice CRC Symposium Field trip – Graham Menzies’ property, February 2005;
- “Big Risotto” – Education Hub, November, 2004, Sydney;
- 2005 Rice Field Days (various locations – NSW & Victoria).

Media coverage

Reports in media outlets for the last financial year are listed below.

Date	Publication outlet	Title/Topic
Media releases/reports - Print		
2004		
Aug	Regional & Metropolitan media	Sex life of rice affected by cold
Aug	Regional & Metropolitan media	Quality, cold tolerant rice varieties closer
Aug	Regional & Metropolitan media	Inside the cold rice plant
Aug	The Area News	Rice’s sex life studied
Aug	The Rural	Cold rice a step closer
Aug	The Area News	Breakthrough for rice growers close
Sept	Regional & Metropolitan media	Stressed rice yields up by 10 percent
Sept	Regional & Metropolitan media	Bloodworm control – good, better, best
Sept	The Area News	A little stress goes a long way in rice
Oct	Regional & Metropolitan media	Golden Apple Snail – gourmet food gone bad
Oct	The Area News “Farming Focus”	Snail could threaten rice industry
Oct	The Irrigator	Aussie rice industry fears snail pest
Dec	Regional & Metropolitan media	Beating rice weeds naturally
Dec	The Area News	Weeds invading rice
Dec	The Irrigator	Natural herbicide to save rice crops
2005		
Feb	Regional & Metropolitan media	Rice Symposium summarises cutting edge research
Feb	Regional & Metropolitan media	Chinese lines boost search for cold tolerant rice
Feb	Regional & Metropolitan media	Tissue culture promises faster rice breeding
Feb	The Area News	Forum shows latest in rice
Feb	The Land	Rice Symposium
Feb	The Irrigator	Rice industry developments
Feb	The Rural	Rice lines reject cold
Feb	The Area News “Farming Focus”	Rice breeding lines are more tolerant
Feb	The Irrigator	Hope for new rice breed
Feb	The Rural	Breeding system a rice revolution
Feb	The Area News “Farming Focus”	Breeding rice now easier
Media releases/reports - Radio/TV		
2005		
Feb	Radio 2RG, STAR FM 99.7	Rice Symposium announcements
Feb	WIN-Griffith, Prime & WIN-	Rice Symposium interviews with presenters

	Wagga Wagga Television News	
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Communications Officer and Education Officer

See Education and Training Program – external communications

GRANTS AND AWARDS

Awards

Name	Organisation	Project Title	Source	Award
D Allen	Univ of Technology Sydney	Continuous salinity imaging along canals and drains (1405)	ANCID	Travel Fellowship Award (\$7,000)

The ANCID 2005 Travel Fellowship Award was presented to David Allen (PhD student, Project 1405) in Adelaide in November 2004. This award provides \$7000 for international travel. Upon return, David is expected to present at the ANCID 2005 Conference - Mildura, the IAA 2005 conference, the Sustainable Irrigation Investors Forum and targeted irrigation industry state and regional workshops and forums. He is expected to arrange further financial support, with the communicative support of ANCID, in the order of \$5000 to cover presentation costs.



David Allen being presented with ANCID 2005 Travel Fellowship Award.

PERFORMANCE MEASURES

	2001/2002	2002/2003	2003/2004	2004/2005
A1 The contributions of staff from each participating institution to the objectives of the Rice CRC .	Staff from each participating organisation have met their commitments to the Centre. These contributions are detailed under “Research Staff Resources” table.	Staff from each participating organisation have met their commitments to the Centre. These contributions are detailed under “Research Staff Resources” table.	Staff from each participating organisation have met their commitments to the Centre.	Staff from each participating organisation have met their commitments to the Centre.
A2 The interaction of the Rice CRC and its contributing staff with other funding bodies.	Interaction has been with ACIAR, RIRDC and Irrigation Companies.	Interaction has continued with ACIAR, RIRDC and Irrigation Companies.	Interaction has continued with ACIAR, RIRDC and Irrigation Companies.	Interaction has continued with ACIAR, RIRDC and Irrigation Companies.
A3 The range of opportunities for exchange of information on the Centre objectives and activities through seminars and workshops.	Exchange of information was facilitated by the Annual Symposium and Program meetings, discussion with irrigation Boards, and many seminars, presentations and contributions to workshops.	Exchange of information was facilitated by the Annual Symposium and Program meetings, discussion with irrigation Boards, and many seminars, presentations and contributions to workshops.	Exchange of information was facilitated by Program meetings, discussion with irrigation Boards, and contributions to many seminars, presentations and workshops.	Exchange of information was facilitated by Program meetings, discussion with irrigation Boards, and contributions to many seminars, presentations and workshops.
A4 The extent of interaction with research groups other than those directly participating in the Centre.	There has been active participation with research groups from the Australian National University, University of Queensland, University of NSW, Incitec Fertilisers Ltd and environmental staff from Murray Irrigation Ltd, Murrumbidgee Irrigation Ltd and Coleambally Irrigation Cooperative Ltd.	There has been active participation with research groups from the Australian National University; University of Queensland; University of Technology Sydney; University of New England; University of Melbourne; Murray Irrigation Ltd; Murrumbidgee Irrigation Ltd; Coleambally Irrigation Cooperative Ltd; Goulburn Murray Water; Wimmera Murray Waters; NASA; BOEING company; University of Maryland, USA; Punjab	There has been active participation with research groups from the Australian National University; University of Queensland; University of Technology Sydney; University of New England; University of Melbourne; Murray Irrigation Ltd; Murrumbidgee Irrigation Ltd; Coleambally Irrigation Cooperative Ltd; NASA; BOEING company; University of Maryland, USA; Punjab Agricultural University; ACIAR; RIRDC; Grains	There has been active participation with research groups from the University of Queensland; University of Technology Sydney; Murray Irrigation Ltd; Murrumbidgee Irrigation Ltd; Coleambally Irrigation Cooperative Ltd; CSIRO Earth Observation Centre; Pratt Water Group; IRRI Philippines; Rice-Wheat Consortium for Indo-Gangetic Plains; Punjab Agricultural University; ACIAR; CRC for Irrigation Futures; CRC for

	2001/2002	2002/2003	2003/2004	2004/2005
		<p>Agricultural University; ACIAR; RIRDC; Grains Research & Development Corporation; Cotton R&D Corporation; Australian Cotton CRC; Horticulture Australia Ltd; Orica Australia Pty Ltd; CRC LEME; Zonge Engineering & Research; Hokkaido University, Japan; United States Department of Agriculture; Cornell University, New York, USA; IRRI, Philippines; Rice Research Centre, Sakha, Egypt; Institut de Biologie Moleculaire des Plantes, Centre National de la Recherche Scientifique, Strasbourg, France; Unilever Research Laboratories, Netherlands; Institut de recherché en biologie vegetale, University of Montreal, Canada; Max-Planck-Institute for Molecular Plant Physiology, Golm, Germany; Rice Research Institute, Yunnan Agricultural University, China; BRI Australia Ltd; Glasgow Caledonian University; Uncle Tobys R&D Centre, Rutherglen; University of Canberra.</p>	<p>Research & Development Corporation; Cotton R&D Corporation; Australian Cotton CRC; Horticulture Australia Ltd; Orica Australia Pty Ltd; Zonge Engineering & Research; Hokkaido University, Japan; United States Department of Agriculture; Cornell University, New York, USA; IRRI, Philippines; Institut de Biologie Moleculaire des Plantes, Centre National de la Recherche Scientifique, Strasbourg, France; Unilever Research Laboratories, Netherlands; Institut de recherché en biologie vegetale, University of Montreal, Canada; Max-Planck-Institute for Molecular Plant Physiology, Golm, Germany; Rice Research Institute, Yunnan Agricultural University, China; BRI Australia Ltd; University of Canberra; Monash University; University of NSW; Specific Site Technology Development Group; The International Atomic Energy Agency, Decision Support Systems for Agrotechnology Transfer Group; National Fertiliser Development Centre, Alabama, USA; Land & Water Research & Development Corporation; Land & Water Australia; Aarhus University Hydrogeophysics Group,</p>	<p>Catchment Hydrology; Cotton R&D Corporation; Australian Cotton CRC; Horticulture Australia Ltd; The International Atomic Energy Agency; Decision Support Systems for Agrotechnology Transfer group; CSIRO's Water for a Healthy Country flagship program; Murrumbidgee Catchment Management Authority; Geo-Force Perth; Zonge Engineering & Research; Aarhus University Hydrogeophysics Group, Denmark; Yezin Agricultural University, Myanmar and Central Agricultural Research Institute; Murray-Darling Basin Commission; Hokkaido University, Japan; Institut de recherché en biologie vegetale, University of Montreal, Canada; Max-Planck-Institute for Molecular Plant Physiology, Golm, Germany; Rice Research Institute, Yunnan Agricultural University, China; International Centre for Tropical Agriculture, Columbia; PhilRice; Chinese National Research Institute; BRI Australia Ltd; Terrabyte Services; Leeton Visitor's Centre; CSIRO Discovery Centre; University of Canberra; GasApps Australia.</p>

	2001/2002	2002/2003	2003/2004	2004/2005
			Denmark; Australia-Korea Foundation; Laboratoire de Microbiologie Appliquée de Quimper, Université de Bretagne Occidentale, France; Plant Health Australia; Murray-Darling Basin Commission; International Centre for Tropical Agriculture, Columbia.	
A5 Evidence of upgraded links between members of participating institutions.	The linkages already developed during the first four years of CRC activities have been reinforced. Stronger links have developed with irrigation companies, particularly through interaction with Program 1. Links between CSIRO and The University of Sydney have expanded, as have links between CSIRO and Charles Sturt University.	Evidence of upgraded links was amply demonstrated by the desire of core partners to participate in the application for an additional year for the Rice CRC. This year marked considerable achievement in improving links between SunRice, NSW Agriculture, Sydney University and Charles Sturt University in Program 4.	Linkages remained strong. Partners demonstrated their belief in the value of these linkages by supporting the application for a new CRC for Value Added Rice Based Systems.	Linkages remained strong. Linkages with CSIRO have expanded to include interaction and collaboration with CSIRO Discovery in Canberra and CSIRO's Water for a Healthy Country flagship program.
A6 The interaction of University and non-University staff in the education program.	Of the 32 postgraduate students who were current during 2001/2002, 17 were supervised primarily by university staff and the remaining 15 were supervised jointly by university and non-university staff.	Of the 17 postgraduate students who were current during 2002/2003, 8 were supervised primarily by university staff, with the remaining 9 being supervised jointly by university and non-university staff.	Of the 15 postgraduate students who were current during 2003/2004, 8 were supervised "primarily" by university staff, with the remaining 7 being supervised jointly by university and non-university staff. Those supervised primarily by university staff had strong interaction with non-university staff.	Of the 13 postgraduate students who were being supported by the CRC in 2004/2005, 6 were supervised "primarily" by university staff, with the remaining 7 being supervised jointly by university and non-university staff.
B1 Papers in refereed journals.	Twelve publications in refereed journals.	31 publications in refereed journals.	26 publications in refereed journals.	24 publications in refereed journals
B2 Invitation to present keynote addresses and participation in courses.	Dr Shahbaz Khan (Project 1201) visited Korea to present work on "Integrated hydrologic economic modelling techniques to develop	CRC participants are often informally invited to present papers at conferences but not necessarily as keynote speakers.	CRC participants gave keynote addresses or submitted "invited" papers on at least 8 occasions for both national and	CRC participants gave keynote addresses or submitted "invited" papers on at least 20 occasions for both national and

	2001/2002	2002/2003	2003/2004	2004/2005
	<p>local and regional policies for sustainable rice farming systems”, at the 1st Asian Regional Conf on Agriculture, Water and Environment, ICID, Sept 2001, Seoul, Korea.</p> <p>While visiting China (March 2001) Dr Khan (Project 1403) gave keynote presentations to a number of organisations including a major seminar on “Surface-groundwater interaction modelling in China and Pakistan” to Huanghe Technical College, Kaifeng. Dr Khan was also invited by IRRI (Philippines) to present research on system scale modelling in Australia, Pakistan and China.</p> <p>Mr Tony Blakeney was invited to present a keynote paper at the International NIR Conference, Korea.</p>	<p>However Dr Shahbaz Khan has continued to be a sought after speaker at conferences which have included:-</p> <ul style="list-style-type: none"> * Irrigation Advisory Services and Participatory Extension in Irrigation Management Workshop, organised by FAO – ICID in Montreal, Canada; * Hydrology for the Environment, Life and Policy (HELP) Symposium in Kalmar, Sweden; and * Water-Wise Rice Production, IRRI, Los Banos, Philippines. <p>Dr Liz Humphreys was a keynote speaker at international conferences and Mr Tim Farrell was a keynote speaker at the International Temperate Rice Conference in Uruguay.</p>	<p>international conferences and workshops.</p>	<p>international conferences and workshops. This doesn’t include CRC staff who were invited to give presentations at the CRC’s international cold tolerance workshop in Canberra in July or the CRC’s Symposium and Hydrology Workshop in Griffith in February 2005.</p>
B3 Software development and application	<p>SWAGMAN Farm web-based version completed.</p>	<p>CRC participants contributed to further development of software for the rice industry, including SWAGMAN Farm® and MaNage Rice extensions.</p>	<ul style="list-style-type: none"> * Further development of water allocation programs. * Contribution to development of maNage Rice. * Software developed by project “Remote sensing of irrigated crop types and its application to regional water balance estimation”. 	<ul style="list-style-type: none"> * Contribution to further development of maNage Rice, SWAGMAN Farm® and water allocation prediction.
B4 Scientific developments that are applied throughout the industry.	<ul style="list-style-type: none"> * EM31 and sodicity being tested throughout industry. * Positional accuracy of GIS data 	<ul style="list-style-type: none"> * Approval was granted by REPAG (Rice Environment Policy Advisory Group) for 	<ul style="list-style-type: none"> * Remote imaging widely used. * New rice products including retort rice. 	<ul style="list-style-type: none"> * Remote imaging now used for >60% of fields. * Water management programs

	2001/2002	2002/2003	2003/2004	2004/2005
	<p>applied in Coleambally Irrigation Area (CIA).</p> <ul style="list-style-type: none"> * Net recharge management applied through the CIA. * Markers for amylose content applied in rice breeding program. * Updated quality evaluation strategies applied across all industry receival sites. * Increased range of quick-cooking rices marketed in supermarkets. 	<p>application of the EM31 and sodicity test.</p> <ul style="list-style-type: none"> * There was extensive application of “crops following rice” for groundwater use. * SWAGMAN Farm® is being applied for net recharge management – particularly by Coleambally Irrigation Cooperative Limited. * There was good application of image analysis for locating tissue testing sites. * New techniques for analysing starch structure are being used by industry for evaluation of texture of quick cooking rice. * There is widespread use of new techniques for evaluating quality of rice at receival. * Quality assurance systems are being applied through the processing sector. * Processes developed by CRC research have been further developed into products now on supermarket shelves. 	<ul style="list-style-type: none"> * “Soil suitability” applied. * “Crops following rice” widely used for water use. * Continued application of “SWAGMAN Farm®”. * Application of cold screening techniques to new variety production and application of anther/microspore culture to rice breeding. * New rice products available in supermarkets. * Quality Assurance and environmental management systems applied through industry. 	<p>by irrigation companies.</p> <ul style="list-style-type: none"> * New products in market place. * Soil suitability tools applied. * “Crops following rice” farming system adopted to make best use of water. * Quality Assurance and environmental management systems applied throughout industry.
C1 The number of graduate programs offered and successfully completed.	<ul style="list-style-type: none"> * There were 336 undergraduate students involved in courses conducted by two lecturers sponsored by the CRC. * 3 Honours students were enrolled, 1 of whom has completed his studentship. 	<ul style="list-style-type: none"> * There were 626 undergraduate students involved in courses conducted by two lecturers sponsored by the CRC. * 6 Honours students were enrolled (4 of whom subsequently withdrew), with 1 completed and 1 ongoing (commenced Feb 03) It is interesting to note that 3 of 	<ul style="list-style-type: none"> * There were 521 undergraduate students involved in subjects/courses conducted by the two CSU lecturers sponsored by the CRC. * There was 1 Honours student whose enrolment was current during 2003/2004. That student has graduated with 1st Class 	<ul style="list-style-type: none"> * There were over 400 undergraduate students involved in subjects/courses conducted by two CSU lecturers sponsored by the CRC. * There were no Honours students still being supported by the Rice CRC in 2004/2005.

	2001/2002	2002/2003	2003/2004	2004/2005
		the withdrawals were students who had completed summer studentships and decided to take on an Honours degree. Since July 1997 the Rice CRC has appointed 14 Honours students (9 completed, 1 ongoing, 4 withdrawals).	Honours and a University Medal. All of the previously funded Honours students have graduated.	
C2 The number of post-graduate opportunities offered and successfully completed. Distribution among the participating institutions is also an important measure.	32 postgraduate students (including Masters students) were enrolled - 7 Sydney University 14 Charles Sturt University 3 University of Queensland 2 Australian National University 2 University of NSW 4 University of Technology, Sydney (4 Masters completed, 3 have submitted their thesis - note some top up CRC funding only. 8 PhD projects completed with 3 students having submitted their thesis. 1 Honours graduated with Honours.)	This financial year 17 postgraduate students (including Masters students) have been funded – 5 Sydney University, 9 Charles Sturt University, 1 University of Queensland, 1 Australian National University, 1 University of Technology Sydney. 3 of these students have completed their scholarship, with the remaining 14 due for completion in 2003/2004 or 2004/2005. Since the commencement of the Rice CRC in July 1997 it has supported 32 PhD students (11 completed, 14 ongoing, 7 withdrawn) and 10 Masters students (6 completed, 3 ongoing, 1 withdrawn).	15 postgraduate students (including Masters) remained current this financial year, supported by the following universities – Charles Sturt University (8), University of Sydney (4), University of Technology Sydney (1), Australian National University (1) and University of Queensland (1).	13 postgraduate students (including Masters) remained current this financial year, supported by the following universities – Charles Sturt University (7), University of Sydney (4), University of Technology Sydney (1) and University of Queensland (1).
C3 Establishment and use of vocational training programs.	Vocational training delivered in - Rice Production; Irrigation; Colour sorting.	Vocational training delivered in - Rice Production; Irrigation; Colour sorting.	* Contributions to “Rice for Profit” course and SWAGMAN Farm@ training. * Contributions to Land & Water Management Plan training.	“Rice for Profit” course.
C4 The extent of wider community information opportunities.	Community information opportunities have been extensive through:-	Community information opportunities have been through:-	Community information opportunities have been through:-	Community information opportunities have been through:-

	2001/2002	2002/2003	2003/2004	2004/2005
	<ul style="list-style-type: none"> * Crop critters program; * Ag learning display at Sydney Royal Easter Show; * over 70 press articles and news releases. 	<ul style="list-style-type: none"> * access to Rice CRC and linked industry websites; * Henty Field Days; * Rice Field Days; * Crop critters program including school visits; * Exhibit at Sydney Royal Easter Show; * Annual Symposium; * presentations to community groups such as Rotary, Lions Club etc; * print, television and radio news releases. 	<ul style="list-style-type: none"> * access to Rice CRC and linked industry websites; * Rice Field Days; * Crop critters program including school visits; * information at Sydney Royal Easter Show; * presentations to community groups such as Rotary, Lions Club etc; * print, television and radio news releases. 	<ul style="list-style-type: none"> * access to Rice CRC and linked industry websites; * Rice Field Days; * Crop Critters program including school visits; * information at Sydney Royal Easter Show at SunRice site; * education hub at "World's Biggest Risotto" event, Sydney; * Display and presentations at CSIRO Discovery Centre, Canberra; * presentations at "non-industry" conferences; * print, television and radio news releases.
D1 Application of improved technology to improve sustainability throughout the industry.	<ul style="list-style-type: none"> * EM31 application. * EM31 and sodicity trials. * "Crops following rice" for groundwater management. * Net recharge management initiatives. 	<ul style="list-style-type: none"> * Further application of "EM31 and sodicity" to reduce net recharge. * Application of SWAGMAN Farm® to control recharge has contributed to watertable declines. * Further uptake of farm management strategy of "crops following rice" and its impact on groundwater levels. 	<ul style="list-style-type: none"> * Further application of "EM31 and sodicity" to reduce net recharge. * Application of SWAGMAN Farm® to control recharge has contributed to watertable declines. * Contributions to RGA Environment Management Program and Environmental Champions Project. 	<ul style="list-style-type: none"> * Soil suitability assessment.
D2 The value of the product, processes or services in increasing exports or import substitution.	Further expansion of "quick cook" products range.	There was limited opportunity for import replacement due to low production as a result of the drought.	Low production was again a problem. New products to be exported.	New products that were developed included retort rice and improved rice cakes.
D3 Contribution of the findings to new standards of operation.	Further improvement of receival quality evaluation.	<ul style="list-style-type: none"> * Applications of quality evaluation in implementation of Quality Assurance programs for production and processing sectors. * Contributions of Rice CRC 	<ul style="list-style-type: none"> * Quality Assurance programs. * Contributions of imaging to improved productivity. 	<ul style="list-style-type: none"> * Improved monitoring of crop areas and types. * Improved monitoring for rice soil suitability. * Continued development of quality assurance programs.

	2001/2002	2002/2003	2003/2004	2004/2005
		research to development of the rice industry environmental policy.		
D4 The extent to which skills of the Centre are drawn on by users.	Program 1: Interaction with Irrigation Companies. Program 2: Advice to growers by many officers. Program 3: Advice on variety use.	Program 1: Extensive use of skills by Irrigation Companies. Programs 2 & 5: Extensive use of the skills by farmers. Program 3: Use of skills in breeding programs. Program 4: Use of skills in developing technology at receival, improved understanding of processing technology in Quality Assurance development and also development of new products by the commercial company (SunRice).	Program 1: Extensive use of skills by Irrigation Companies. Programs 2 & 5: Extensive use of the skills by farmers. Program 3: Use of skills in breeding programs. Program 4: Use of skills in developing technology at receival, improved understanding of processing technology in Quality Assurance development and also development of new products by the commercial company (SunRice).	Program 1: Extensive use of skills by Irrigation Companies. Programs 2 & 5: Extensive use of the skills by farmers. Program 3: Use of skills in breeding programs. Program 4: Use of skills in developing technology at receival, improved understanding of processing technology in Quality Assurance development and also development of new products by the commercial company (SunRice).
D5 Contribution to user-orientated presentations - eg. seminars, popular journals or other media.	CRC staff have contributed to at least:- *4 field days; *15 workshops; *30 conferences; *12 seminars; and a number of print, radio and television opportunities.	CRC staff have contributed to at least:- *3 field days; *13 workshops; *28 conferences; *10 seminars; and a number of print, radio and television opportunities.	CRC staff have contributed to at least:- *3 field days; *32 conferences; *17 workshops and seminars; and a number of print, radio and television opportunities.	CRC staff have contributed to at least:- *3 field days; *18 conferences; *25 workshops and seminars; *31 technical reports; *3 trade magazines; *4 chapters/books; *24 refereed journals; and a number of print, radio and television opportunities.
E1 Normal financial reporting and auditing will ensure that the resources are effectively managed.	Financial and auditing system in place.	Financial and auditing system in place. Management Committee and Board fully informed on a quarterly basis.	Financial and auditing system in place. Management Committee and Board fully informed on a quarterly basis.	Financial and auditing system in place. Management Committee and Board fully informed on a quarterly basis.
E2 Establishment of procedures to monitor and report on the research program and achievements in relation to	Project system is established.	Project system is established. Half yearly and yearly progress reports from Project Leaders monitored by Program	Project system is established. Half yearly and yearly progress reports from Project Leaders monitored by Program	Project system is established. Half yearly and yearly progress reports from Project Leaders monitored by Program

	2001/2002	2002/2003	2003/2004	2004/2005
other activities of the Centre.		Managers and Management Committee.	Managers and Management Committee.	Managers and Management Committee.
E3 Timely and accurate reporting of progress towards the objectives of the Centre.	Progress reporting both timely and accurate.	Accurate reporting provided as required except for delay in production of 2002/2003 Annual Report, partly due to pressure of other deadlines (including work on CRC rebid) and difficulties experienced in collection of information from Program 4 due to staff resignations.	Progress reporting both timely and accurate.	Progress reporting both timely and accurate.
E4 The extent to which objectives are modified or rationalised in line with new knowledge or changes in the social or economic environment.	Modification to use rice genome developments.	Objectives particularly in relation to technology transfer were modified to meet extreme production shortages following drought.	Objectives – particularly in regard to technology transfer, environmental management, production systems and product development – all modified to meet need.	Objectives for Year 8 were extensively modified and approved in light of drought pressures and a program which was in “finalisation” mode.
E5 Accurate monitoring of projects including financial management and progress towards meeting agreed milestones.	Project management systems are in place.	Project management systems are in place.	Project management systems are in place.	Project management systems are in place.
E6 Accurate monitoring of agreed performance indicators and financial transactions.	Milestones and financial transactions are continuously monitored.	Milestones and financial transactions are continuously monitored.	Milestones and financial transactions are continuously monitored.	Milestones and financial transactions are continuously monitored.

**BRIAN H. MAGUIRE
ASSOCIATES**

**INDEPENDENT ACCOUNTANT'S REPORT TO
THE CO-OPERATIVE RESEARCH CENTRES' SECRETARIAT
DEPARTMENT OF EDUCATION, SCIENCE AND TRAINING
REPRESENTING THE COMMONWEALTH IN RESPECT OF
CO-OPERATIVE RESEARCH CENTRE FOR SUSTAINABLE RICE PRODUCTION
FINANCIAL STATEMENTS FOR THE YEAR ENDED 30 JUNE 2005**

Scope

We have conducted a limited scope review of the financial statements of the Co-operative Research Centre for Sustainable Rice Production (CRC-SRP) for the year ended 30 June 2005 comprising Budget Tables 1, 2 and 3 in accordance with clause 14(1)(f) of the Commonwealth Agreement. The parties to the Co-operative Research Centre are responsible for the preparation and presentation of the financial report and the information contained therein.

The scope of our review is based on our understanding of the business activities of the Co-operative Research Centre for Sustainable Rice Production and the systems for recording financial information and preparing financial statements. The review is limited to specific procedures consisting primarily of:

- inquiries of and written representation from CRC-SRP personnel as to:
 - the continued effectiveness of internal accounting controls;
 - the existence of material matters relating to the financial position
 - compliance with the terms of Clauses 4, 5(1), 5(2), 5(3), 9(1), 9(5) and 12(2) of the Commonwealth Agreement; and
- analytical review procedures applied to financial data

These procedures provide less assurance than an audit conducted in accordance with Australian Audit Standards. We have not performed an audit and, accordingly, we do not express an audit opinion.



BRIAN H. MAGUIRE & ASSOCIATES

ABN 30 048 704 919

17 KURRAJONG AVENUE • PO BOX 773 • LEETON • NSW • 2705

TELEPHONE (02) 6953 3022 • FACSIMILE (02) 6953 3406

PARTNERS: A.J. COLLINS CPA • A.J. RODDY CPA

Review Opinion

In our opinion, the financial information presented in Tables 1, 2 and 3 presents fairly the sources of funding, the application of funding and the financial position of Co-operative Research Centre for Sustainable Rice Production for the year ended 30 June 2005 in accordance with Australian accounting concepts and applicable Accounting Standards, the CRC Secretariat's Guidelines for Auditors, and the requirements of the Commonwealth Agreement in terms of Clauses 4 (Contributions), 5(1), 5(2), 5(3) (Application of Grant and Contributions), 9(1), 9(5) (Intellectual Property) and 12(2) (Financial Provisions).

1. The multipliers adopted by the Centre to value in-kind contributions other than salary costs have a sound and reasonable basis and each partner's component of the Researcher's Contributions for the year under report has been provided at least to the value for that year committed in the Budget as specified in the Agreement, and the total value of all Contributions for the year under report equalled or exceeded the amount of grant paid during the year (not including advances). [Clause 4]
2. The Researcher has used the Grant and the Researcher's Contributions for the Activities of the Centre and in my professional opinion there appear to be no material report irregularities. [Clause 5(1)]
3. The Researcher's allocations of the budgetary resources between Heads of Expenditure has not been lower or higher than the allocation in the budget by \$100,000 or 20% (whichever is the greater amount) without prior approval by the Commonwealth. [Clause 5(2)]
4. Capital Items acquired from the Grant and Researcher's Contributions are vested as provided in the Joint Venture Agreement [Clause 5(3)]
5. Intellectual Property in all Contract Material is vested as provided in the Joint Venture Agreement and no Intellectual Property has been assigned or licensed without the prior approval of the Commonwealth. [Clause 9(1), 9(5)].
6. Proper accounting standards and controls have been exercised in respect of the Grant and Researcher's Contributions and income and expenditure in relation to the Activities of the Centre have been recorded separately from other transactions of the Researcher. [Clause 12(2)]

LEETON NSW
7 September 2005

BRIAN H MAGUIRE & ASSOCIATES



ASHLEY J COLLINS - PARTNER

**BRIAN H. MAGUIRE
ASSOCIATES**

GLOSSARY

ABA	Abscisic acid
ACIAR	Australian Centre for International Agricultural Research
ACRES	Australian Centre for Remote Sensing
AFM	atomic force microscopy
ANU	Australian National University
AWQMG	Australian Water Quality Management Guidelines
BRR	Bangladesh Rice Research Institute
CANCES	Centre for Advanced Numerical Computation in Science and Engineering
CIA	Coleambally Irrigation Area
CICL	Coleambally Irrigation Cooperative Limited
CMS	cytoplasmic male sterile
COM	component object model
COS	carbonyl sulphide
CRC	Cooperative Research Centre
CRC Rice	Cooperative Research Centre for Sustainable Rice Production
CSIRO	Commonwealth Scientific & Industrial Research Organisation
CSU	Charles Sturt University
DCP	dynamic cone penetration
DH	double haploid
DIPNR	Department of Infrastructure, Planning & Natural Resources (formerly DLWC)
DLWC	NSW Department of Land and Water Conservation
DOC	dissolved organic carbon
DOM	degree of milling
DSC	differential subtraction chain
DSSAT	Decision Support Systems for Agrotechnology Transfer
EAL	Environmental Analytical Laboratory
ECa	apparent electrical conductivity
EM	electro magnetic
ESP	Exchangeable Sodium Percentage
EPA	Environment Protection Authority
ERIC	enterobacterial repetitive intergenic consensus
ESEM	scanning electron microscopy
EST	expressed sequence tag
ET	evapotranspiration
ETM	enhanced thematic mapper
ETo	reference evapotranspiration - calculation of evapotranspiration
EQOs	environment quality objectives
GAMS	General Algebraic Modelling System
GBSS	granule bound starch synthase
GIS	geographical information systems
GPC	gel permeation chromatography
GPS	global positioning system
GRDC	Grains Research & Development Corporation
ha	hectares
HACCP	hazard analysis critical control point
HELP	Hydrology, Environment, Life and Policy (UNESCO program)
HQI	halogen quartz iodide
IAEA	International Atomic Energy Agency
IREC	Irrigation Research & Extension Committee
IRRI	International Rice Research Institute
IGS	intergenic spacers
ITS	internal transcribed spacers
IWMI	International Water Management Institute
LAI	Leaf Area Index

L&WMP	Land and Water Management Plan
LP	linear programming
LWRRDC	Land and Water Resources Research & Development Corporation
MC	microspore culture
MDBC	Murray-Darling Basin Commission
MIA	Murrumbidgee Irrigation Area
MU	Melbourne University
N	Nitrogen
NCGM	National Centre for Groundwater Management
NHT	National Heritage Trust
NIR	Near Infra-Red
NSW	New South Wales
NSWAGRIC	NSW Agriculture
NSW DPI	NSW Department of Primary Industries
OH&S	Occupational Health & Safety
OP	organophosphate
PBI	Plant Breeding Institute
PCR	polymerase chain reaction
PhD	Doctor of Philosophy
PI	panicle initiation
PIN	panicle initiation nitrogen uptake
PMF	peptide mass fingerprint
PRC	People's Republic of China
QTL	quantitative trait loci
QU	Queensland University
RCL	Ricegrowers' Co-operative Limited
REP	repetitive extragenic palindromic
REPAG	Rice Environmental Policy and Advisory Group
RGAA	Ricegrowers' Association of Australia
RIRDC	Rural Industries Research and Development Corporation
RNA	ribonucleic acid
RRDC	Rice Research and Development Committee
RVA	rapid visco analysis © Newport Scientific
SAR	sodium absorption ratio
SATs	stomatal aperture-related traits
SDI	sporophytic development inducers
s.e.d	standard error of difference
SEP	standard error of performance
SGRL	Stored Grain Research Laboratory (CSIRO Entomology)
SPC	Statistical Process Control
SPI	Standard Precipitation Index
SSR	single sequence repeat
SU	Sydney University (The University of Sydney)
SWAGMAN	Salt Water And Groundwater MANagement (@Registered trademark for CSIRO suite of models)
t/ha	tonnes per hectare
TOC	total organic carbon
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNSW	University of New South Wales
USA	United States of America
USDA	United States Department of Agriculture
USGS	United States Geological Survey
UTS	University of Technology, Sydney
WMO	World Meteorological Organisation

**Cooperative Research Centre
For Sustainable Rice Production**

C/- Yanco Agricultural Institute
Private Mail Bag
YANCO NSW 2703

Telephone (02) 69512713
Facsimile (02) 69512533
Email - crc.rice@agric.nsw.gov.au
Website - <http://www.ricecrc.org>