



**COOPERATIVE RESEARCH CENTRE  
FOR SUSTAINABLE RICE PRODUCTION**

**ANNUAL REPORT 2000/2001**



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

# MISSION STATEMENT AND OBJECTIVES

## MISSION

The Cooperative Research Centre for Sustainable Rice Production will increase the economic, environmental and social sustainability of the Australian rice industry and enhance its international competitiveness through both strategic and tactical research and implementation of practical, cost-effective programs.

## OBJECTIVES

This CRC aims to increase the contribution the rice industry makes to the national economy and to the welfare of all Australians by:

- generating knowledge to improve the sustainability of the natural resources and the systems used to produce rice;
- developing germplasm which will be the basis of a sustainable increase in rice yields and quality;
- developing a more strategic base for rice research in Australia; and
- formally linking key agencies involved in rice research, education and extension and focusing their effort on a common purpose.

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# COOPERATIVE RESEARCH CENTRE FOR SUSTAINABLE RICE PRODUCTION

## ANNUAL REPORT 2000/2001

An unincorporated joint venture between:

**Charles Sturt University**

**The University of Sydney**

**Ricegrowers' Co-operative Limited**

**CSIRO**

**(Plant Industry, Land and Water and Entomology)**

**NSW Agriculture**

**NSW Department of Land and Water Conservation**

**Rural Industries Research and Development Corporation**



**CHARLES STURT  
UNIVERSITY**



**Ricegrowers**  
RICEGROWERS' CO-OPERATIVE LIMITED  
A.B.N. 607 481 156 INC. NSW



Established and supported under the  
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# TABLE OF CONTENTS

- EXECUTIVE SUMMARY, HIGHLIGHTS ..... 3
  - Chairman’s Report ..... 3
  - Director’s Report ..... 5
  
- DESCRIPTION OF STRUCTURE AND MANAGEMENT ..... 8
  
- COOPERATIVE LINKAGES ..... 14
  
- RESEARCH ..... 20
  - Sustainability of Natural Resources ..... 20
  - Sustainable Production Systems ..... 44
  - Genetic Improvement for Sustainable Production ..... 67
  - Product and Process Development ..... 87
  
- EDUCATION AND TRAINING ..... 101
  - Education, Skills Development and Technology Transfer ..... 101
  
- UTILISATION AND APPLICATION OF THE RESEARCH, COMMERCIALISATION,  
LINKS WITH USERS ..... 120
  
- STAFFING AND ADMINISTRATION ..... 123
  
- LIST OF PUBLICATIONS AND PATENTS ..... 130
  
- PUBLIC PRESENTATIONS, PUBLIC RELATIONS & COMMUNICATION ..... 135
  
- AWARDS ..... 146
  
- PERFORMANCE INDICATORS ..... 147
  
- BUDGET ..... 156
  
- AUDIT ..... 162
  
- GLOSSARY ..... 164

# EXECUTIVE SUMMARY

## Chairman's Report

Although our CRC is composed of a wide and varied group of organisations and scientists, we have always been fortunate to have a strong and practical sense of unity and purpose. This feeling of unity has been fundamental in enabling the CRC to become a mature and productive organisation, clearly fulfilling the terms of its Vision statement which is to “increase the economic, environmental and social sustainability of the rice industry through strategic and tactical research and the implementation of practical and cost effective programs”. Subsequently, there is a clear understanding in the CRC that the social stability of the region has a great dependence on a strong and stable rice industry.

The Board of the CRC has recognised the necessity to promote rice research, not only to rice growers as its main client base but to the general community in wider urban areas. With this in mind the Board has funded its Communications Officer, Mr Michael Cook, to develop a broader target of influence whilst still maintaining the crisp image of disciplined and professional science.

The CRC is maintaining its leadership in developing rice that has significant tolerance to cold. If this promising research achieves its objectives, then annual benefits to Australian rice growers could be measured in tens of millions of dollars.

Rice growing in Australia, and indeed the world industry, will benefit from work being done by the CRC in identifying and subsequently modifying the grain characteristics which, in combination, create the subtle quality characteristics of premium rice quality. It is not widely appreciated by Australians that the palates of sophisticated rice eaters in nations where rice is a staple food are as capable of detecting as many flavour and texture variations as can be identified by their counterparts in the wine industry. If desirable characteristics can be initially incorporated into the breeding programs it will greatly reduce the period of variety development.

Models of land and water management strategies funded by the CRC have been tested and developed to the point where they are being applied in practice by several of the irrigation companies.

The usefulness of our training policy has been highlighted by the employment of several of our Honours graduates in rice-related industries and operations in our region.

The Board of the CRC was greatly strengthened by the appointment of Ms Sulari Goonetilleke. She brings with her valuable and comprehensive qualifications in law, science and management of the environment and has already made significant contributions to the Board table.

Grateful acknowledgement must be extended to Dr Graham Harris, Chief of the Division of Land and Water, CSIRO, who retired from the CRC Board during the year. Dr Harris gave enormous support and guidance to the CRC and his wisdom and intelligent advice is warmly appreciated.

The contribution made by our Director, Dr Laurie Lewin, continues to be invaluable. The continuing success of the CRC is largely due to his skill and energy and we are deeply indebted to him.

I wish to thank the Deputy Chairman of the Board, Mr John Herbert, for his support to me during the year when I had a period of ill health. His willing contribution was of great personal value to me and to the development of the objectives of the CRC.

The generous relationship between the CRC and the NSW Department of Agriculture continues to be a great advantage to the rice industry and the support of Yanco Agricultural Institute is of pivotal importance to us.

Our staff are great contributors and have developed a strong bond of common purpose with all the component members of the CRC.

A handwritten signature in cursive script, reading "Jane Savage". The signature is written in black ink and is positioned below the main body of text.

## Director's Report

This report marks the fourth year of the CRC for Sustainable Rice Production. It has been a year that has consolidated the early achievements of the CRC. This is particularly true for the cementing of cooperative arrangements and the collaboration between individuals.

I have been particularly heartened by the spirit that is evidenced each time members of the CRC get together. This was particularly obvious at the Rice CRC Symposium held in February but is also a feature of smaller meetings and workshops.

### The Rice CRC Program

There has been good progress in all Program areas and results are now being applied across all levels of the rice industry. This is, in a large part, due to the enthusiasm of the researchers and their commitment to seeing adoption of their work.

Program 1 has cemented its place as a key program of the CRC.

The EM31 technique of estimating land suitability is now firmly established as a key tool in controlling water use and new modifications are now improving the technology.

Use of remote sensing for determining crop areas, types and growth are also entering a new and exciting phase. One project has strong links to the new experimental satellite platform being developed under the auspices of NASA. Other projects in Program 2, however, are also extending use of remote sensing and linking its use to aspects of precision agriculture.

Application of the net recharge management model by irrigation companies is an important development in managing salinity and watertables. The model has been modified to make it more friendly, to include economic parameters and to include additional recharge parameters.

The experiments to evaluate rice cultivation on permanent beds have not indicated real water use efficiency savings but have pointed to the use of the technique as a component of a system to save costs, manage groundwater and encourage more efficient production. Other research has pointed to the importance of crops following rice in managing groundwater.

There has been good consolidation of the research on movement of water and salt at the regional scale. This research has considered both Murrumbidgee and Murray Valleys and considered impacts of climate, management and hydrogeology on movement and impact of salt. This research is vital to understanding the longer-term impact of irrigation and salinity management options.

Water quality is monitored closely by irrigation companies and managed by landholders. The CRC research on the dynamics and management of chemicals in floodwater will assist this process. Similarly, work on bioremediation of chemicals will enhance management options in threatening situations. This research is supported by work in other Programs on bioherbicides, genetic resistance to insects and allelopathy.

Managing rice production to minimise environmental impact and optimise resource use is the priority of Program 2 of the CRC. Soil nutrients must be managed to maintain soil health and ensure balanced nutrition for growth and grain quality. Imbalance can lead to problems such as acidification, physiological disorders such as straighthead and impacts on grain quality. Initiatives such as NIR testing for soil N supply and soil properties like sodicity can assist managers in their quest for efficiency and sound environmental management.

A disease risk study indicated that rice blast, a major worldwide rice disease could be a problem if introduced into the rice producing area. During the course of this study a minor disease, Aggregate sheath spot, was described for the first time.

Rice is an important model cereal in this new era of genetics and plant breeding. This CRC has a small program that capitalises on this new science. Most research is aimed at cold tolerance but there is also research on insect tolerance and grain quality.

The CRC program on rice quality has assisted to better define rice starch structure and functional properties. This initiative has already had an impact on breeding programs and will pave the way for new product development.

The cold tolerance program is a genuine example of cooperative endeavour. Research has demonstrated the importance of cold for Australian rice production, with yield affected by an average 0.7 tonnes/ha each year. Sources of tolerance have been identified and selection techniques suggested that could eliminate this reduction when incorporated into the breeding program. This research has been supported by some excellent studies on the effect of cold at the plant, cell, protein and gene level. This research aims to lead to substantial cold tolerance to increase the options for Australian rice production.

Improvements to the evaluation of rice quality at receipt have been matched by a better understanding of both the drying and the milling processes. Development of new products and definition of flour properties have matched this.

One of the most exciting components of the CRC has been the development of education programs. Further development of undergraduate and vocational programs has extended the reach of training and development of human capital. The postgraduate students add a mix of youth, skill and enthusiasm to the CRC. This not only adds to the research and education program but will provide a sound, trained resource to underpin the industry's future.

## CRC Management

The leaders of each Program have continued to shoulder great responsibility and to share the load of guiding the CRC. They have worked tirelessly to ensure that the program remains on course and the objectives for collaboration, excellence and researcher needs are balanced. Their work has been complemented by the Management Committee to ensure the overall integrity of the program.

The Centre Visitor, Mr Jim Miller, has continued to provide us with timely and well directed advice. Jim has always been available when required.

The administrative team of Mr Gordon Hart and Ms Julie Symes has again provided excellent service to the CRC. They have once again ensured effective administration and accountability while maintaining a sense of humour. The appointment of Mr Michael Cook as Communications Officer has added a new dimension to the CRC. He has performed a very important role in publicising the work and coordinating the public face of the CRC.

I am particularly grateful for the input of Dr Ian Davidge as Chairman of the CRC. His contribution is both as Chairman and supporter and we of the Rice CRC family recognise him as the "father" of our organisation. I am also grateful to Mr John Herbert for taking on the role of acting Chairman for those periods when Ian has been unwell during the year.

It has been an exciting year for the Rice CRC. This is due to the people involved. They have ensured a program that is successful and one that epitomises the aspirations of the CRC movement - excellence, collaboration, commitment to industry and continuous improvement.

A handwritten signature in black ink, appearing to read "R. G. Hart".

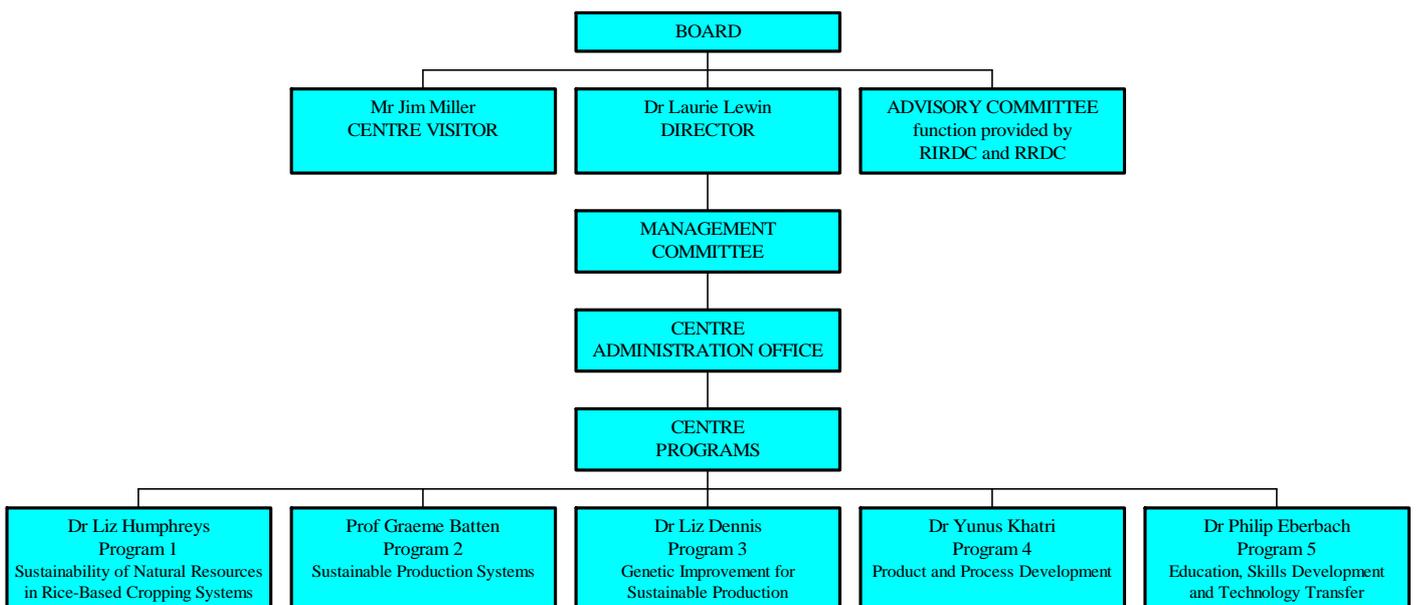
## DESCRIPTION OF STRUCTURE AND MANAGEMENT

The Cooperative Research Centre for Sustainable Rice Production is an unincorporated joint venture established in 1997 by an Agreement between the Centre parties:-

Charles Sturt University  
 The University of Sydney  
 CSIRO  
 NSW Agriculture  
 NSW Department of Land and Water Conservation  
 Rural Industries Research and Development Corporation  
 Ricegrowers' Co-operative Limited

and an Agreement with the Commonwealth of Australia.

The organisational structure of the Centre is outlined below. The management structure consists of the Board and the Director. The Board and Director are advised by Committees and supported by an administration office dealing with administrative and financial activities. The Board is responsible for the strategic direction of the Centre and for ensuring Centre management. The Director is responsible for day-to-day operations of the Rice CRC. He is assisted by a Management Committee, which includes key staff, and Program Leaders. The Rice Research and Development Committee of RIRDC is an advisory committee to the Rice CRC. The Centre Agent is NSW Agriculture and it provides financial and research program/project service and support for the Centre. The Centre's administrative office is located at the Yanco Agricultural Institute (NSW Agriculture).



## THE BOARD

The Centre is governed by a Board of Directors comprised of an independent chairperson, a high level nominee of each of the participating core partners and two persons to represent the interests of the Centre Associates and the Riverina community.

The Board meets a minimum of four times a year, usually two weeks after a Committee meeting so any issues requiring consent of the Board can be dealt with promptly.

The Board has the following functions and powers.

1. To establish policies for the Centre which cover research, education, training, intellectual property, commercialisation, planning, staffing, finance, accounting, reporting and such other matters as the Board considers necessary for the conduct of the business of the Centre, and its accountability to the Commonwealth and the participants pursuant to the Commonwealth and Centre Agreements.
2. To approve the activities of the Centre annually and the subsequent Annual Budget as described in Schedules 1 and 4 of the Commonwealth Agreement.
3. To monitor, measure and approve the performance indicators for the Centre.
4. To appoint, oversee and review the performance of the Director.
5. To take account of the relevant policies of each of the parties when considering any matter.
6. To authorise others to act on behalf of the Board and of the Centre.
7. To review the parties' contributions and seek to amend the Schedules of the Commonwealth Agreement provided that affected parties shall have agreed to any change in or any change to their intellectual property arrangements. Such changes will require the approval of the Commonwealth.
8. To consider and, if appropriate, approve new Programs recommended by the Management Committee. Such new Programs will also require approval by the Commonwealth and appropriate changes to the Schedules of the Commonwealth Agreement.

### **Board membership for 2000/2001**

Dr Ian Davidge, AO	Chair
Dr Laurie Lewin	Director, Rice CRC
Prof Kath Bowmer [to December 2000]	Charles Sturt University
Prof Paul Burnett [from March 2001]	Charles Sturt University
<i>Alternative:</i> Prof Jim Pratley	Charles Sturt University
Prof Don Napper	The University of Sydney
<i>Alternative:</i> Prof Don Marshall	The University of Sydney
Dr Graham Harris [to March 2001]	CSIRO Land and Water
Prof Kath Bowmer [from March 2001]	CSIRO Land and Water
<i>Alternative:</i> Dr Jim Peacock	CSIRO Plant Industry
Ms Helen Scott-Orr	NSW Agriculture
<i>Alternative:</i> Mr Martin May	NSW Agriculture
Mr Geoff Fishburn	NSW Department of Land and Water Conservation
<i>Alternative:</i> Mr Adrian Thompson	NSW Department of Land and Water Conservation
Dr Keith Hutton	Ricegrowers' Co-operative Ltd
<i>Alternative:</i> Mr Bob Jones [from September 2000]	Ricegrowers' Co-operative Ltd
Mr Jim Kennedy	Prime Minister's Supermarket to Asia Council
Mr John Herbert	Rural Industries Research and Development Corporation (RIRDC)
<i>Alternative:</i> Mr Peter Core	Rural Industries Research and Development Corporation
Mr Peter Draper	Rice Research and Development Committee (RRDC)
Ms Sulari Goonetilleke [from December 2000]	Independent (representing the broader community interest)

## MANAGEMENT COMMITTEE

The Management Committee is comprised of the Director, the Program Leaders, the Executive Officer and representatives of the parties, not otherwise represented.

The Management Committee assists the Director in attaining the objectives of the Centre through the implementation of the policies of the Board in relation to research, education and training, technology transfer, publication of research outcomes, finance and staffing.

The Committee coordinates the Centre's activities and prepares new programs and policies for consideration by the Board.

The Committee meets a minimum of four times a year, usually two weeks before the next Board meeting so that any issues requiring consent of the Board can be dealt with promptly.

### *Management Committee membership for 2000/2001:*

Dr Laurie Lewin	Chairman
Mr Gordon Hart	Executive Officer, Rice CRC
Dr Liz Humphreys	CSIRO Land and Water [Program 1 Leader]
Dr Liz Dennis	CSIRO Plant Industry [Program 3 Leader]
Dr Yunus Khatri	Ricegrowers' Co-operative Limited [Program 4 Leader]
Dr Philip Eberbach	Charles Sturt University [Program 5 Leader]
Dr Bruce Sutton	The University of Sydney
Mr Ary Van der Lely	NSW Department of Land and Water Conservation
Dr Jeff Davis	Rural Industries Research and Development Corporation
Prof Graeme Batten	Charles Sturt University [Program 2 Leader]
Mr Warwick Clampett	NSW Agriculture
	[from December 2000 following Prof Batten's resignation from NSW Agriculture]
Dr Ian Davidge	Chairman, Rice CRC Board

## **ADVISORY COMMITTEE**

The advisory committee is the Rice Research and Development Committee (RRDC) of the Rural Industries Research and Development Corporation (RIRDC).

As the advisory committee to the Centre, the RIRDC Rice Research and Development Committee assists in providing broader input to the policies, planning and Programs of the Centre and to ensure coordination of research projects and functions.

Interaction between RRDC and the Rice CRC has been facilitated by cross-representation on the Board, Management Committee and the Rice Research and Development Committee. Details of Rice CRC Programs are conveyed to RRDC members through the annual Rice CRC Symposium and regular newsletters. This was not found to be sufficient, however, and members of RRDC have been allocated to liaise with the five Rice CRC Programs (as shown below). These are all rice grower members of RRDC.

Program 1 - Sustainability of Natural Resources  
Mr Noel Graham, Mr Leigh Vial

Program 2 - Sustainability of Production Systems  
Mr Peter Sheppard, Mr Russell Ford

Program 3 - Genetic Improvement for Sustainable Production  
Mr Randall Williams, Mr Ian Mason

Program 4 - Product and Process Development  
Mr Daryl Gibbs, Mr John Hemley

Program 5 - Education, Skills Development and Technology Transfer  
Mr Peter O'Connor, Mr Stuart Nixon

## **CENTRE VISITOR**

The Rice CRC's Visitor is Mr Jim Miller. He is appointed by the CRC Secretariat to liaise with and assist in monitoring the CRCs he has been allocated. He acts as an independent adviser and helps establish constructive links between the Secretariat and the CRCs.

## **CENTRE PROGRAMS**

The research Programs are broken into five main areas, these are :-

1. Sustainability of Natural Resources in Rice-Based Cropping Systems.
2. Sustainable Production Systems.
3. Genetic Improvement for Sustainable Production.
4. Product and Process Development.
5. Education, Skills Development and Technology Transfer.

Each Program has a leader to direct and monitor the research activities. The Programs are further divided into Sub-Programs, which also have a nominated leader. Beneath each Sub-Program are the research projects which all have a Project Leader who is the principal researcher.

## **CENTRE COMMITMENT**

The Rice CRC is a distributed organisation with participants located with partner organisations throughout NSW, ACT and Queensland. It is always essential, therefore, to address the commitment of participants to the Centre.

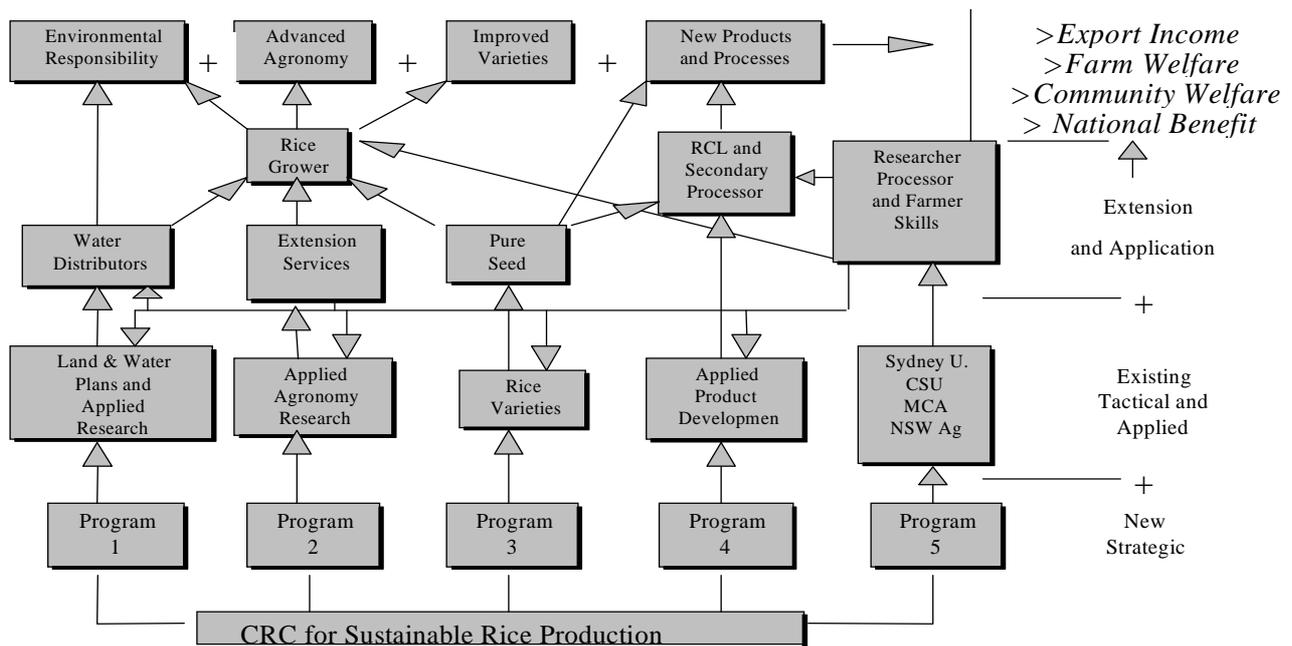
The Annual Symposium is a key component of this strategy. It always provides an ideal opportunity for building team spirit. Other initiatives such as the Rice CiRCle (newsletter) and smaller group workshops have all contributed to the development of a Rice CRC ethos.

## COOPERATIVE LINKAGES

The Rice CRC sits within an existing network of research, development and service structures impacting on rice production and resource use in the southern irrigation areas. These groups include research, extension and education service providers, regulatory authorities, irrigation suppliers, community groups such as Land and Water Management Plan groups and industry organisations. There have also been active links with international organisations at various levels.

The role of the Rice CRC is to establish new links or to enhance those that have not been strong in the past.

Strong links are important to ensure cooperation across all levels from natural resource use to marketing of end-product. The Rice CRC does not operate in isolation from either more applied research and development activities or the day-to-day operations of the industry. It is linked to the existing community and industry infrastructure in a way that aims to ensure a seamless two-way exchange between the theoretical and the practical application of technology (Figure 1).



**Figure 1**

Cooperative links have been fostered internally and with outside organisations within Australia and internationally. These are summarised in the table of cooperative linkages. The table highlights the extensive linkages that have developed in the Rice CRC and these have been enhanced or extended in many projects during the year. Three specific examples illustrate the type of linkages that have developed for specific projects.

Extensive links have been developed with many organisations through Project 1105 (Remote sensing of irrigated crop types and its application to regional water balance estimation). These include CSIRO Land & Water, NSW Agriculture, CSIRO Plant Industry, Charles Sturt University, Coleambally Irrigation Cooperative Limited and Murray Irrigation Limited. The project was enhanced by close ties with the CSIRO Earth Observation Centre and international links with scientists and engineers from TRW (a United States company contracted by NASA to build the first satellite-based hyperspectral instrument called Hyperion) and scientists from the Department of Geography, University of Maryland. During the 2000/2001 growing season, these collaborations have meant that over 10 hyperspectral satellite images have been acquired for a focus area in the Coleambally Irrigation Area (CIA) in NSW. Such data are not available commercially and CIA is seen by NASA and TRW as the main agricultural time series validation site in the world for the sensor Hyperion.

Strong linkages between NSW Agriculture, Charles Sturt University and The University of Sydney have been enhanced in Sub-Program 2.3 (Mineral nutrition and grain quality). These were extended by developing links with the University of Adelaide and the International Rice Research Institute. Links with the United States Department of Agriculture (USDA) ARS Plant, Soil and Nutrition Laboratory, Cornell University, New York were strengthened with the visit of Prof Ross Welch. Prof Welch was invited as the external reviewer for the nutrition - quality and production projects in CRC Sub-Program 2.3. Prof Welch also visited CRC scientists at The University of Sydney, Canberra, Yanco and Griffith.

The problem being investigated in Project 3402 (Understanding amylose structure: what it controls and what controls it) will benefit from using facilities and expertise located at Sydney University with Prof Bob Gilbert, in Canberra with Dr Matthew Morell (CSIRO Plant Industry) in the Wheat CRC, and with Dr Bill Park at the Texas A & M University in Texas and Dr Christine Bergman, USDA, Beaumont, USA. Ms Geraldine Tinkler, from RMIT University in Victoria, has recently completed her honours thesis looking at the solubility of amylose and the molecular weight of amylose that leaches from starch granules during cooking.

### ***Rice CRC Symposium***

The annual Rice CRC Symposium was held at Yanco on 7 & 8 February, 2001. It was attended by the majority of Rice CRC staff and was an excellent opportunity to reinforce cooperative links, to publicise the work of the CRC, to continue team building and to inform the Rice CRC staff about CRC and industry issues.

The Symposium also featured presentations by Dr Liz Dennis (CSIRO Plant Industry) on “genomics and gene technology”; Prof Peter Cullen (CRC for Freshwater Ecology) on “technology transfer, communication and knowledge brokering in relation to environmental and water management issues”; and Mr Matt Linnegar (Ricegrowers’ Association of Australia) on “Rice industry environmental policy”.

## ***Newsletters***

Rice CRC members are invited to contribute to our internal newsletter, the Rice CiRCle, which is distributed to all participants. Four newsletters were distributed in the last financial year. A revised version of this newsletter, the Rice CRC Update, is also circulated to all rice growers to keep them abreast of developments within the CRC and its research.

## ***International Projects***

Project 1205 (Quantifying and maximising the benefits of crops after rice) is also the Australian component of ACIAR Project no. 9432 (Nutrient and irrigation management for sustainable rice-wheat cropping systems in Bangladesh and Australia). Other partners in this project are The University of Melbourne (c/- Prof. David Connor, project leader), the Bangladesh Rice Research Institute (c/- Dr Panaullah) and the Bangladesh Agricultural Research Institute (c/- Dr Razzaque).

## ***Visiting Scientists***

Visitors included:-

Dr Jay Pearlman, from TRW, visited CIA in late February and was involved in the site characterisation for the LANDSAT and Hyperion overpass for 19 February, 2001 in regard to Project 1105. Dr Shunlin Liang and Monisha Kaul, both from the Department of Geography, University of Maryland and the US Department of Agriculture, were at the Coleambally Irrigation Area (CIA) in NSW to take ground measurements as the CIA was acquired by LANDSAT and Hyperion on both the 3rd and 10th February 2001.

The Rice CRC sponsored a one-week visit by Dr T.P. Tuong, soil water management scientist from the International Rice Research Institute, who was accompanied by Dr Bas Bouman, crop modeller at IRRI. The purpose of the visit was to exchange information and continue the development of the ACIAR project proposal "Growing more rice with less water: increasing water productivity in rice-based cropping systems". This visit related to work being undertaken in Project 1205.

## ***Overseas Visits by CRC Staff***

Dr Melissa Fitzgerald travelled to the United States to learn to use the amylose microsatellite marker and to develop collaborative linkages with the Rice Cereal Chemist, Dr Christine Bergman at the USDA, Beaumont. This was an extremely profitable trip, and resulted in the successful implementation of the marker into the NSW rice improvement program. The CRC has initiated a collaborative venture to use the techniques developed in this project to measure the amylose structure of the rices in Dr Bergman's collection of useful varieties.

The following table identifies linkages established within Rice CRC projects.

<b>Project No.</b>	<b>Chief Investigators</b>	<b>Linkages</b>
1102	NSW Agriculture	Murray Irrigation Limited Coleambally Irrigation Cooperative Limited Jemalong Irrigation Ltd NSW Department of Land and Water Conservation
1105	CSIRO Land and Water	NSW Agriculture Coleambally Irrigation Cooperative Limited Charles Sturt University CSIRO Plant Industry CSIRO Earth Observation Centre Murray Irrigation Limited University of Maryland, USA TRW, USA United States Department of Agriculture
1107	NSW Agriculture	CSIRO Land and Water LandPAC Pty Ltd Landholders Murray Irrigation Limited Sinclair Knight Merz consultants
1201	CSIRO Land and Water	Coleambally Irrigation Cooperative Limited NSW Agriculture Murrumbidgee Irrigation Limited Murray Irrigation Limited NSW Department of Land and Water Conservation Land & Water Resources Research & Development Corporation Department of Agricultural Economics, University of the Orange Free State, South Africa
1204	NSW Agriculture	CSIRO Land and Water Charles Sturt University
1205	CSIRO Land and Water	ACIAR Project 9432 University of Melbourne International Water Management Institute Bangladesh Rice Research Institute Bangladesh Agricultural Research Institute International Rice Research Institute, Philippines
1301/ 1302	CSIRO Land and Water	Charles Sturt University
1303	CSIRO Entomology	Charles Sturt University Cotton Research and Development Corporation Australian Cotton CRC Horticulture Australia Ltd Orica Australia Pty Ltd Prof Alan Devonshire, IACR-Rothamsted, England
1401(b)	Dept. of Land & Water Conservation University of Technology Sydney	CSIRO Land and Water NSW Agriculture

<b>Project No.</b>	<b>Chief Investigators</b>	<b>Linkages</b>
1403	CSIRO Land and Water	Murrumbidgee Irrigation Limited Murray Irrigation Limited Coleambally Irrigation Cooperative Limited Dept. of Land and Water Conservation ACIAR Project International Water Management Institute Land & Water Resources Research & Development Corporation
1403(a)	CSIRO Land and Water	Rice CRC Project 1403
2101	Charles Sturt University	CSIRO NSW Agriculture Incitec Fertilisers University of Western Australia
2102	Charles Sturt University	NSW Agriculture Incitec Fertilisers
2103	NSW Agriculture	Charles Sturt University
2106	NSW Agriculture	Charles Sturt University Rural Industries Research & Development Corporation
2201	NSW Agriculture	University of Queensland, linked to cold group Hokkaido University, Japan
2205	University of Queensland	NSW Agriculture, linked to cold group
2302	NSW Agriculture	The University of Sydney Adelaide University
2303	Ricegrowers' Co-operative Limited	NSW Agriculture, Charles Sturt University
2405	NSW Agriculture University of Melbourne	Charles Sturt University
2406	NSW Agriculture The University of Sydney	Charles Sturt University CSIRO Entomology
3101	NSW Agriculture	IRRI Philippines
3201/ 3204	CSIRO Plant Industry	Dr Deep Saini (Montreal), linked to cold group
3202	The University of Sydney	NSW Agriculture CSIRO Plant Industry (linked to cold group) Institut de Biologie Moleculaire des Plantes, Centre National de la Recherche Scientifique, Strasbourg, France Unilever Research Laboratories, Netherlands
3203	CSIRO Entomology CSIRO Plant Industry	NSW Agriculture
3205	Charles Sturt University	NSW Agriculture
3206	Australian National University	NSW Agriculture
3207	Australian National University	NSW Agriculture
3208	CSIRO Plant Industry	NSW Agriculture
3209	CSIRO Plant Industry	Charles Sturt University
3301/ 3303	The University of Sydney	NSW Agriculture IRRI, Philippines

<b>Project No.</b>	<b>Chief Investigators</b>	<b>Linkages</b>
3402	NSW Agriculture	Charles Sturt University Ricegrowers' Co-operative Ltd University of Sydney CSIRO Plant Industry/Wheat CRC Texas A&M University, USA United States Department of Agriculture
3403	Charles Sturt University	NSW Agriculture CSIRO Plant Industry
4101	Ricegrowers' Co-operative Limited	Rice Research Australia Pty Ltd Grimson Transport Deniliquin Engineering Graincorp
4201	Ricegrowers' Co-operative Limited	CSIRO Stored Grains Research Laboratory
4301A	University of New South Wales	Ricegrowers' Co-operative Limited
4301A	University of New South Wales	Ricegrowers' Co-operative Limited
4303	Ricegrowers' Co-operative Limited	CSIRO Stored Grains Research Laboratory
4501	The University of Sydney Ricegrowers' Co-operative Limited	BRI Australia Limited
4504	Charles Sturt University	Ricegrowers' Co-operative Ltd Glasgow Caledonian University Leeton Citrus Juices Uncle Tobys R&D Centre, Rutherglen CSIRO Food Research, Sydney
5101	NSW Agriculture	CRC participants
5204	Charles Sturt University	CSIRO Land & Water, NSW Agriculture, farmers
5301	NSW Agriculture	Links to education Ricegrowers' Co-operative Limited
5302	NSW Agriculture	CRC participants, Leeton Visitors' Centre
5401	Charles Sturt University	NSW Agriculture
5504	Charles Sturt University	School of Biomedical Sciences, Charles Sturt University
5505A	University of Sydney	NSW Agriculture
6201	NSW Agriculture	Murrumbidgee Irrigation Limited CSIRO Land and Water Charles Sturt University NSW Department of Land and Water Conservation Rural Industries Research & Development Corporation Ricegrowers' Co-operative Limited

See Part B