



Farmer-Driven Research, Development and Extension in the Grains, Sugar and Winegrape Industries

Participative evaluation of learning and impacts

Jane Fisher and Peter Carberry

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Researcher Contact Details

Jane Fisher
Rural Industries Research and Development
Corporation
Email : Jane.fisher@dpi.vic.gov.au

Peter Carberry
CSIRO Sustainable Ecosystems
PO Box
TOOWOOMBA QLD 4350
Phone: 07 4688 1200
Email: Peter.Carberry@csiro.au

In submitting this report, the researcher has agreed to RIRDC publishing this material in its edited form.

RIRDC Contact Details

Rural Industries Research and Development Corporation
Level 2, 15 National Circuit
BARTON ACT 2600
PO Box 4776
KINGSTON ACT 2604

Phone: 02 6271 4100
Fax: 02 6271 4199
Email: rirdc@rirdc.gov.au.
Web: <http://www.rirdc.gov.au>

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Foreword

Farmer-driven research has become an increasingly large investment for Research and Development Corporation in Australia since 1994. The pressure on government agencies and demand from farmers for research related to local issues has seen the emergence of well resourced farmer groups undertaking research in regional locations. Both the winegrape and grains industry have well developed regional infrastructure for undertaking research, and a similar trend has emerged in the sugar industry.

This report is targeted at those who fund, conduct and participate in farmer driven research.

It recommends that:

- Trials be scientifically reviewed before they are implemented, to ensure that farmer groups undertaking research implement well designed trials that are reported in industry publications, and in appropriate peer-reviewed journals when the science is original.
- A cross-industry discussion working group be established to maintain and improve the scientific, and social capacity building that was begun through this project.

The project also found that across industries:

- Working with industry champions who are effective networkers with good project management skills was the best way to carry farmer-driven research forward
- Research initiated by the funding body was less effective in local impacts than research initiated by the growers
- Facilitation support for groups was an effective way to carry the process forward more rapidly
- Development and implementation of formal monitoring and evaluation strategies was important in developing effective processes for the scientific, social and economic aspects of farmer-driven research and
- Coordinating work between groups was an effective mechanism for ensuring quality of processes and results, and in linking groups to one another, promoting discussion and facilitating monitoring and evaluation by groups.

This project was funded through the Cooperative Venture for Capacity Building in Rural Industries which is made up of the research and development corporations: Australian Wool Innovation; Cotton Research and Development Corporation; Dairy Australia; Grains Research and Development Corporation; Grape and Wine Research and Development Corporation; Horticulture Australia Limited; Land & Water Australia; Meat & Livestock Australia; Murray-Darling Basin Commission; Rural Industries Research and Development Corporation; Sugar Research and Development Corporation; and the Australian Government Department of Agriculture, Fisheries and Forestry.

This report is an addition to RIRDC's diverse range of over 1800 research publications which can be viewed and freely downloaded from our website www.rirdc.gov.au. Information on the CVCB is available online at <http://www.rirdc.gov.au/capacitybuilding/>.

Peter O'Brien
Managing Director

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The report is produced as a result of a project funded by the Cooperate Venture (CVCB) partners. The Cooperative Venture was established in 2001 by R&D corporations to enhance capacity building in rural industries in Australia. Its goal is to instigate and support learning by farmer and rural communities. Through research and development initiatives initiated by the CVCB, rural communities will be placed in a position to prosper and grow as Australian rural industry adapts successfully to global change. This is done by investing in R&D that focuses on: enhancing the understanding of learning, improving organisational arrangements to support rural human capacity building, and inspiring innovative farming practices

Abbreviations

AJAR	Australian Journal of Agricultural Research
AJEA	Australian Journal of Experimental Agriculture
BCG	Birchip Cropping Group
CFI	Conservation Farmers Inc
CRCV	Cooperative Research Centre for Viticulture
CSE	CSIRO Sustainable Ecosystems
CVCB	Cooperative Venture for Capacity Building
GRDC	Grains Research and Development Corporation
GWRDC	Grape and Wine Research and Development Corporation
OFR	On Farm Research
POFT	Participatory on farm trials
QDPIF	Queensland Department of Primary Industries and Fisheries
RDE	Research Development and Extension
SRDC	Sugar Research and Development Corporation
Vic DPI	Victorian Department of Primary Industries

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Executive Summary

What this report is about

Farmer-driven research has become an increasingly large investment for Research and Development Corporations (RDCs) in Australia since 1994. The pressure on government agencies and demand from farmers for research related to local issues has seen the emergence of well resourced farmer groups undertaking research in regional locations. Both the winegrape and grains industry have well developed regional infrastructure for undertaking research, and a similar trend has emerged in the sugar industry.

Who is the report targeted at?

This report is targeted at those who fund, conduct and participate in farmer-driven research.

Background

This inquiry concerning farmers undertaking or sponsoring research initially assumed two realities. The first was that the farmers' research perspectives are radically different to that of scientists; the second was that farmer-sponsored research, which is effective from their perspective, may suffer from lack of rigour due to failure to adhere to basic practical 'rules' that strongly influence veracity of outputs. The initial expectation of the participating researchers assumed there was the need for a research process that could produce practically meaningful and scientifically sound research findings. The initial project emphasis was to be centred on techniques aimed at avoiding errors in research design by drawing on the stock of research experience and principles that exist in the research community.

Objectives

The objectives of this project were to work with farmer groups in the grains, sugar and winegrape industries to enhance the design, implementation and evaluation of farmer-driven research in Australia.

Methods used

The framework used for this research project had three components: quantitative assessment of research trials in case study groups in the winegrape, grains and sugar industries; analysis of the institutional constraints on farmer-driven research based on the seven constraints proposed by Ashby (2003), and exploration of the applicability of the recommendations of Hassalls (2004) for stronger farming systems research in the grains industry to the winegrape and sugar industries.

The steps that were followed in the research were:

- (i) Explore the grey literature of each industry
- (ii) Establish a co-learning group with scientists, facilitators and farmers
- (iii) Work with industry representatives on research design
- (iv) Qualitatively evaluate the farmer-driven and on-farm research

Key Findings

The project critiqued and provided recommendations on research designs for farmer-sponsored trial activities in each of the three industries – these examples are reported in subsequent chapters. Whichever the industry, attention to trial design and assistance in analysis of results is clearly required in farmer-sponsored research. Processes for how this is being achieved varied from grower groups employing their own professional staff, to grower groups soliciting researcher collaboration in the trial operations, to industry RDCs funding explicit support services for trial design and analysis. All these approaches worked if rigour was acknowledged as a key criterion for successful on-farm research. Peer or professional review of trial results and reports was seen as the ingredient most often missing

from current efforts and a project recommendation is that reviewing of trial reports be studiously undertaken prior to their publication and distribution.

As the project progressed, the most important activity and acknowledged benefit was the sponsored establishment of a community of practice consisting of representatives of the sugar, winegrape and grains industries and the participating researchers from CSIRO and State Departments of Primary Industries. This community of practice was established and progressed via (i) annual project-sponsored workshops, (ii) cross-industry visits and meetings, and (iii) regular communications with research project staff. Such interactions provided opportunity for lively debate and learning from the experiences of influential participants from each industry. A performance indicator of success for this community of practice has been the ongoing relationship between the grains and sugar industries with project participants maintaining engagement beyond specific project activities.

The mutual learning within this community of practice approach is summarised the Sugar Research and Development Corporation (SRDC) Program Manager who participated in the project activities:

“SRDC have, as you know, learned a lot from your project. Without your project SRDC would not have learned as much from the past experiences of the grain & viticulture industries. The 2-day meeting earlier this year at the QBP to share experiences with individuals from grains, viticulture and sugar was an extremely valuable event. I have greatly valued our phone conversations re: this project, and your willingness to share information and ideas.

As a result of your project SRDC are increasingly aware of the importance of providing support for grower groups to delivering successful grower group projects. This project has also reinforced to SRDC the importance of communication and evaluation in grower group projects. The project also highlighted the challenges associated with achieving scientific rigor and relevant outputs/outcomes from industry-led research projects. The participative, consultative process you have implemented within this project has been excellent, and SRDC have greatly valued the opportunity to work with you and your team on this project.”

This work supported the results of Hassalls (2004) who found that

- Working with industry champions who are effective networkers with good project management skills was the best way to carry farmer-driven research forward.
- Research initiated by the funding body was less effective in local impacts than research initiated by the growers.

Recommendations

- Trials [designed by and for farmer groups] be reviewed by appropriate scientists before they are implemented, to ensure that the trials will answer the question/s being asked, and that the methods used are sufficiently rigorous to withstand peer review.
- Research funded through farmer groups by research and development corporations be reported in industry publications, and in appropriate peer-reviewed journals.
- Industry publications reporting trials use a peer review process to ensure that trials are discussed in both a regional and temporal context, and that results from similar trials in different regions are compared and contrasted, enabling effective analysis of the broader applicability of the trials.
- Industries who provide funding to farmer groups for trials:
 - enable and encourage farmer groups to have access to appropriate discipline-based scientists
 - enable all participants (farmers, facilitators, scientists and farmers) in the research process to respect one another’s different world views, and to develop an appreciation of the social, scientific and economic capacity building that takes place through well designed and delivered farmer-driven research programs
 - train facilitators, scientists and farmers working with grower groups in group processes and

- develop and implement formal monitoring and evaluation strategies to ensure that effective processes for the scientific, social and economic aspects of farmer-driven research are used.
- Cross-industry discussion groups of farmers, facilitators and funders be supported to continue co-learning on how to improve the scientific and social capacity building processes that was begun through this project.

Chapter 1: Introduction

Since the 17th century and the Age of Reason, scientific investigation has been dominated by ‘positivism’ or ‘rationalism’ (Pretty, 1995). Positivist science assumes the existence of an objective, value-free external reality, driven by immutable and universal laws. Scientists seek to investigate and discover the true nature of this reality, the ultimate aim being to discover, predict and control natural phenomena. As a result, knowledge derived from science is equated with ‘truth’ and is perceived as superior to other forms of knowledge. Technology is considered to be value-free and culturally neutral.

Constructivism offers a different perspective. Constructivist science, which emerged from the Frankfurt school of philosophy in the 1960’s, is based on the perception that there is no objective external reality (Berger & Luckmann, 1967; Watzlawick, 1976; Maturana & Varela, 1979; Glaserfeld, 1987). Instead, members of separate groups develop a sense of reality through communication and cultural processes based on concepts, beliefs, theory and practice. Technologies have a value system attached to them, are culturally significant, and don’t move easily between organizations and cultures.

The underlying research paradigm influences both the roles that different actors (farmer, scientists and facilitators) choose to perform, and the approaches used in an innovation process (Hagmann, 1999, Probst et al., 2000). An appreciation of the philosophical approach that underlies research is crucial to understanding the move by funding bodies from funding research undertaken by scientists for the benefit of farmers, to funding farmers to undertake their own research.

The situation of farmers conducting trials on their own farms is not a new phenomenon, whether they are using simple fertilizer strips or exploring more complex issues. Meat & Livestock Australia (MLA), since 1993, has been sponsoring graziers in conducting their own research through an industry-funded Producer Initiated Research and Development program (www.mla.com.au) and the Grains Research and Development Corporation (GRDC) have sponsored grower groups to undertake research projects (www.grdc.com.au/growers/growergroups.htm). Therefore, in the Australian dryland farming areas, there has been an emergence of pro-active, coordinated groups with explicit aims of undertaking organised research into their farming systems – the Birchip Cropping Group (BCG) is a well-known example (www.bcg.org.au).

A common rationale for initiating these research-focused farmer groups was both the desire to have locally-relevant research activities as well as some sentiment that such localities were “*in a bit of a no-man’s-land*” for publicly-funded RD&E effort (Carberry, 2001). More recently, a more ambitious goal has emerged, with a stated belief that “*leading edge growers will become the deliverers of research information and the marketers of regional innovation*”. Such groups are now employing agricultural graduates, developing research infrastructure such as long-term trial sites and laboratories, gaining sponsorship from agribusiness and Rural Industry Research Funders and are producing their own trial result and extension publications.

It is difficult to critique the growing efforts of “farmer-driven research” in Australian agricultural systems given a lack of formal documentation. It is particularly difficult in trying to judge whether such research has become simply a substitute for the RD&E efforts that have traditionally been controlled by agricultural science professionals in public agencies. Part of the difficulty is in the differing perspectives on what comprises research and how it should be judged.

Research is a systematic process of inquiry and of learning (Gazaiano and Raulin, 1993). The term “research and development” (R&D) is used to describe “creative work undertaken on a systematic basis to increase the stock of knowledge, including knowledge of man, culture and society and the use of this knowledge to devise new applications” (Hall, 1994; Industry Commission, 1995). Collinson (2000) defines farming systems research (FSR) and its use as “a diagnostic process as a basket of

methods for researchers to elicit a better understanding of farm households, family decisions and decision-making processes. The objective of using this definition is to increase the efficiency with which human and economic capitals are used for agricultural development including research, extension and policy formulation”.

“Participatory research” refers to a process of interaction between local and external actors to ‘co-create’ innovations. Biggs (1989) and Probst (2000) described four different types of participation according to varying degrees of involvement in and control over decision-making in the process. The typology of participation was contractual science, consultative science, collaborative science and collegiate science.

- Contractual research: Conventional or contractual participation (no farmer participation) ‘scientists’ make the decisions alone without organized communication with farmers.
- Consultative research: Scientists make the decisions alone but with organized communication with farmers. Scientists know about farmers’ opinions, preferences and priorities through systematic one-way communication with them. Scientists may or may not factor this information into their decisions. Decisions are not made with farmers, nor delegated to them.
- Collaborative research: Decision making is shared between farmers and scientists based on organized communication between the two parties. Scientists and farmers know about each others ideas, hypotheses and priorities for the research through organized two-way communication. Experimental or management decisions are made jointly, neither scientists nor farmers making them on their own. Neither party has the right to revoke or override the joint decision.
- Collegiate research: Farmers make management decisions collectively, either in a group process or through individual farmers who have organized communication with scientists. Farmers know about scientists’ priorities and research / management hypotheses through organized one-way communication. The farmers may or may not let this information influence their experimental or management decisions.

This typology describes a continuum from where scientists work on their own, through to farmers working with scientists to improve their capacity to make business decisions.

Petheram and Clark (1998) reviewed farming systems research in Australia and observed that there was little uniformity in approaches between groups undertaking systems research, development and extension (RDE) and little evidence of reference to past learnings and experiences in systems research. They provided strong argument for participatory research approaches as the appropriate methodology for such research efforts. Similarly, RIRDC collated 33 case examples of tools used in participatory RDE in Australia (Petheram, 2000) and suggested that little information on participatory tools and farmer learning processes had formally been reported in Australia.

While “farmer-driven research” efforts are likely to be highly relevant, Carberry (2001) argues that they also need to be reviewed, not just in terms of participant satisfaction but also in the broader light of the credibility of research results. Professional review constitutes an attribute of quality control along with attributes such as usefulness and equity. Carberry (2001) in his review of the 1999-2000 Shared Solutions Manual made a number of observations regarding their reported activities:

- Many of the trials appeared little different to traditional research trials, employing small replicated plots suited to using Analysis of Variance to determine treatment differences.
- A high proportion of trials addressed simple technologies, such as herbicide application strategies at rates different to those recommended by agri-chemical companies.
- There was generally little attempt to interpret results beyond the site and season experienced in the trial under study. A number of trials were repeated over several sites and seasons, yet interpretation of results in this context was limited both by the trial designs and analysis tools.
- Unexpected results from trials were found difficult to interpret. Such difficulties were compounded by limitations in data collection methodologies and design.

- Speculation about results and their consequence was common, with many conclusions made on results from single trials influenced by the site and season experienced.
- What quality checking was undertaken of the published results and interpretations is unknown.

While such a critique was cursory, without substantial review of procedures and results beyond that reported in the Shared Solutions Manual, it is based on the information, recommendations and conclusions as were distributed to 14,000 grain growers in Australia.

In 2004, Hassall and Associates were contracted by GRDC to review farming systems research funded by GRDC. The research found that the critical factors to project success were the people driving the process, their drive, enthusiasm and energy, their project management skills, and the regional networks within which they operated.

The five recommendations from that review relevant to this project were:

- To develop and implement a formal monitoring and evaluation strategy that should consider the farmer-level indicators of triple bottom line performance.
- To develop and implement an overarching coordination project, to ensure quality of processes and results, provide links to relevant regional organisations, provide links between groups and projects, coordinate publications and raise greater awareness in the wider industry, and facilitate monitoring and evaluation by groups. It was seen as important that someone be responsible for understanding the GRDC funding system keeping abreast of changes in direction and staff movements within groups.
- To direct investment to where the three critical success factors were found to be operating: namely, the people involved (champions and owners with vision, inspiration, creativity and drive), networks apparent in the region and the quality of the project management (formal planning and priority-setting processes, allocation of roles and responsibilities, etc).
- That as a general principle, groups should not be started by the funding body (GRDC), as these success factors are likely to be missing. The agency-driven approach is valid as long as it has its equivalent champions, attracts senior management support and attempts a genuine partnership with growers.
- To invest in capacity-building processes, such as providing facilitation support to groups. The involvement of private and public agronomists should also be encouraged, as this can influence wider industry engagement with the findings.

As far as practical, the relevance of these recommendations will be explored for the sugar and winegrape industry, as well as the grains industry.

Petheram (pers. comm.) is of the view that international thinking on FSR was important in informing the decisions by RDC's to fund farmer groups to undertake their own research. Pertinent points about farmer-driven research from a participatory perspective are made by a cohort of international researchers. Ashby (2003) lists seven problems encountered with participatory research that are rooted in organizational behaviour rather than in the choice of methods or types of participation. They are:

1. Lack of representation of key stakeholders in the research process.
2. Participation is not developed around clearly specified rights, roles and responsibilities.
3. Mechanisms of accountability among participants are lacking, especially accountability of researchers.
4. The process is corrupted by hidden agendas.
5. Conflicts of interest are not made explicit or negotiated.
6. Transaction costs of participation exceed the benefits to the participants.
7. Feedback mechanisms, such as monitoring and evaluation of the research process are not in place so that learning about how to improve the process is minimal or slow.

The applicability of these organisational behavioural problems will also be explored for each of the three industries in this research project.

During the mid to late 1980s, some significant methodological and institutional innovations were introduced with the implementation of the farming systems approach with a whole farm focus. The development of participatory rural appraisal (PRA) techniques provided a way of responding to three concerns: farmer interpretation of production situations, intra-household relationships and gender issues in FSR, and development of more appropriate methods to analyse results from on-farm research (Ashby, 2003). Only the first of these, farmer interpretation of production situations was considered in this project, although gender issues and statistical analysis of farmer-driven research would be useful to investigate in more detail.

Biggs (1989) found that PRA enabled exploration of how farmers interpreted their production situations; how this influenced the way they articulated their constraints and needs to researchers; and the desire for farmers to contribute more directly and creatively to the design and evaluation of new technologies. PRA techniques improved the potential usefulness of farmers' participation not only from the farmers' but also from the researchers' perspective by improving systematization of farmers' knowledge and opinions. PRA enabled researchers to move from working relationships with farmers that were contractual or at best consultative to those that were more consultative and collaborative.

The Cooperative Venture for Capacity Building and Innovation in Rural Industries (CVCB) funded this project to undertake a study of 'Participative evaluation of learning and impacts from farmer-driven research, development and extension. The objective of the project was to work with pro-active farmer groups to enhance the design, implementation and evaluation of farmer-driven research, development and extension (RDE). This report describes three different approaches to farmer-driven research in the Australian grains, sugar and wine-grape industries. These approaches were initiated by different actors, and used different collaborative paradigms. We describe the models of farmer-driven research used in each industry, the science, and give an analysis of the different collaborative, scientific arrangements, using evaluative inquiry and action learning methodologies. A total of four different groups of farmers from three industries (grain, sugar and wine-grape) were invited to participate in the project.

The framework used for this research project had three components: quantitative assessment of research trials in case study groups in the winegrape, grains and sugar industries; analysis of the institutional constraints on farmer-driven research based on the seven constraints observed by Ashby (2003), and exploration of the applicability of the recommendations of Hassalls (2004) for stronger farming systems research in the grains industry to the winegrape and sugar industries.

Chapter 2: Methods

This project was conducted with three different Australian industries: the grains industry, the sugar industry and the winegrape industry. The farmer groups involved were the Birchip Cropping Group (a grains industry group based in the Victorian Wimmera-Mallee), Conservation Farmers Inc (a grains group based in the northern grain belt of NSW and Queensland), the HCL Harvesting Group (a sugar industry group based in the Burdekin delta in coastal north Queensland) and grape growers of the Griffith Winegrape Marketing Board. The groups were chosen to participate through previous association with the researchers (BCG, CFI and HCL), or at the suggestion of the industry (Griffith winegrape growers).

The framework used for this research project had three components: quantitative assessment of research trials in case study groups in the winegrape, grains and sugar industries; analysis of the institutional constraints on farmer-driven research based on the seven constraints proposed by Ashby (2003), and exploration of the applicability of the recommendations of Hassall and Associates (2004) for stronger farming systems research in the grains industry to the winegrape and sugar industries.

The steps that were followed in the research were:

1. Explore the grey literature of each industry
2. Establish a co-learning group with scientists, facilitators and farmers
3. Work with industry representatives on research design
4. Qualitatively evaluate the farmer-driven and on-farm research

The rigour of farmer-driven science was established by reviewing examples of the published industry grey literature, and by reviewing the science of farmer-driven research using a panel of scientists to assess the proposed and existing trials. This traditional, positivist approach to peer reviewing science fed into a constructivist, participatory process of evaluative enquiry with a co-learning group.

An action research methodology was used to develop and implement new joint tests of innovations on appropriate research methods. The action learning framework used is described in "Fourth Generation Evaluation" by Guba and Lincoln (1989). Participant observation (Pretty et al., 1995) was used throughout the process, to derive from an understanding of the community's values, dynamics, internal relationships, structures and conflicts through their observed actions, rather than from their (normative) statements of what "is". We attempted immersion in the grower community to the extent permitted, in order to understand and document how things happened.

The participatory action research process used in the co-learning group facilitated reflective practice amongst the participants: the scientists, the farmers driving the research process, the facilitators / scientists undertaking the research, and the funders who enabled the research to take place.

An assessment of the rigour and relevance of farmer-driven and on farm research in the literature published by the Australian grains, winegrape and sugar industries was undertaken. The source material used was industry non-refereed or "grey" publications. Rigour was assessed against the criteria of identification of the research question, design, implementation and extension of the results. Relevance was assessed against grower participation in the trial development and implementation, and interest in the results from the research.

A co-learning group was established in September 2003 with one facilitator / participant from each of the farmer groups, three scientists from CSIRO Sustainable Ecosystems and one scientist from Queensland Department of Primary Industries. The co-learning group was convened at three workshops held in Queensland and Victoria between September 2003 and May 2005. The objectives of the co-learning group were to:

1. compare and contrast the processes used for identifying research questions, and designing trials
2. report on the results and adoption of trial recommendations within the communities serviced by each of the different grower groups.

The workshops were run as facilitated, semi-structured action learning processes. The group explored:

- the models of farmer-driven research used by the participating industries (Workshop 1)
- the rigour and reporting of farmer-driven research (Workshop 2)
- the expectations of and achievements from farmer-driven research (Workshop 3).

Co-learning resulted in a shared mental model (Cannon-Bowers et al., 1993; Klimoski et al., 1994; Mathieu et al., 2000) about farmer-driven and on farm research processes between the participants. In the three successive meetings, through dialogue, reflection, and questioning, the values, beliefs, assumptions of participants, their knowledge about field research and its relationship to good farming were identified and clarified. Relevant plans for joint action were formulated and where possible, implemented. Where possible, members of the co-learning group trialled the recommendations that were established through the process.

Trial designs for proposed and existing trials being run by or on behalf of the grower groups were available for critique in the winegrape and grains industries. These trials were assessed by scientific panels.

A semi-structured, qualitative interview process to evaluate farmer and facilitator attitudes to farmer-driven and on-farm research was undertaken with the winegrape, sugar and grains industries. A mix of one-to-one and video conferencing was used. The interviews were recorded, transcribed and analysed to identify themes in the data. The full interview protocol is given in Appendix 2. In summary, the questions asked of the farmers and farmer groups were:

- What research has the group undertaken?
- What was the motivation for the group undertaking research?
- What processes are the group using in designing the trial, in implementing the trial, in analysing the data and disseminating the research results?

Table 2.1: Assessment of institutional arrangements of participating groups (after Ashby, 2003)

	Birchip Cropping Group	Sugar industry	Winegrape
Were key stakeholders involved in the research process?	Yes	Mostly	Yes
Was participation developed around clearly specified rights, roles and responsibilities?	Yes		Mostly
Were there mechanisms of accountability among participants, particularly of researchers?	Yes	Usually good, could be improved	Usually good, could be improved
Was the process corrupted by hidden agendas?	No	No	No
Were conflicts of interest made explicit or negotiated?	N/A	N/A	N/A
Did transaction costs of participation exceed the benefits to the participants?	No	Occasionally	Yes, for some
Monitoring and evaluation in place	Yes	Not when this research was undertaken	Not when this research was undertaken

During the interviews and analysis, data were also collected to answer the following questions about institutional arrangements (Table 2.1):

- Were key stakeholders involved in the research process?
- Was participation developed around clearly specified rights, roles and responsibilities?
- Were there mechanisms of accountability among participants, particularly of researchers?
- Was the process corrupted by hidden agendas?
- Were conflicts of interest made explicit or negotiated?
- Did transaction costs of participation exceed the benefits to the participants?
- Were feedback mechanisms, such as monitoring and evaluation of the research process in place so that learning about how to improve the process is rapid and effective.

An analysis of these results and their implications for institutions undertaking and funding farmer driven research is given in Chapter 8.

Chapter 3: Farmer-driven RDE

3.1 Quantitative assessment of trials

A review of reported farmer-driven research was undertaken for each of the participating industries. Two methods of scoring the research were developed: the Rigour Score, and the Relevance Score.

The Rigour Score was based on a framework that worked through the steps used in designing, implementing and extending research used by peer reviewed journals like the Australian Journal of Agricultural Research and the Australian Journal of Experimental Agriculture. The four stages of experimental design used were identification of the research questions, experimental design, implementation of the experiment, analysis of the results, and extension of the results. Table 3.1 below shows the criteria that were used to evaluate rigour. There is a valid argument that the trials may not have been designed to appropriately answer the research question, however, it was beyond the scope of this review to assess that.

Table 3.1: Evaluation framework for assessing reported farmer-driven research for scientific rigour

Stage of experimental design	Assessment criteria	Score (0 or 1)
Identification of the research question	What is the rationale for the trial? What do we already know (review of literature)?	
Design	What is the plan for dealing with variation between sites and seasons? What is the role for replication and randomization? How will the trial be analysed?	
Implementation	What is the data collection protocol?	
Analysis and Interpretation of Results	Can the design deal with unexpected results? Is the influence of site and season accounted for? What role do statistics play? Will results depend on speculation? Does the data support conclusions? What check on rigour (e.g. peer review)?	
Extension	What is the main message?	
Rigour Score	Highest possible score	13

Table 3.2: Framework against which reported farmer-driven research was evaluated for relevance.

	Criteria	Score
What process was used to develop the trial? Were growers involved? How were they involved?	Was the trial developed using: Contractual processes Consultative processes Collaborative processes Collegial processes?	0 1 2 3
Level of interest shown in the trial by farmers?	How many growers came to field days? (of local population) 0 – 10 % 10 – 30% 30 – 50% 50 – 70% > 70%	1 2 3 4 5
	Did growers from outside the district visit the trial?	1
Implementation of research by local growers	Not been implemented Has been implemented	0 1
Relevance Score	Highest possible score	10

A relevance score was also developed, based on the process that was used to select the trial (were growers involved in choosing the trial, was the relationship contractual, consultative, collaborative or collegial), level of interest shown by growers in the results (how many growers came to field days, how many local growers asked questions about what was going on, level of interest from outside the district - eg bus trips visiting the trial site), and local implementation of the research (Table 2.1).

3.2 Grains

Grains-sponsored farmer-driven research published in the Grains Research and Development Corporation's (GRDC's) 2003 National Farm Groups' Manual, GRDC's 2004 National Farm Groups' Manual, the Southern Farming Systems 2003 Trial Results Manual and the Southern Farming Systems 2004 Trial Results Manual were reviewed against the rigour and relevance criteria. A total of 48 trials (of a possible 261) were reviewed. Trials for review were chosen systematically – one from each section of the GRIST manuals, and every fourth trial from the Southern Farming Systems Manuals. Trials reported in the grains industry literature reviewed for this project were mostly developed using consultative process (relevance score of 1), and field days held to view the trials were well attended according to industry reports. Most of the trials were reasonably well designed, and while improvement in rigour was noted in the recent grains publications, four issues raised by Carberry (2001) remained apparent. These were:

- reported trials where results did not support the conclusions drawn from the data;
- trials addressing similar issues making opposing recommendations without any editorial comment to explain the differences between sites and regions;
- lack of quantification of experimental error; and
- lack of base measurement of site characteristics.

Trial reporting in grains industry funded publications would be improved by developing and using protocols documenting the type of data to be collected and reported against, emphasising that experimental error needs to be supplied in the results, that baseline measurements need to be made and used in the reporting process. The industry funded publications would be improved by having editorial comment that discusses and explains why results for the same trial vary between regions. While the trials on similar topics may have been designed and implemented to answer specific, different research questions, it was not possible to make this assessment in a number of cases.

3.3 Viticulture

At the time of this investigation (2003-2005), the Cooperative Research Centre for Viticulture (CRCV) funded trials were being reported in Viticare News, available electronically from the CRCV website (www.crcv.com.au/viticare/newsletters), published monthly (2002-2003) or bi-monthly (2005). The 18 trial reports in 11 editions of Viticare News published in 2001 and 2002 were descriptive, giving a brief snapshot of the different trials undertaken by various groups. The interaction between scientists and grapegrowers was both contractual and collaborative. All trials were rigorously designed by scientists (contractual research), and chosen by various grower groups to meet a defined regional need for more information on a particular topic (collaborative research).

Two trial reports described the trial in sufficient detail for it to be repeated, and three trials presented the results with statistics. While the reporting from this source was, for the most part, insufficient to make an assessment of the rigour or relevance of the research, trial designs available to this investigation (Laukert et al, unpublished; and Robinson et al., unpublished) show that the trial designs used as part of the CRCV On Farm Research program were very rigorous.

The relevance of the work to growers' needs, as assessed by grower participation in field days at trial sites (reported in Viticare News, and by growers participating in the trials) varied regionally. Generally, grower participation (as a percentage of the growers in the district) at viticultural field days was not high.

Viticare News had a different function to the GRDC trial manuals. It was designed to keep growers and other stakeholders interested in the Viticare On Farm Research program abreast of new developments, while the GRDC trial manuals were specifically designed to report on research undertaken by Farming Systems Groups. The limitations of the reporting of the Viticare On Farm Trials program from a scientific perspective would be best addressed by having a separate, annual publication that reported on the trials.

3.4 Sugar

When this project began working with the sugar industry in 2003, funding for farmer-driven research was not available from SRDC, and there was no reporting of farmer-driven research in sugar industry publications. In 2005, the Sugar Research and Development Corporation (SRDC) made funding available for farmer-driven research through the Grower Group Innovation Program (GGI) (www.srdc.gov.au). The 28 research proposals from farmer groups submitted to SRDC in 2005 for the first round of Grower Group Innovation funding were reviewed against the rigour and relevance criteria listed in Table 3.1 (it was not possible to assess and discuss the results of the research funded in the first round of GGI funding because these trials were not implemented in the timeframe of this project). Figure 3.1 shows that there was a range in both the rigour and relevance of these proposed trials. All the proposed research was collaborative according to the Probst typology. The sugar trials discussed in Chapter 6 (Sugar Industry) were self-funded by growers with input from facilitators and scientists from CSR and CSIRO and were underway when this project began.

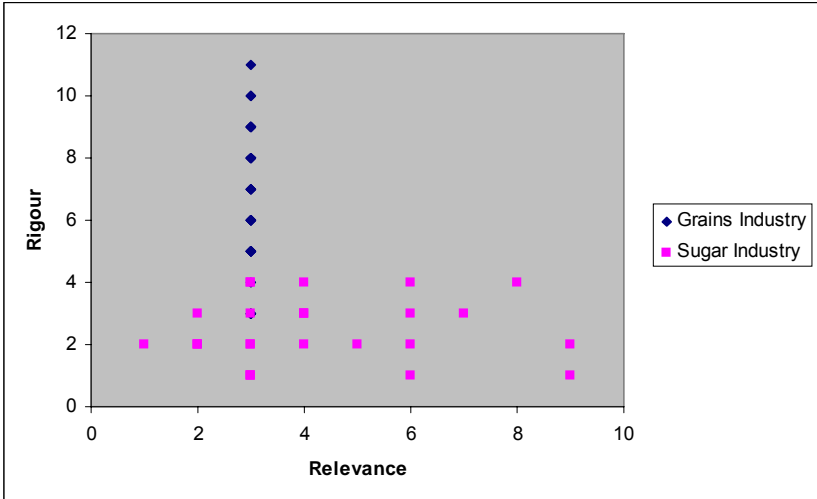


Figure 3.1 Rigour and relevance of farmer-driven research in the grains and sugar industry.

3.5 Discussion and Conclusions

The data for the rigour and relevance of farmer-driven research in the grain and sugar industries shown in Figure 3.1 demonstrated the variability in experimental design and industry relevance that farmer-driven research has given rise to in the industries. It also reflects the maturity of the industries with respect to processes and infrastructure available for farmer-driven research in the two industries. Farmer-driven research is more rigorous when undertaken in partnership with scientists, be they consultants, or employed by state agencies.

An assessment of the rigour and relevance of the research for the grains and winegrape industries is shown in Figure 3.2 according to the type of research partnership between the farmers and the scientists based on who designed the trial (farmer group or researcher) and who implemented the trial (farmer group or researcher).

. Three types of research are described according to rigour and relevance:

- i. researcher designed, researcher run
- ii. farmer group designed, farmer group run
- iii. researcher designed, farmer run.

In general, the grains research was seen by grain growers to be immediately relevant to their needs, while the wine-grape research was seen by winegrape growers as less immediately relevant. The assessment of the winegrape trial designs against the criteria listed in Table 3.1 showed that it was highly rigorous, while the grains research varied in rigour. These results reflected the way the research was conceived and conducted.

This assessment of research does not ascertain if the trials answered the question that was asked. While this view is valid, it was beyond the scope of this project to revisit the trials with the groups and researchers who undertook them to make that judgement.

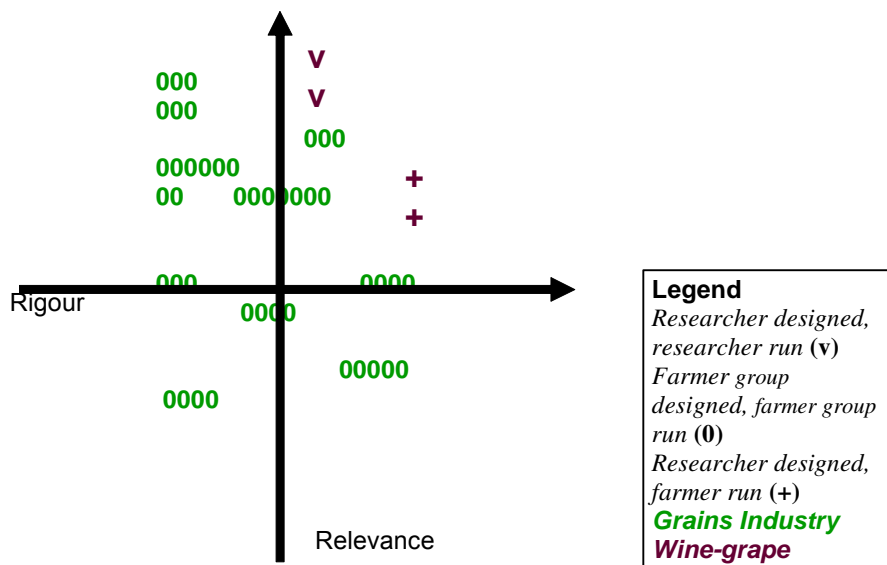


Figure 3.2: Schema illustrating the spread in rigour and relevance between the winegrape and grains industries.

Table 3.3 summarises the approaches to trial design used in the three industries. It shows that the grains industry used a bottom up approach – the farming systems groups were self-initiated and self-driven to both extend existing information to a new audience and to explore new research questions initiated by the group. Trial designs were generally rigorous, and the trial results were accessible through local group and GRDC reporting processes. The role of the processes used by the group in building social capacity were recognised and encouraged (Gartmann et al., 2003), and the farming/business capacity aspect of the research was also recognised. The group used both formative and summative evaluation, resulting in rapid and effective change to all aspects of the farmer-driven research, business development and social capacity building.

The winegrape industry used a top-down approach that focussed on extension of existing information, with existing grower groups becoming involved in trials that been developed by scientists independently of the growers. Unanswered research questions were directed to institutionally-based researchers. The trials were rigorously designed, but the results were not readily accessible at the time of this inquiry. The social capacity of the farmer-driven research was not given much emphasis in the process, and while farming and business capacity building was discussed, no indicators were in place to measure change within the life of this project. While the importance that evaluation could play in the program was recognised, limited resources meant that no formal formative or summative evaluation program was in place.

The sugar industry was in a state of transition. Grower groups and grower trials were initiated by the growers, and funding support became available from SRDC during the life of this project. The

emphasis of the trials funded by SRDC was on industry development, and on extension of existing knowledge. At the time the project was run, there were limited mechanisms in place for capturing unanswered research questions, reporting of trials had not been formally developed, and evaluation of the project was in place.

Table 3.3: Summary of approaches to trial design in the three industries

		Grains	Winegrape	Sugar
Who initiated the program (top down or bottom up)		Grower Group Bottom up	Research and Development corporation – top down	Grower Groups and RDC Both top down and bottom up
Purpose of the program		Extension of existing information, new Science	Extension of existing information	Industry development
Were mechanisms in place for capturing unanswered research questions?		Yes – answered by grower group research, and by institutionally based researchers	Yes – sent back to researchers	Not at the time this research was run
Were the following attributes included in the reporting?				
	Trial design – replicable?	Accessible in reporting	Sometimes accessible	Too soon to tell
	Trial Interpretation and Conclusions	Accessible in reporting	Sometimes accessible	Too soon to tell
Reporting Process	Data available in a format suitable for peer review (written report)	Reports were suitable for peer review	Reports are mostly, descriptive, data are not shown	Too soon to tell
Recognition of Social Capacity building		Recognised and encouraged	Not recognised	Recognised
Farming / Business Capacity		Spoken of, written about, indicators in place	Spoken of, no indicators in place	Spoken of, written about, indicators being developed.
Evaluation	Formative (ex ante)	Plan available	No plan available	Plan available
Evaluation	Summative (post-hoc)	Two external reviews completed	Being spoken of	Too soon to tell

Chapter 4: The Grains Industry

4.1 Introduction

At the 10th Australian Agronomy Conference, held in Hobart in January 2001, the plenary session entitled “Participatory Research Processes and Results” contained two contrasting papers: the first a farmer perspective on the merits of farmer-driven research (McClelland and Eyres, 2001) followed by a researcher perspective warning on the loss of rigour from the emerging phenomenon of grower research groups in Australia (Carberry, 2001). The Birchip Cropping Group (BCG) subsequently invited researchers from CSIRO Sustainable Ecosystems to visit Birchip to both view their existing operations and explore collaborative research opportunities. By 2006, BCG and CSIRO had collaborated on over 15 joint research projects, covering a wide range of topics from farming systems research, to climate change research, to biodiversity research to co-investment in an on-line commercial crop forecasting system – see www.bcg.org.au for details on BCG’s collaborative research portfolio. This transformation from competitors in the domain of limited RDE funds to collaborative research partners has provided mutual benefits: BCG gains access to high-level science expertise and tools while CSIRO benefits from closer alignment to industry needs and research grounded in real-world actions. Although yet to be rigorously quantified, the participants believe that this collaboration is leading to better outcomes from a limited RDE funding resource.

A similar, though less dramatic, experience led to collaboration between CSIRO Sustainable Ecosystems and Conservation Farmers Inc. (CFI). What started as a request to CSIRO to assist CFI in interpreting data from a problematic planter-evaluation and establishment trial has evolved into collaboration on projects. CFI usually forms consortia in which they concentrate on addressing extension and communication activities and subcontract data collection and analysis to organisations such as CSIRO.

This Chapter of the report provides background to both BCG and CFI as farmer-led organisations operating within the RDE spectrum, it reports on CVCB project interactions with both organisations and it reflects on this experience in terms of consequences and current collaborations.

This CVCB project played an influential role in facilitating the evolution of practices in all three organisations, BCG, CFI and CSIRO. Primarily, the project arranged an avenue for these organisations, alongside representatives from other industries, to reflect on current practices and design future activities. Concrete outcomes from project interactions include the invitations for Peter Carberry (CSIRO) to join the CFI Board (2003 -) in order to add a researcher perspective to CFI operations, and to be a member of the external panel to review the research practices of BCG (Nov 2004); participation in the latter activity was funded directly by this CVCB project.

4.2 Birchip Cropping Group (BCG)

The BCG describe themselves in the following way:

“The BCG (Birchip Cropping Group and Wimmera Farming Systems) is a farmer-driven agricultural organisation operating as a not-for-profit incorporated association, conducting applied research and extension on all the major crops grown in the region [the mallee and Wimmera regions located in north west Victoria]. The Group’s purpose has been redefined since its inception and aims to investigate the critical success factors that ensure sustainable and profitable crop production systems.

Improved viability of local rural communities, as stated in the BCG’s mission, is also a priority. All of the Group’s information is not only freely distributed, but also passionately promoted. A manual of trial results, distributed free to 6000 farmers in four states has been the BCG’s definitive publication.

The BCG has trial sites at several locations in the Mallee, Wimmera and North Central regions, covering all the major soil types and climate zones. The Group has 500 farm business members. These members direct the focus of all trial and extension activities through a Trials Subcommittee consisting of farmers, technical and industry representatives. Field days and information expos are consistently well attended, attracting in excess of 3500 visitors annually.

[BCG's] main aims [are]

- *to demonstrate and develop better farming practices and technology for the main soil types in the Wimmera and Mallee (primarily on the Culgoa, Hopetoun and Tyrell Land Systems)*
- *to transfer information and knowledge to farmers and the agricultural community with the aims of improving productivity, profit and long term viability*
- *to draw together farmers, industry and government department representatives in the one resource area so that they may combine and interact to solve common agricultural problems.”*
(www.bcg.org.au)

4.2.1 BCG Research review

At the time of its review (October 2004), the BCG had been carrying out research and extension activities for over ten years. Their strong belief was that in order to stay at the forefront of farmer-led research and extension new research and extension methods were needed. Thus the aims of the review were:

1. to undertake a review of the R & D efforts undertaken by the BCG
2. to ensure that the reviews are independent
3. to assess and evaluate the current research and extension as it is related directly to the research program
4. to provide direction to the BCG in how to improve current activities
5. to enable the BCG to take the next step in developing new research programs

The purpose of the research review was not to evaluate the whole of the extension program as carried out by the BCG but to focus on the research work, including how the results of the research are communicated to members and the general public.

The review panel consisted of Prof. Tim Reeves (Review Chair, ex-CIMMYT Director General, consultant), Allan Mayfield (SA agronomic consultant and GRDC panel member), Neil Smith (SA farmer and ex-GRDC panel member) and Peter Carberry (CSIRO Sustainable Ecosystems). Involvement of Peter Carberry was funded by this CVCB project.

The following section draws from the BCG review but it should not be taken as being fully representative of the review findings and recommendations. The use of this information in the context of this project report has been approved by the BCG.

Review comments

Of the organised grower groups around Australia, the reviewers believed BCG had the greatest capacity to undertake research and development activities and its annual RDE output was amongst the highest. The review concurred with submissions highlighting BCG's strong commitment to undertake high quality RDE and deliver benefits to their community and Australia. Relative to a nominated baseline (the 1999-2000 Shared Solutions Manual as critiqued by Carberry, 2001), the review recognised significant improvement in BCG publication of trial reports. In 2004, all reports followed a written guideline which asks for specific information on aims, background, methods, results, interpretation, commercial practice and summary. The review judged that BCG was amongst the best at reporting results of their trial program, and certainly was leading the way for other grower groups in Australia. Commissioning this review was seen as an excellent performance indicator of such leadership.

In reviewing BCG research efforts, the reviewers provided commentary against distinct stages within a typical research cycle:

Identifying and Prioritising research issues

The BCG used surveys to enable members to identify emergent issues and also established a BCG Research Advisory Committee, to come up with innovative ideas for research. Both approaches work well.

The BCG research portfolio consists mainly of large numbers of single issue trials run as small replicated plots at several field sites. Fewer more complex trials are also undertaken. It appears as if they are trying to do much with the available resources at any one time. Formalising the process for identifying and costing research issues remains a challenge.

Funding is a key issue for BCG. It is difficult to balance their own research initiatives against the requirement to seek funded projects where their efforts are levered by others (eg. GRDC). This key issue can only be dealt with by good leadership, strategic planning and budgeting and BCG appears well placed on each of these criteria. Also, as BCG has become better known, there are increasing invitations to partner other agencies in research initiatives.

Design of experimental program

One of the most difficult aspects of research is clearly defining a research question and an appropriate experimental procedure which will answer the specified question. The key steps in determining a research question are developing the rationale, reviewing what's already known, specifying the hypothesis to be tested and deciding on whether the question can be appropriately addressed with the resources and skills available. The BCG has reflected on this need and employs a range of trial concepts and demonstrated excellent appreciation of their pros and cons. A standard experimental design is employed in the majority of its small plot trials. The advantage of this standard is that it enables many trials to be undertaken in a single season with common layout and analysis procedures. The disadvantages are that the one design is not always best aligned to the research question, and that Type 1 error – falsely rejecting the null hypothesis may occur. Formalising pre-schedules for each proposed trial with specific sections on rationale, review of past knowledge, elicited research question and justified trial design was commended as a means of adding rigour to such trials.

Implementation of experimental program

Professionalism was clearly evident in implementing BCG's large and complex field trial program. BCG staff are motivated and committed to delivering results and demonstrate a willingness to achieve quality trials. Any concerns on implementation were more aligned with the design, management or analysis of experiments, or in trying to do too much and stretching resources. Good experimental implementation is based on training and protocols and the BCG is actively addressing these areas.

Analysis, interpretation and reporting of results

The BCG trial program could be classified and reported under several categories (i) exploratory trials (single season, standard design, quick look), (ii) repeated trials (trials repeated and interpreted over several sites or seasons) and (iii) long-term detailed trials (eg. Systems Trial). Attention to the analysis and interpretation of results will be a key determinant of the research reputation of any grower group undertaking RDE activities. Reporting of trials in the 2003/2004 BCG/WFS Crop & Pasture Manual shows clear improvement over earlier efforts, with a number of criticisms in the benchmark now addressed – more effort appeared to have been directed to interpretation with less speculation apparent. Interpretation of results beyond the site and season experienced in the trial under study remained difficult. Trial reports were published with limited peer review.

In the past 10 years, BCG has placed little effort in publication of their research in the science literature. They have written some papers (eg. Agronomy and Farming Systems conferences) and been co-authors on others (eg. PhD students). Scientific publishing has several benefits for staff employed by grower groups:

1. Publishing necessitates deep and clear thinking in designing and analysing experimental results, it necessitates the rigour required for good research.
2. Being represented in the published literature earns a research reputation amongst other researchers.
3. Publishing enhances one's career prospects.
4. Publishing adds to the science profession.

While not essential for BCG's operations, scientific publishing was listed as an issue for BCG to contemplate.

Evaluation of learnings and impacts

Evaluation is a necessary phase in research in order to learn how to improve one's own practice as well as determine the impacts from the research – 'to prove and improve'. Most researchers and their agencies fall well short in this important activity and so grower groups such as BCG were encouraged seek guidance on designing appropriate evaluation activities and allocate resources to their implementation.

BCG responses to review recommendations

After receiving the review report in December 2004, the BCG produced a formal document by July 2005 outlining their actions in response to a wide range of recommendations covering governance, human resources and experimental procedures. Those actions relating to experimental procedures were aimed at increasing the rigour in their research program, but conscious of the constraints in resources and organisational capabilities.

The following summary points represent a selection of actions (of relevance to the domain of this CVCB project) and implemented by BCG in response to their review:

1. Preparation of a pre-schedule for all proposed trials (rationale; review of past knowledge; research question; trial design) and review by stakeholders
2. BCG research and demonstration trials to be classified into
 - a. exploratory trials and demonstrations (quick look)
 - b. repeated trials (over a number of seasons and locations)
 - c. long term detailed trials
3. Increase level of analysis and interpretation of research results and undertake peer review of published reports
4. Encourage publication of results in scientific literature, especially in collaboration with researchers from other research institutes; encourage staff to participate in conferences as part of the staff development plan
5. Seek outside advice on evaluation of RD&E impacts

4.2.2 Reflections on current practices

The BCG research review represented an explicit and demonstrable effort by BCG to reflect on and improve their RDE practices. In preparation for the review and in their response to review recommendations, BCG formally documented their practices and then provided action plans for how to improve processes in response to review recommendations. However, this reflection was evident in their thinking and practice much earlier than the formal review. Early in the timeframe of this CVCB project, BCG provided a written document describing their program of research trials including rationale, analysis procedures and communication approaches. Thus, a history of their reflection is evidenced in the following selection of formal documents produced by BCG staff:

1. BCG / WFS Trials and Demonstrations – an overview (Nov 2003)
6. BCG Research Philosophy (Oct 2004) – trial concepts, a brief description, together with positive and negative implications
7. Guidelines for writing articles for the BCG Manual (Dec 2004)
8. Implementation of Research Review Recommendations (June 2005)

This CVCB project played a small though influential role in assisting BCG reflect on their RDE practices. In addition to membership of the review panel, the project invited BCG representation to its discussion workshops (see Chapter 7 of this report), it provided feedback on the above BCG documents and it facilitated BCG engagement with others concerned by similar issue in other industries and from within the research profession.

Today, BCG and CSIRO Sustainable Ecosystems have an effective, collaborative research relationship, one empowered by the interaction on issues explicit with the CVCB program.

4.3 Conservation Farmers Inc (CFI)

The following text is an extract from www.cfi.org.au. Editorial additions are inserted between [].

Conservation Farmers Inc is an independent grower-based, non-profit organisation [servicing mainly the northern grain cropping regions of Australia, including north-west NSW, southern and central Queensland] involved in the exchange of integrated information on profitable, sustainable farming systems. A principal role is developing strong linkages between farmers, agribusiness and the public sector to improve sustainable economic management in agriculture. The focus is on leading edge technologies, which build on farmer and industry knowledge and promote excellence in on-farm environmental management and production systems.

[CFI] objectives [are:]

1. To promote excellence in agriculture by advocating profitable and sustainable farming systems.
2. To provide benefits to members by way of information of value and opportunities for networking.
3. To seek opportunities for projects and partnerships in the development and extension of information in the area of profitable and sustainable agriculture.
4. To develop partnerships with external contractors who can contribute expertise for projects and activities of CFI.
5. To provide a rewarding and satisfying work experience for employed staff.
6. To achieve these objectives through an effective Board with clearly defined roles and guidelines on the frequency and method of communication.

4.3.1 Evolution in CFI practices

As a farmer organisation, the CFI has similarities to BCG, in its farmer subscribers and in its publishing of information in various forms. However, there are also significant differences, particularly in the desire to undertake on-ground agronomic research; with far fewer staff and equipment, CFI has little capacity to run large research or demonstration trials. Rather, as the CFI's web site now states, its core business is providing information which helps farmers to be more profitable and sustainable and to manage a dynamic and constantly changing farming scene. While its focus is on conservation farming and related environmental issues, its strengths are both in interpreting research and technology and in having a network of farmers and advisers to call on for practical experience and the extension of information. While CFI employs several staff, its mode of operation is more as a coordination and communications group which works with partners and independent providers who provide specific experience and skills relevant to projects at hand.

In 2001, the CFI Board and staff developed its current 5-10 year strategic plan which specifies its current objectives and core business (as stated above). The implementation of this plan, and the consequent evolution in CFI practices, has coincided with the timeframe of this CVCB project. While not claiming much influence over this evolution, the project has provided stimulus (via project workshops) and assistance in thinking about the implementation of CFI's strategic plan (via Board membership of Peter Carberry).

One interpretation of the evolution in CFI practices is from a farmer-led organisation wishing to be active across the complete research, development and extension spectrum to a farmer-representative organisation concentrating more on the D&E end of this spectrum while linked to other organisations with comparative advantage in rigorous R. Earlier frustrations of CFI staff in attempting to run on-farm trials and make something of the data collected undoubtedly contributed to this shift in emphasis.

Today, CFI is well established in its information business role. Not only does it package and deliver R&D information, it is active in establishing and coordinating consortia to deliver on RDE projects. As an example, a successful project submission to GRDC by a CFI-led consortium is briefly described in the following section and provides insight into the role of CFI in the RDE spectrum..

GRDC Western Farming Systems Project

The project entitled “Guiding growers to a more profitable and sustainable cropping systems in the western districts of the northern grain belt” is being delivered by a consortium of organisations coordinated by CFI. The vision for this project is to validate and integrate new technology through grower groups in north-west NSW and south-west Queensland graingrowing zones.

CFI's defined project role is in monitoring and evaluation, communication and collaborating with the project partners. A primary task is to engage the wider farming community and increase the number of growers performing close to industry best practice.

The project will concentrate on four areas:

1. Coordination of communication events - CFI will coordinate field days, media releases, workshops and seminars with the content for each sourced both from the activities of collaborating parties as well as from the broader agricultural RDE community represented in the region. In most cases, communication material and presenters will be sourced as in-kind contributions from existing projects who seek such communication events to deliver their extension milestones.
2. Engagement of grower groups - CFI will seek to engage with the smaller grower groups in the region, especially in NSW, in order that they participate in and benefit from WFS activities. A register of these grower groups will be developed. The interests and expectations of each of these groups will be sought and activities of interest to each group will be negotiated.
3. Facilitation of the validation of on-farm practices - while CFI does not have capacity to run extensive on-farm trials it will seek to facilitate grower groups in implementing their own on-farm trials. This will principally involve being a liaison between grower groups and public or private agencies with mutual interest in the topic being considered. It can also extend to providing design and analysis advice. A core requirement here is frank assessment of the relevance / rigour trade-off in any on-farm trial and such assessment will be sought through advice from CFI partners.
4. Monitoring & evaluation - CFI has engaged specialists with a track record in evaluating agricultural performance indicators, to include the biophysical, economic and environmental attributes. Project members will gather & supply benchmarking information. The interpretation and results will be supplied by partners and will be extended to team members and through media channels

4.4 Discussion

Farmers conducting trials on their own farms is not a new phenomenon, whether they are using simple fertilizer strips or exploring more complex issues. However, over the past ten years in the Australian dryland farming areas, there has been an emergence of pro-active, coordinated farmer groups with explicit aims of undertaking organized research into their farming systems – the Birchip Cropping Group (BCG) is an obvious example. In fact the RDE funding organizations in Australia have not only recognized the emergence of farmer groups undertaking organized research but are directly funding such groups to deliver research outcomes.

Any review of these grower groups must start with the observation that such organizations have often created new businesses that attract and keep talented staff in rural towns. The existence of such organizations in rural Australia can have significant impacts on the sustainability of rural towns and on the social fabric of the surrounding farming community and on their membership (some groups have up to 500 farming businesses). The capacity to keep staff motivated and to keep an agricultural RDE-based business growing, when many public agencies and private agribusiness firms are reducing their on-ground RDE investment, is a testament to the achievements of the leadership and management of many of these groups.

A recent review of grower groups in Australia identified over 20 such groups supported by the GRDC alone (www.grdc.com.au/growers/res_summ/HAS00002/contents.htm). This report confirmed economic, environmental, and social benefits which have accrued from the RDE activities undertaken by these groups and provided strong recommendation for continued investment in this approach to RDE provision. However, such recommendations also included an imperative that these farmer groups address issues of environmental sustainability in more meaningful ways than previously attempted.

The research-focused farmer groups in Australia were initiated with a strong focus on hard science approaches to simple, common issues relevant to their own region. They created space for themselves in the RDE business in Australia by attracting sponsorship and employing their own RDE staff. As their RDE legitimacy and capacity has grown, their desire has been to expand their systems research boundary to approach more complex issues. To do so, they require partnerships with other research agencies with relevant disciplinary skills. The opportunity for action research with farmers and researchers joining as co-workers researching the key production and environmental trade-off issues can be clearly enhanced through the efforts of farmer groups.

Participatory Action Research (PAR) is an increasingly used buzz-word within research agencies. It represents an approach whereby control of research is shared between the research experts and farmer practitioners, where the researcher is not an outside expert but rather a co-worker with other stakeholders in researching practical problems and exploring real-world opportunities. The emerging adoption of PAR by agencies should be seen as a great opportunity for grower groups as it provides the vehicle by which research specialists can be attracted into the grains farmers' research agenda.

Chapter 5: Viticulture

5.1 Introduction

Viticulturists have had access to two sources of funds for farmer-driven RDE. The first is through the Grape and Wine Research and Development Corporation's (GWRDC's) Regional Innovation and Technology Adoption (RITA) Program. Growers and grower groups can apply for funding to undertake small local research programs of up to \$13,000 (in 2003) per annum. Funding has been available to growers and grower groups from this source since at least 1995. The second source of funding was through the Cooperative Research Centre for Viticulture's (CRCV) On Farm Research Program.

The CRCV's On Farm Research Program was initiated in 1998 by the Victorian Department of Primary Industries. It sprang from observations that trials undertaken by growers and companies were lacking in rigorous design and statistical analysis. The program was seen as a way to improve the research undertaken by the wine-grape industry.

The CRCV On Farm Research Program has had two phases. The first phase ran from 2000 – 2003. It was initiated for and aimed at helping growers to:

1. Obtain information on best practices and research towards improved management practices
2. Test different viticultural practices on their property
3. Measure the impact of changes with respect to efficiency and sustainability (that is, environmentally acceptable and cost effective)
4. Make informed decisions about their vineyard management based on their results

The second phase ran from 2003 to 2006, and had the following, different objectives:

1. Using existing regional industry networks, involve the local industry in addressing regional priorities through the implementation of Viticare Trials
2. Improve access to, and understanding of, scientifically derived technologies and management solutions through information brokering networks at the regional level
3. Disseminate regional trial outcomes and practical experiences of trialled research & technology to the wider community through utilising established regional networks and national publications.
4. Encourage regional RITA applications through GWRDC where 'Viticare Trials and Information Brokering' were unable to support regional trial ideas

This case study on Farmer-driven Research in the winegrape industry had three parts:

1. Participation of the National Facilitator in the program workshops as a member of that community of practice
2. A review the science in the trials, using the criteria described in Tables 3.1 and 3.2
3. Evaluation of the growers response to the program

5.2 The Structure of the CRCV On Farm Research Program.

The CRCV On Farm Research Program largely used a "top down" model, in that it was initiated and driven by the funding body rather than by growers. This model doesn't strictly fit the definition of "farmer-driven research", but offered an interesting opportunity to compare and contrast the relative advantages of top-down vs bottom up farmer-driven research to participants, and to industry. While research funded through the RITA program is more closely aligned with the concept of farmer-driven RDE than the CRCV On Farm Research Program, the latter was used as the case study for the winegrape industry at the request of the CVCB reference committee.

The National Facilitator (who changed during the life of the project) was invited to each of the three synthesis workshops. This CVCB project was invited by the CRCV to work in the Griffith District with the Griffith regional information brokering network, made up of local grower liaison officers; staff from both the Griffith Winegrape Marketing Board and NSW DPI; and growers who hosted

trials. Growers ran the trials with assistance from the local facilitator and NSW DPI staff. The trial was designed by CRCV research staff.

The CRCV On Farm Research Program had a National Coordinator, and regional facilitators. In Phase 1 of the program, the regional facilitators worked directly with grower groups, who identified the trials that they wanted to undertake from a reference book of trials in consultation with the facilitator. In Phase 2, the facilitators worked with regional information brokering networks who identified regional issues on which research was undertaken.

In Phase 2, the regional information brokering networks were developed to increase the impact of the program on a regional basis. It was thought that it would be more efficient to have the grower liaison officers (employed by wineries and who work with a broad spectrum of growers) to both identify research issues, and to disseminate trial results than for one facilitator to work with a small number individual growers.

5.3 Characteristics of the Griffith District

Griffith is a traditional, warm climate grape growing district. It was established as an irrigation district in 1912, following construction of the Burrinjuck Dam. Land was taken up by a number of potential farmers, including many Italian migrants. It was also a soldier settler area following World War I. The first grapes were planted in 1913. The region has some of Australia's most successful winery businesses including de Bortoli, Casella and McWilliams. A number of grape varieties are grown, including shiraz, chardonnay and cabernet sauvignon. Wineries supply both the bulk and high quality national and international wine markets.

During the life of this project (2003-2006) it was apparent that there was a local industry view on the national wine-grape research funding arrangements. The Griffith region contributed 20% of the national grape and wine research funds, five percent of which were spent in the district. This funding distribution was commented upon a number of times, and may have influenced grower perceptions about the On-Farm Research Program run by the CRCV.

5.4 Scientific Review

Members of CSIRO Sustainable Ecosystems (CSE) Agricultural Landscapes program reviewed two research programs undertaken in the Griffith region. One was a trial on "Midrow management on a sandy and clay soil" and the second a survey on "Benchmarking performance indicators of change in practice from flood to drip irrigation". The trial is the focus of this discussion. A detailed report on the trial is given in Appendix 1.

Traditionally, vineyards in the Griffith district used flood irrigation systems. This system is being superseded by drip irrigation systems. The trial "*Midrow management on Sandy and Clay Soil*" investigated the capability of cover crops to cool down vineyard soil in comparison to bare soil, and arose from observations that vineyards with a cover crop suffered from fewer "cooked" flavours than vineyards with bare soil.

In the first year, the primary objective of the trial was to compare two different cover crop mixtures: (Rose clover & Ryegrass mix with Coolabah Oats) for capability to cool down the vineyard compared to bare soil. The trial also aimed to look at the effect of cover crops on fruit quality, particularly the "cooked berry" syndrome compared to bare soil. The cover crop trial was based on work that had been undertaken in Griffith and Wagga during the 1990's.

Following the design phase (undertaken by CRCV staff), the trial was given to the farmer to implement with some assistance from the facilitator and NSW DPI staff who were members of the grower liaison network. It wasn't clear how much input the growers had into trial design. Trial design was an issue for farmers, and will be discussed later.

There appeared to be some confusion about what the trial was seeking to achieve. It appeared to have begun as one of the ‘recipe trials’ developed in the first CRCV On Farm Trials program. At the time the trial was undertaken, growers were being strongly encouraged to change from their traditional system of furrow irrigation to drip irrigation to improve water use efficiency. However, the wet midrow associated with traditional furrow irrigation meant that the evaporative cooling effect would be lost if drip irrigation was implemented. The summer of 03/04 was particularly warm and ‘cooked’ flavours were reported from vineyards that had changed from furrow to drip irrigation. Members of the regional information brokering network reported that drip irrigated vineyards with a cover crop experienced less “cooked” flavours in the fruit than those without cover crops. With this information in mind, the cover crop trial was expanded to include measurements of canopy temperature with the objective of quantifying the benefits of cover crops in reducing canopy temperature and fruit quality.

In the change in the trial design, the reviewing scientists thought that some elements had been overlooked: The cover crop species chosen in the first year had died by early November, rather than growing through to December / January as expected. For the 2005/06 season it was decided to use native species, based on work done by Chris Penfold in the Riverland.

5.4.1 Research or Demonstration?

In the first and second year of the trial, research in Sunraysia (GWRDC, 1992) and the Riverland (Penfold) was being validated. The oats/rye grass mix had been developed at NSW Agriculture Dareton Research Station by Graham Sanderson, while the native species work was initiated by Chris Penfold in the Riverland. Thus both were “demonstration trials” although the difficulties encountered in establishing the cover crops in the first year suggest that there was limited understanding of the requirements of the plants for survival by the management team.

The cover crop trial in Griffith was more in the nature of original research than a demonstration trial. The issues of species selection (failure to grow) and management of weed competition indicate a level of unfamiliarity with the requirements for successful trial management that should have been sorted out for a demonstration trial.

5.4.2 Science Quality and Process

The trial was reviewed using the criteria listed in Table 3.1. It wasn’t clear from the research proposal how the cover crops would reduce vineyard temperature – whether by evaporative cooling, or by shielding the soil from radiation. The review panel speculated that change in radiation load may have an impact, but data about these parameters were not being collected.

There was a long list of people involved in the trial design, which gave an excellent start for building capacity in the district amongst technical specialists and participating farmers. Including a plant physiologist on the project team would have strengthened the science.

Tremendous energy was expended in running the trial by all involved. The trial design showed huge enthusiasm for data collection with a great deal of attention paid to making detailed measurements. However, lots of data can be time consuming to collect and to analyse. The measurement load could have been reduced by choosing those data crucial to developing the story rather than making exhaustive measurements appropriate for research on a research station, but not necessarily on a working farm.

Inclusion of a traditional furrow irrigation treatment to quantify and demonstrate the change in vineyard micro-climate and its impact on grape flavours (easily done by wetting a plot with a hose) would have strengthened the results from the trial.

Much of the data collection relied on electronic sensors, with 2 replications per treatment. The review panel suggested that three replications would offer a more robust series of measurements in the event of equipment failure.

Trial results were not available when this project concluded, so it isn't possible to critique them in terms of science or the conclusions drawn from them.

5.5 Grower response to the CRCV On Farm Research program

The second phase of the work was a qualitative evaluation of the research process with two groups of growers: those who had hosted on farm trials and stopped participating in the program, and those growers who hosted on farm trials in the program.

Six semi-structured interviews were conducted with growers in the Gundagai / Griffith region of NSW in May 2005. The interview protocol is given in Appendix 2.

Of the six growers interviewed, two had parents who were viticulturists; four had a general farming background and had moved into viticulture because of the employment opportunities it offered. Two were vineyard owners; four were in management positions with companies. All growers interviewed were men, whose ages ranged from their mid-twenties to their late fifties.

5.5.1 What worked for the growers – why they participated

The growers hosting the trials in the Griffith and surrounding regions were very interested in and excited about the research, and committed to the trials. Their reasons for participating included:

- Developing viticultural practice that would be more environmentally sustainable.
- Developing a sense of community within the local grower group, ie bringing the growers to something that had a common sense of purpose;
- Working with scientists – to ask questions of scientists, and to have answers given, or to initiate exploration on a new topic “no-one knows the answer to this, but we will have a go to find out”
- Learning – all participating growers were deeply motivated to do the best job they could growing grapes to meet or exceed winery requirements, managing the physical environment as well as they could while making an economic return and maintaining work-life balance. They were hungry for information that could help them with this
- Gaining credibility with their peers. The OFR process gave the participating growers interested in trying new ideas peer support they might otherwise lack.
- Seeing the research done on farm meant that they were able to assess the success of the trial against their criteria of return on investment and ease of implementation

Grower Concerns

Growers raised a number of concerns with regard to the CRCV OFR program, namely trial design, local participation, risk management, the reasons behind on farm research, and process.

Trial Design

Growers expressed concern about the trial designs. All growers interviewed thought that the trial designs were better suited to research stations than to working vineyards. An example from the cover crop trial is three changes in seed for small plots, down a row – a simple technique to use on a research station with machinery designed for the task, more complex in a working vineyard with semi-skilled staff not quite understanding what they are doing. They also felt that the detailed measurements which they were expected to undertake were inappropriate given their time commitments as vineyard managers. It was felt that this mitigated against grower participation and building a common sense of purpose in the district.

“It was alright for us, we were big enough to absorb the workload, but the smaller vineyards backed out – were glad to be frosted so they didn't have to go ahead with the trial”.

In a good use of an action learning cycle within the program, some of these concerns have been addressed by employing locally based staff to undertake the detailed measurements in the peak of the season.

In the first CRCV On Farm Research Program, trials were designed with plot-based measurement. In the second CRCV On Farm Research Program, this was modified to regional “block based design” which was more in keeping with vineyard management practices.

Local Participation

Growers expressed frustration that not more people in their district were involved or interested in results from the trial:

“I am pushing the proverbial up hill here because there are not many people jumping on the band wagon to help drive it”

“The regional networking, which is why I got involved, is not working”

One grower felt that too much time was taken to set up the trial, and that it would be as effective to

“Talk about the trial, what we are going to do”

He thought that more time spent facilitating the process would get more people in the district involved, thus getting more ownership of the research. It would also create a greater sense of community in the district, something this grower was keen to foster.

Risk

All were comfortable with the notion that trials might not work, and recognized that there was as much to be learned from failure as from success. All believed that locally done research – on their own or their neighbour’s property - was more believable than research done out of the district or interstate. However, growers felt that they were taking a financial risk in running trials on their properties. Depending on the size of the trial area, the growers were putting a portion of income on the line if the trial didn’t work.

“Risk – there are economic risks to me in undertaking this work which I am not able to absorb if the trial doesn’t work”.

Reasons behind on farm research

One grower was of the opinion that the research was being moved off research stations and on to grower vineyards as a cost-cutting measure for government.

Process

Concerns were expressed about role definition, and who was responsible for undertaking measurements and making decisions. Growers felt frustrated about not being kept in the decision-making loop, not having ideas listened to and incorporated into the trial. They were frustrated that equipment was put in the vineyard, and the manager didn’t know where it was – which proved something of a problem at harvest:

“There is a lack of communication about what is going on. The way they do things are not practical for a vineyard. I am not told where the measuring equipment is, and it got taken to the winery and back at harvest”

5.7 Discussion

According to the Probst typology, the CRCV program was operating in the contractual/consultative research domain. The scientists / facilitators appeared to be making many decisions without organized communication with the viticulturists. The viticulturists knew about the scientists’ priorities, but did not always know about research management decisions made by the science team. The scientists’ priorities and hypotheses did not appear to be influencing management decisions in the district at the time this research was being undertaken. The viticulturists were seeking a more collaborative approach, where decision making was shared between the two parties, and with time would have enjoyed a collegiate model, in which the viticulturists were making informed decisions about the research based on communication with the scientists.

The participating growers were very interested in the research, in the questions being asked, and the answers given. They were frustrated by the number of measurements that they were required to make, and the time it took from their business – one of the growers was running a harvesting business in addition to the vineyard, while the other was managing a large vineyard operation. The issue was addressed by the CRCV employing casual staff to make the harvest measurement (an excellent example of responsiveness to grower demands).

One participant, who was involved in both the CRCV On Farm Research program, had also obtained funding from the GWRDC Regional Innovation Technology Adoption (RITA) program. He felt that the RITA program was more useful than the CRCV OFR approach because it answered the questions he wanted answered, was less hassle to implement and manage, and gave more contact with the scientists. Direct contact with scientists was highly valued, as they were seen to be more knowledgeable than the facilitators and therefore had more to give to the growers. Interestingly, growers reported control issues within RITA trials – the scientists began to assume ownership of what had been a grower's idea, and this caused some tensions.

A grower who participated in phase 1 of the program had a perception that the program was shifting costs from research providers to growers. This perception was at odds with the phase 1 program's objective of giving growers the capacity to make more informed decisions through appropriate trial design and data analysis techniques. Phase 1 was targeting companies who ran trials who may not have been making appropriate scientific decisions from the data they collected. This evaluation shows that there was a difference in opinion between the growers and the funding organization about what constitutes valid research. The grower was satisfied that the experimental methods he was using were giving him appropriate answers, and had not identified a need to be doing things differently. Until that need was generated, he was unlikely to be an advocate for the program.

Positives about the process include:

I have much better networks with the scientists now than I did before. It is much better to be able to talk directly to the scientists than to work with the GLO's (grower liaison officers), who don't usually know the real reasons like the scientists do"

Communication is perhaps an under-rated and underestimated part of the process. Allocating more of the facilitators' time to discussing what is going on with collaborators, involving them in the decision making process throughout the experimental program would diffuse a lot of the tension observed. Moves were afoot to establish local grower groups through the Griffith Winegrape Marketing Board which might address this problem.

At the time this CVCB project was undertaken, the participating growers were showing good critical thinking, conceptual knowledge, planning, communication, problem solving skills and motivation. They suggested that the trials be assessed against three criteria of cost benefit, market benefit and sustainability benefit before they were implemented

The research trials were well designed from a scientific perspective, and by incorporating the grower suggestions into the program so that the trials were more suited to a grower situation, would be made more suitable to working vineyards. With some adjustment, the program would likely become more effective.

Some suggestions for modifying the CRCV approach are to:

- Provide training in methods of participatory process to facilitators, scientists and growers.
- Develop an action learning process for working with growers so they develop an understanding that their existing approaches to research may lack rigour and so may give invalid answers, and are more accepting of the need for replication.

- Evaluate the effectiveness of the regional networks in identifying research questions, and disseminating the trial results to the wider viticultural community
- Change the emphasis of the program from operating in a contractual / consultative research domain to working with the growers to collaborative and collegiate research, enabling growers to make informed decisions about research.

Chapter 6: Sugar

6.1 Introduction

This project began working with the sugar industry in 2003. At this time, farmer-driven research was in its infancy in this industry. There were few grower groups, and little funding was available to growers for conducting their own research either from the Sugar Research and Development Corporation (SRDC) or from other funding sources. Some grower groups did exist in the Burdekin, of which many were traditional harvesting cooperatives and others were discussion groups formed as part of the CSR-initiated Cane Productivity Initiative. There was very little farmer-driven research taking place and thus little opportunity to work with growers groups in refining the science of farmer-driven research in the rigour-relevance paradigm. Nevertheless, the sugar industry participated in project-sponsored workshops and contributed to project discussions. Over the course of the project, the sugar industry saw some significant changes, some of which were facilitated by the interactions made possible in this CVCB project.

6.2 Industry Structure

The Queensland sugar industry began in the late 19th Century. The industry has been an important part of the Queensland economy for more than a century, contributing between 1.5 to 2 billion dollars in 1990. The mid-nineties saw a slump to 1.3 billion dollars. Forecasts for 2006 (before the outbreak of smut in May 2006) estimated that export earnings would be in the order of 2 billion dollars (McNeill, pers comm.). The economy of Queensland's coast from Nambour in the south to Mossman in the north has been dominated by sugar, although tourism and the minerals boom have overtaken this role in the last twenty years.

Traditionally, canegrowers have produced sugar for a particular, locally based sugar mill in a region known as a mill area. The costs of transporting cane have meant that there has been almost no movement of cane between mill areas. The relationship between the mill and the growers has been, and remains, one of mutual dependency. The mills in the case-study region of the Burdekin were owned by CSR. Cane price is set by the international markets, and local mill supply agreements set the start and finish dates for the season, and the penalty rates.

Research for the sugar industry has been undertaken by the Bureau Sugar of Experimental Stations (BSES). Extension has been undertaken by both BSES and the mills. Until 2003, BSES was funded partly by the Queensland State Government, and partly by grower levies. At the time this project began, BSES became BSES Limited, a commercial, privatised agency. BSES Limited is funded by a non-compulsory levy.

The case study region for the research was the Burdekin Delta. The Burdekin is located in the "Dry Tropics", about 100 km south of Townsville. The Burdekin delta is a major irrigation area with more than 35,000 ha of irrigated sugarcane and other crops. Cane is grown on the rich and variable soils of the Burdekin delta, and irrigated both with ground water and with water from the Burdekin Dam. This system is unique because it overlies major groundwater supplies, is close to environmentally sensitive wetlands, waterways, estuaries, and the Great Barrier Reef (www.clw.csiro.au/lbi/burdekin.html)

In September 2003, the sugar industry was described as being in decline. It was portrayed as being slow to adopt new things. The culture has been relatively stable (and conservative) for over 100 years. Traditionally, there were few risks associated with growing sugar, and its high value meant large profits. There was little incentive or pressure to look at becoming more efficient. Excessive inputs of nitrogen and water were common as they were regarded as cheap insurance in guaranteeing high productivity. The outlook became less optimistic for the industry in the mid nineties as the expansion of the Brazilian sugar industry led to a glut on the international market, and an associated reduction in world sugar prices, and a consequent decline in economic return and industry viability for Australian

cane farmers. Simultaneously, sugar yields from Queensland cane declined. This was due to a range of factors including widespread use of a cane variety susceptible to a leaf fungus known as orange rust; very dry conditions and poor agronomic practices including growing cane as a monoculture without any break crops. The industry was also under pressure from environmental imperatives including water reform, environmental audits, and maintenance of the Great Barrier Reef.

As a consequence of these issues, and industry leaders began revisiting the knowledge system of the sugar industry in 2000. It was realised that many farmers had a poor understanding of both sustainable land management practices and of crop physiology. High priority was given to improving grower knowledge of irrigation scheduling, nutrient management, soil properties, particularly soil water holding capacity, and basic crop physiology. The Sugar Yield Decline Joint Venture was funded to determine the agronomic causes of decline in sugar yield, and to develop solutions to the problem.

6.3 Farmer-driven Research in the Sugar Industry.

A special interest “Soil health group” was initiated by CSR as a R&D coordination reference group. Its objectives were firstly to ensure that soil health research in the Burdekin was matched to the region’s needs and secondly that adoption of new research was improved. The group involved interested growers, extension officers and researchers.

After going through a process of ‘where do we go now?’ and of examining aspirations and ideas of what is possible, group members agreed to benchmark variable costs of production to see where each could improve. They next described their individual farming systems to learn from each other. They discussed the possibilities of gaining economies of scale through aligning farming systems, so that duplication of equipment etc was reduced and other resources were better utilised, including the skills of individuals within the group in areas of financial and business management.

The grower group made several unsuccessful applications to SRDC and to the National Landcare Program in 2003 and 2004 for funding to implement a sustainable farming systems program in the Burdekin. The group successfully won funding from SRDC to fund a bus trip from the Burdekin to other parts of Queensland, to study sustainable farming systems; grower cooperatives; grower groups and environmental management in both the grains, horticultural and sugar industries. Thirty people went on the bus trip, and were inspired by what they saw. What impressed them the most was that growers in other industries were taking responsibilities for their own destinies, rather than waiting for the government.

6.4 Project activities in the sugar industry

In 2004, one of the farmers in the group participating in this CVCB project decided to fund a sustainable farming systems project on his farm, to prove the system and to convince others in his harvesting group of what was possible. The research questions were not clearly defined. However, the grower wanted to investigate the effect of different varieties and irrigation scheduling on yield. While the basic concept was not compared to a control, soil starting conditions and inputs were recorded. At the time the research began, the grower did not have funding from a donor organization; however, the group was successful in obtaining funding from SRDC at a later date.

The trials were implemented by the grower, who had a planter built that could plant into 1.8m permanent beds that would be established using GPS guidance (at the time, the usual bedwidth was 1.5m). He planted 40 ha, and intended to green cane trash blanket after harvest, and plant a legume break crop after the 3rd ratoon.

According to our typology of farmer-driven research, this trial was collegiate, non-extractive research which was leading to empowered farmers, able to design, implement and evaluate the development of new ways of dealing with a problem.

Our CVCB project enabled some members of the sugar industry to learn more about participatory on-farm research and network with practitioners from other industries. The project sponsored several workshops on how growers can do their own research (Ayr, November 2004) although early participation was low. However, as a consequence of the connections made through this project members of the Birchip Cropping Group were invited to go to Townsville to talk about how the grains industry has setup and sponsored grower groups and grower-run research trials.

Representatives of SRDC were invited to the third cross industry project workshop held in May 2005, and the possibilities of funding a farmer-driven research program were discussed. Subsequently, this program was established and two facilitators were employed to work with the industry. The issue of rigour in sugar-related farmer-driven research, development and extension was a key discussion point. One of the arguments in the rigour versus relevance debate was that there was a trade off, and that poor science could lead to poor conclusions.

While concern was expressed by scientists that the SRDC Grower Group Innovation Program was diverting research dollars from traditional institutions, the SRDC saw the program as part of the sugar extension budget. The funding body did not feel that researchers were going to suffer funding cuts because of this new initiative, instead feeling that the change in production systems and empowerment of industry was of far more importance to the long term survival of the industry.

Many of the submissions to the SRDC Grower Group Innovation program were devoted to validating the findings of the sugar yield decline joint venture on a regional basis.

6.5 Discussion

This project developed great connections within the sugar industry and provided a venue for influential sugar industry representatives to engage with representatives from the grains and viticultural industries. However, little could be established on-ground in the sugar industry due to the early days of participatory on-farm research in the industry. The initiation of grower-led on-farm research in the sugar industry lagged behind initiatives in the other industries and it was beneficial for all involved to discuss the advantages and disadvantages of such initiatives as applied within sugar. A performance indicator of impact is the continued close relationship of growers in the Burdekin sugar industry to the Birchip Cropping Group with invitations to visit the Burdekin issued to BCG members and funded by the sugar group.

Funding for farmer-driven research became available from SRDC in 2005 in their Grower Group Innovation Project, for growers to develop and build their capability to conduct their own research and development into more profitable and environmentally sustainable sugarcane farming systems. The high social benefits, including grower involvement in research and development, the increasing learning opportunities and new or enhanced partnerships were cited by the SRDC representative to our project workshops as rationale for such initiatives:

“SRDC have, as you know, learned a lot from your project. Without your project SRDC would not have learned as much from the past experiences of the grain & viticulture industries. The 2-day meeting earlier this year at the BSP to share experiences with individuals from grains, viticulture and sugar was an extremely valuable event. I have greatly valued our phone conversations re: this project, and your willingness to share information and ideas.”

SRDC have become increasingly aware of the importance of providing support for grower groups to delivering successful grower group projects. This CVCB project has reinforced to SRDC the importance of communication and evaluation in grower group projects. The project also highlighted the challenges associated with achieving scientific rigor and relevant outputs/outcomes from industry-led research projects.

Chapter 7: The Workshops

Three workshops were held over the life of the projects. The first established the co-learning group and gave participants an understanding of the issues facing the three participating industries of sugar, grains and winegrapes. The second undertook detailed discussion of rigour in publication, and offered different models for working with industries. The third workshop examined the issues of farmer-driven research from the scientist, funder and farmer perspectives for the three participating industries. Peer review was discussed at great length.

This chapter briefly synthesises the discussion from the three workshops under headings of funder and farmer perspectives of farmer-driven research and rigour and relevance.

7.1 The Funder perspective

Answers to the following questions were sought from funding agencies over the life of the project:

- Why has your funding body invested in on-farm research, what does it expect from it?
- What criteria are used to evaluate the success of the project?
- Why were these chosen?
- What support networks are being established to support staff employed by grower groups but funded by the RDC?

Industries established on-farm research for a range of reasons. The winegrape industry had recognised that tens of thousands of dollars were being spent on grower funded research and that trials were not giving the results that they should have because of flaws in design and implementation. The grains industry established farming systems groups in response to grower demands for local research investment. SRDC established funds for research upon seeing the impact of the grower driven research on the grains industry, seeing grower funded research as a valuable tool to build capacity within the sugar industry to adapt to a changing world market place, to develop capacity within the grower community to learn, to change and to innovate.

While the emphasis of successful farmer driven research varied between industries, the more successful programs emphasised the need for both scientific and community capacity building.

All industries provided support to staff employed by grower groups.

7.2 The Farmer perspective

Answers to the following questions were sought from farmers over the life of the project:

- What has being part of a farmer driven research process meant to me?
- Am I confident that the answers that I get from my trials are robust enough for me to decide to change my farming system?

There was a gap between scientist and farmer perspectives with respect to the reporting of research. The scientists were clear that research needs to be of a high enough standard to be able to be reported in peer reviewed journals and to withstand the scrutiny which that process entails. The participating farmers had a different view, and maintained that research undertaken through farming systems groups needed to be of direct value to the farmers, and that they were the ones who needed to assess whether or not the research was relevant. This difference in views led to an interesting conversation that emphasised that the world view of the two groups diverged - not surprisingly, the scientists were focussed on good science defined by their positivist training, while the farmers wanted answers to their questions without always understanding the many steps that needed to be undertaken to ensure that answers were valid.

Analysing the discussion led to the following conclusions:

- The research needs to be designed to answer questions being posed by farmers.

- Detailed measurements frequently require more time and resources than farmers have available.
- Research results need to be rigorous – to ensure that management decisions made by farmers based on the results are appropriate.

The following suggestions are made to resolve these tensions.

1. Write pre-schedules and have them assessed by competent scientists who are discipline specialists versed in using participatory approaches, and then workshop the critique with the whole group – participating scientists, farmers and facilitators – so that farmer groups come to understand the scientific discipline required in undertaking research, and scientists design experiments suitable for farms. The expected outcome is that the trials undertaken will give more reliable answers.

2. Report research. Often, the research undertaken by or on behalf of farmer groups doesn't meet the criteria of originality required by scientific journals for publication. Industry publications like the GRIST manual don't critique research reports. Scientifically reviewing research for industry publications would ensure that many of the criticisms of these publications are overcome.

Chapter 8: Summary

The three case study industries represent a continuum: from the “young” Wine-grape industry, with many new entrants, knowledge hungry and passionate about their product, just facing up to the realities of over-supply and price decline; to the “middle-aged” Grains industry in which growers know that their survival depends on maintaining global competitiveness and sound natural resource management; and to the “mature” Sugar industry that is changing from being a secure and affluent industry to one that is undergoing a massive restructure in the face of declining global competitiveness, and under increasing pressure to demonstrate sound natural resource management.

The first co-learning workshop (September, 2003) established that there are two “models” for on-farm research: “bottom up” as exemplified by the Birchip Cropping Group, and “top down” embodied in the Wine-grape Industries’ Viticare On Farm Trial Project. Farmer-driven research in the sugar industry was less developed than the other two industries.

The BCG began in 1992 from local frustration with the failure of traditional government agencies to meet grower research requirements (Gartmann, 2003). The group has successfully attracted research dollars from Grains Research and Development Corporation, and other sources. There has been strong emphasis on community capacity building and the development of infrastructure, as well as on research. It has become a model for other grains-based communities.

The CRCV Viticare On Farm Trials began in 2000 with the premise of teaching farmers to be scientists. This national program has concentrated on providing farmers with the tools to validate existing research. The national facilitator in association with scientists and statisticians has developed “Recipe Trials” – well designed trials on specific topics. Growers identify a research issue from the trial manual that is relevant to them, and undertake the research in association with the local facilitator. New research questions are referred to institutionally-based scientists. To date, there has been little emphasis on capacity building, although it has been an important and undocumented part of the process. Questions that have arisen from our reviews of this work include: does the recipe approach mean that new ideas are discarded at inception? How do the viticulturists view the “recipe” approach to science?

A review of on-farm trials was undertaken for each of the participating industries. A framework was adopted against which the available trial results were evaluated. Several publications of grains-sponsored on-farm research (e.g. the GRIST manual – an annual summary of research conducted by grower groups) and on wine-grape research have been evaluated against the criteria from the framework. While improvement in rigour was noted in the recent grains publications, some issues remain, for example:

- reported trials where conclusions were not supported by trial results;
- trials addressing similar issues concluding opposing recommendations;
- lack of experimental error quantified;
- lack of base measurement of site characteristics.

Suggestions to overcome these problems are to:

- Write pre-schedules and have them assessed by competent scientists who are discipline specialists versed in using participatory approaches, and then workshop the critique with the whole group – participating scientists, farmers and facilitators — so that farmer groups come to understand the scientific discipline required of undertaking research, and scientists design experiments suitable for farms. The expected outcome is that the trials undertaken will give reliable answers.
- Report research. Often, research undertaken by or on behalf of farmer groups doesn’t meet the criteria of originality required by scientific journals for publication. Industry publications like the GRIST manual don’t critique research reports. Scientifically reviewing research for

industry publications would ensure that many of the criticisms of these publications are overcome.

The process of interactive inquiry used in this project has identified that capacity can be built with facilitators, scientists employed by groups and group employees (both facilitators and scientists). Qualitative evaluation of the workshop process has shown that the facilitators and scientists working with or for grower groups have benefited greatly from sharing their experience with colleagues. It has provided an environment in which experiences of working with groups can be shared and reflected upon in a supportive environment. Anxieties about “am I doing this job the best way possible” have been aired, and different ways of working with their groups proposed.

There is a need for the capacity building aspect of participatory on farm trials to be recognized, rewarded and formalized by funding bodies sponsoring participatory on-farm research.

The main activities and benefits from this CVCB project were the multi-industry workshops. They gave an excellent opportunity for vigorous discussion between farmers, facilitators and scientists, leading to the development of shared mental models. Some shared views of the participants of the three workshops included realisation that:

- The important starting point to participatory on farm research is defining and developing a shared mental model between participants.
- Farmer driven trials cover a range of activities, and have no one set way of implementation, and may be formal or informal.
- While the latter is not necessarily wrong, the former may be and requires critique. It is important to be discerning in a review process.

A key consensus outcome from these interactions was that trial reporting in industry funded publications on farmer-driven research would be improved by:

- having an annual publication specifically devoted to reporting research which adopted a process of scientific review;
- developing and using protocols:
 - documenting the type of data to be collected and reported against;
 - emphasising that experimental error needs to be supplied in the results;
 - emphasising that base line measurements need to be made and used in the reporting; and
 - adding editorial comment that discusses and explains why results for the same trial vary between regions.

Used effectively, the PRA approach can lead to methodological innovations which will improve the potential usefulness of farmer participation in all phases of the research process, from problem identification to technology design, development, and evaluation. However, institutional changes to encourage more collaborative and collegial relationships between farmers and researchers would also improve the processes currently used in the different industries.

Using the typology of farmer-driven research described in Chapter 1 was valuable in improving the understanding of participants in the program of both the scientific and collaborative processes necessary for successful farmer-driven research. It showed that differences in approaches taken by industries in working with growers – grains took a collegiate approach, winegrape a consultative approach and sugar a collegiate approach – was reflected with the level of satisfaction that growers and scientist experienced with the research process. The collegiate approach resulted in growers feeling informed by and enthusiastic about research and committed to the process. The consultative approach was not as successful with growers.

Some of the institutional constraints to farmer-driven research identified by Ashby (2003) were observed in the groups participating in this project. In some instances, mechanisms of accountability among participants were lacking, transaction costs of participation exceeded the benefits to the

participants, and feedback mechanisms, such as monitoring and evaluation of the research process were not in place so that learning about how to improve the process was minimal or slow. However, in general, processes were well managed, and the threats to process were observed and dealt with in a timely fashion.

This work endorses the conclusions of the review of farming systems research undertaken by Hassall and Associates (2004)

- Working with industry champions who are effective networkers with good project management skills is the best way to carry farmer-driven research forward.
- On farm research initiated by the funding body is less effective in local impacts than research initiated by the growers.

Recommendations

- Trials [designed by and for farmer groups] be reviewed by appropriate scientists before they are implemented, to ensure that the trials will answer the question/s being asked, and that the methods used are sufficiently rigorous to withstand peer review.
- Research funded through farmer groups by research and development corporations be reported in industry publications, and in appropriate peer-reviewed journals.
- Industry publications reporting trials use a peer review process to ensure that trials are discussed in both a regional and temporal context, and that results from similar trials in different regions are compared and contrasted, enabling effective analysis of the broader applicability of the trials.
- Industries who provide funding to farmer groups for trials:
 - enable and encourage farmer groups to have access to appropriate discipline-based scientists;
 - enable all participants (farmers, facilitators, scientists and farmers) in the research process to respect one another's different world views, and to develop an appreciation of the social, scientific and economic capacity building that takes place through well designed and delivered farmer-driven research programs;
 - train facilitators, scientists and farmers working with grower groups in group processes; and
 - develop and implement formal monitoring and evaluation strategies to ensure that effective processes for the scientific, social and economic aspects of farmer-driven research are used.

The cross industry discussion group was an effective mechanism for ensuring quality of processes and results, promoting cross-industry learning and discussion about both science and industry capacity building. It is recommended that the cross-industry discussion group be maintained to continue the co-learning about improve the scientific, and social capacity building processes that was begun through this project, and that similar groups be established for other industries and groups involved in farmer-driven research, development and extension.

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Appendix 1: Review of Winegrape experimental program

CSE Observations on CRCV Cover Crop Trial – Griffith, 2004-2005.
Jane Fisher, Farming Systems Researcher, CSIRO Sustainable Ecosystems
PO Box 102, Toowoomba Qld 4350

The Cooperative Research Centre for Viticulture's Griffith trial "Midrow management on a sandy and clay soil" is one of four case studies for the CSE project "Participative evaluation of learning and impacts from "farmer-driven RDE" (OFR) funded by the Cooperative Venture for Capacity Building. The other case studies are with the sugar and grains industry. The objectives of the OFR project are to work with influential, pro-active farmer groups, to enhance the design, implementation and evaluation of "farmer-driven RDE" in Australia through:

1. Formation of recommended actions to improve processes, learnings and impacts through review of past, current and planned RDE activities of collaborating farmer groups; and
2. Active involvement of researchers alongside farmer and adviser members of collaborating groups in designing, implementing and evaluating RDE case studies which have adopted recommendations from 1 (above).

Research is exciting, offering the potential to search out answers to questions and to explain and to manipulate the phenomenon in new ways. One of the most difficult aspects of research is clearly defining a research question and an appropriate experimental procedure which will answer the specified question. The key steps in determining a research question (Fisher and Carberry 2004, in press) are:

- developing the rationale,
- reviewing what's already known,
- specifying the hypothesis to be tested and
- deciding on whether the question can be appropriately addressed with the resources and skills available.

CSE scientists with experience in on-farm research and viticulture (Jane Fisher, Jeremy Whish, Neil Huth, Peter Carberry, Perry Poulton) discussed the pre-schedule in November 2004 using the framework described above. Whilst this pre-schedule covers all of these aspects it is suggested that some more detail in the rationale and review sections would be valuable.

Rationale

It was suggested that the pre-schedule would be more informative if it put the trial into context eg "increased demands on water in the Murrumbidgee Irrigation Area (MIA) that have come about because of drought and requirements for environmental flows mean that growers are having to shift from traditional flood irrigation methods to drip or trickle. This change is challenging the culture of the area. Anecdotal observations suggest that the change has meant that vineyard temperatures have risen, resulting in 'cooked' flavours in the fruit".

It is also important to document the incidence of "cooked" flavours in the Griffith district vineyards and how the problem came to be identified as a regional issue. The recent hot summers could mean that cooked berries may have occurred regardless of irrigation regime, or presence of cover crop. Documenting (quantifying) the trend will enable more rigorous analysis of the problem.

The pre-schedule needs to be more specific about what the aims of the research are, the trial is quite complex, and some of the central tenets are not well established. More detail would be useful, for example:

How widespread have cooked flavours been in the Griffith District in the last three years?

Is it related to:

- Soil type
- Grape variety
- Row orientation
- Form of irrigation
- Presence or absence of cover crop
- Cover crop species

What have the temperatures been like in the district in these years – have they differed from previous seasons?

What does the literature say about:

- Development of cooked flavours in winegrapes, and how they are influenced by temperature;

- The role of cover crops in reducing vineyard temperature – and how does this happen, is it through evapo-transpiration (evaporative cooling) or by changing the black-body radiation?

Cover Crop

- Are the cover crop species supposed to be alive throughout the growing season?
- Why were Rose clover & Ryegrass mix and Coolabah Oats chosen as the cover crop species?
- What advantage do they offer over other species?
- When are the cover crops supposed to remove water from the vineyard and why is this necessary?
- How are the cover crops supposed to improve soil structure, and why is this necessary?
- How are they supposed to influence organic matter and nutrients in the long term – what is the hypothesis?

Recommendation 1: strengthen the introduction to the pre-schedule by including a rationale, and more detail about the decisions taken in designing the trial.

Consultation

There is a long list (of both industry development officers, government extension officers and suppliers, scientists and statisticians) who have been involved in the trial, which is excellent. However, there isn't anyone with a background in grapevine physiology on the list. The CRCV includes a number of grape physiologists who would have this expertise.

Recommendation 2: talk to a grapevine physiologist about the experiment

Literature Review

It would be useful to explain the physiology of flavour development of winegrapes, and to present an hypothesis about the impact of temperature or other forms of radiation on fruit flavour. It would also be useful to expand on the role of cover crops in vineyards.

Recommendation 3: expand the literature review

Data Collection

The trial is well designed for the traditional measurement of soil water content and soil organic matter etc, the trial would be improved by including a treatment mimicking the traditional flood irrigation treatment to define the difference in vineyard soil and canopy temperatures between flood and drip /

trickle irrigation systems. One suggestion is to use a hose to put water on a couple of plots – two plots would probably be enough.

It was also suggested that the level of soil and canopy temperature measurement be increased to 3 reps to better monitor variability in temperature across the trial area and to minimize the potential for lost data through equipment failure. Thermocouples are cheap to make, and CSE can provide multi-channel Campbell Scientific data loggers for use in the trial.

Recommendation 4: include a treatment mimicking traditional flood irrigation.

Recommendation 5: use more replication for soil and canopy temperature measurements.

Conclusion

It was clear that a lot of thought and consultation has gone into the covercrop trial. Incorporating the recommendations will clarify the research question(s). It will also give a well written document that will form the basis for later reporting in either the popular viticultural press, or in the scientific literature.

Research often raises as many questions as it resolves. It would be useful to review the results at the end of the season, looking to see what data were expected, what were unexpected, and what were questions that should have been asked but weren't.

Appendix 2: Semi-structured questionnaire

Objective of questionnaire:

- *The objectives of the questionnaire are to work out the characteristics of people involved in on farm research;*
- *To look at the participatory process being used, and to classify it according to Probsts typology, or to develop a new one*
- *To discuss the participatory process being used to answer the following questions:*
 - *Can the participatory process be made more effective?*
 - *What would the recommendations be?*
 - *Can the science be made more rigorous?*
 - *What would the recommendations be?*

- *Who is participating in the on farm research process*

Questions

1. How long have you been involved in winegrape industry?
Were you born into it? Did you come into it from the outside?
2. Do you have the ability to make decisions on your property? – or does your father, parents, wife make the decisions collectively?
3. What attracted you to on farm research?
4. What do you expect to get from it?
5. What trial are you undertaking? Has anyone helped you with this – how?
6. What would you need to see from your trial to make a change in your management practices?-tease this one out a bit.
7. What results would you like to see from the trial?
8. How do you feel when the trial does not produce the results that you had expected?
9. What do you do next?
10. Is research done on your own or your neighbors farm more believable than research done on a research station? Why or why not?
11. Has any training in research been offered to you?
12. If yes, how did you find it?
13. If no, what would you like the training to cover?
14. Have you designed and run any trials on your farm as a consequence of that training?
15. When making a decision to implement changes from trials reported in the literature eg Grapegrower and Winemaker, what makes the research relevant to you?

Do you have any burning issues – things that you would like to see more research on?

Appendix 3: 4th International Crop Science Congress, Brisbane, 2004 Poster

sustainable agricultural systems

Farmer-Led On-Farm Trials: Problem or Solution?

Jane Fisher^{1,2} and Peter Carberry^{1,2}

¹CSIRO Division of Sustainable Ecosystems, P.O. Box 102 Toowoomba, Qld,

Australia 4350 www.csiro.au Email Jane.Fisher@csiro.au Email

Peter.Carberry@csiro.au

²Agricultural Production Systems Unit, P.O. Box 102 Toowoomba, Qld, Australia

4350 www.apsru.gov.au www.farmscape.cse.csiro.au

BACKGROUND

Over the last 10 years, farming systems research in Australia has become increasingly participatory, with grower groups obtaining funding to run trials on local issues. Carberry (2001) expressed concern that the increased relevance of trials to farmers as they moved from research station to properties had been accompanied by a decline in rigour. This study reviews the processes, learnings and impacts of farmer-led participatory on-farm trials (POFT) in the grains, wine-grape and sugar industries, using evaluative inquiry and action learning methodologies to evaluate the roles and merits of both scientifically rigorous and locally relevant trials.

OBJECTIVES

The objectives of the project are to:

- Work with pro-active farmer groups to enhance the design, implementation and evaluation of farmer driven research, development and extension (RDE);
- Review activities and develop recommendations to improve processes, learning and impacts;
- Validate the recommendations by working with researchers and farmer groups who have adopted these recommendations



Figure 1: Industry interaction will lead to shared insights about processes for trial design and implementation.

The participating industries are at different stages of development of on-farm trials. Grains groups have been running trials for a number of years, the winegrape industry began in 2000, and the sugar industry is in its infancy. Evaluation of the co-learnings and cross fertilization between the farmer groups and the participating industries will enable identification of elements crucial to the success of the on-farm trial process, and to the viability of the appropriate industry.

REVIEW OF ON FARM TRIALS

A review of on-farm trials has been undertaken for both the wine-grape and grains industries. A framework was developed against which the available trial results were evaluated. Using the model suggested by Petheram (2000), trials were ranked on rigour and relevance, according to whether they were designed and implemented by farmers or researchers (Figure 2). The data show a spread of rigour and relevance between

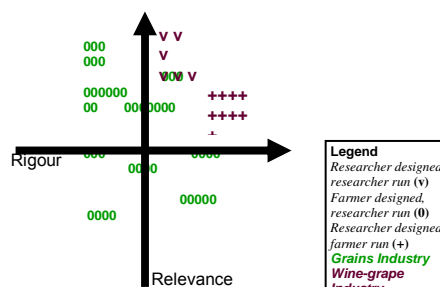


Figure 2: Analysis of industry literature shows a spread of rigour and relevance in the wine-grape and grains industries.

CONCLUSIONS

The participants at the two workshops associated with the project have concluded that:

- Participatory on-farm trials cover a range of activities, and have no one set way of implementation;
- On-Farm Research may be either formal or informal. It is important to be discerning in a review process;
- The starting point for participatory on-farm research is defining and developing a shared mental model between participants.

Future work in the project will attempt to quantify the value of on-farm research to solving scientific problems for farmers, whether the trials be run by scientists or farmers.

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