Developing an integrated cropping-systems RD&E program for the sugar industry

Allsopp, PG
DEVELOPING AN INTEGRATED CROPPING-SYSTEMS RD&E PROGRAM
FOR THE SUGAR INDUSTRY

by
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PR08001

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SUMMARY

The project aimed to develop industry-wide integration of cropping-systems RD&E to maximise effectiveness and efficiency of industry RD&E expenditure and expertise.

Two activities were held:

- A facilitated 2-day meeting of key cropping systems players representing major organisations. Short presentations were made on current projects to identify the current programs of work and gaps and synergies were identified.
- Informal meetings of a small group interested in pursuing common goals to digest the outcomes from the 2-day meeting and develop an outline of the integrated RD&E vision.

No formal driver for an overarching joint-venture model was identified – institutions have different foci and need to keep their ‘independence’. The participants identified that engagement should be on a project-by-project basis and with some co-location and with industry better defining what RD&E it needs and a more active brokering role from RD&E funders. Cropping systems RD&E should focus on four areas:
  - Conventional farming systems;
  - The ‘new’ farming system
  - Integration of sugarcane with alternative crops
  - Development of systems for production of sugarcane for non-sucrose uses, eg ‘energy’ canes.

In conventional farming systems RD&E needs to focus on the E component, in new farming systems the focus needs to be on the D and E components, whilst in integration of sugarcane with alternative crops and in the development of alternative-use sugarcane crops the emphasis needs to be in the R and D components. Sitting above these is the need to reduce the industry’s environmental footprint and to minimise input costs.

Meetings such as this workshop were seen as useful forums for updating others on what is happening, developing closer personal contacts, and developing new collaborations and ideas. These need to be repeated regularly, perhaps annually.
1.0 BACKGROUND

Sugarcane cropping systems RD&E is highly fragmented. There are some good relationships, usually based on close personal contacts. However, the main providers (BSES Limited, Queensland DPI&F, CSIRO Sustainable Ecosystems, Queensland NR&W, National Centre for Engineering in Agriculture (NCEA) and CSR) have limited knowledge of each other’s goals, resources and activities. They generally seek concerted action only on specific projects, and usually in the brief period following an SRDC funding call. This restricts them, and the sugar industry, from making best use of their limited resources.

BSES has recently moved to better integrate its cropping-systems research with extension as its QCrops program. ‘New’ players, such as regional NRM bodies and WWF, who have a growing interest in sugar-industry cropping-systems research, find it difficult to form the partnerships necessary for impact in this scattered cropping systems landscape. Integration of the BSES QCrops program with activities being undertaken by a wider range of RD&E players will logically enhance delivery of R&D outcomes to industry end users.

The BSES-CSIRO joint venture on plant improvement, the now-defunct Sugar Yield Decline Joint Venture and the CRC for Sugar Industry Innovation through Biotechnology provide excellent examples of how, by coordinating activities across organisations, the industry can enhance the use of its human and financial capital. This will become increasingly important in cropping systems RD&E, for which a looming skills shortage and limited institutional support make it critical that existing resources are used efficiently. This can only occur if RD&E providers have a common view of industry needs and coordinate their responses via shared goals and implementation pathways. This will inform both the tactical (project design) and strategic (staff levels and skills mix) decisions required to effectively meet the ongoing RD&E needs of the sugar industry.

2.0 OBJECTIVES

SRDC and BSES co-funded project BSS314 Developing an integrated cropping-systems RD&E program for the industry aims to develop a plan for delivering coordinated cropping systems RD&E to the industry, based on industry consultation and institutional buy-in. Two sets of activities were undertaken:

- A facilitated 2-day meeting of key cropping systems players representing major organisations. Short presentations were made on current projects to identify the current programs of work and gaps and synergies were identified.
- Informal meetings of a small group interested in pursuing common goals to digest the outcomes from the 2-day meeting and develop an outline of the integrated RD&E vision.

The activities and outputs of the process are described here.
3.0 FACILITATED MEETING STRUCTURE

The 2-day meeting was held on 18-19 June in Brisbane and facilitated by Denis Loney of Corporate Context. Attendees (an invited group providing a compromise between having a workable number of people, and covering all disciplines, all organizations and all projects) were:

- BSES – Peter Allsopp, Bernard Schroeder, Peter Samson, Barry Salter, Barry Callow, Rob Cairns, Cam Whiteing, Marian Davis, Toni Anderson
- CSIRO Sustainable Ecosystems – Peter Stone, Peter Thorburn, Rob Bramley, Steve Attard
- CSR Sugar – Andrew Wood
- Queensland DPI&F – Mike Bell, Neil Sing, Vicki Battaglia
- Queensland DNRW – Phil Moody
- National Centre for Engineering in Agriculture (NCEA) – Erik Schmidt, Craig Baillie
- Terrain NRM – John Reghenzani
- CANEGROWERS – Tim Wrigley
- SRDC – Bianca Boseley

Others, for example ASMC, were invited but could not attend.

The first day was mainly devoted to a welcome, summarising organizational and program objectives and brief project descriptions so that all knew what was being done and in what context. To make best use of the time available, attendees were asked to summarise projects by:

1. Identify the area(s) that best describe the nature of the program/project, and
2. Preparing a short (no more than five slides) PowerPoint description of the program/project for presentation at the workshop, using the headings:
   - Area that best describes the program/project
   - Program/project
   - Participants
   - Organisations
   - Objectives
   - Planned outputs
   - Extension linkages

The day ended with a set of observations from the group as a whole.

Day two focused on future R&D needs and major priorities, major opportunities for coordination and integration, recommendations on methods for integration, and the next steps for advancing integration. We used a three-group format with two report-back and discussion sessions.
4.0 DISCUSSIONS

4.1 Day 1

Peter Allsopp outlined the aim of project BSS314 – to develop industry-wide integration of cropping-systems RD&E to maximise the effectiveness and efficiency of industry RD&E expenditure and expertise – and the process involved (Appendix 1).

Aims and targets of SRDC, BSES’ Improved Cropping Systems program, CSIRO Sustainable Ecosystems’ sugar program, NCEA, Reef Rescue and FutureCane, and Terrain were presented by Bianca Boseley, Bernard Schroeder, Peter Stone, Craig Baillie, Neil Sing and John Reghenzani, respectively (Appendix 2).

Major points from these were (including my interpretations):

- SRDC’s capability to fund new projects will be reduced – larger, high-impact projects will be favoured, but, perhaps, cropping-systems projects will find it difficult to generate enough of the ‘Wow’ factor to secure funding
- BSES has the widest capability in cropping systems, through harvesting, and nutrient, pest, disease, weed and water management, and a focus on packaging R&D outcomes for delivery to industry
- QDPI&F R&D capability will focus on the integration of sugarcane with alternative or competing crops
- CSIRO will focus on providing underpinning science to address national priorities (in sugar, particularly off-site impacts on national assets) – this will change their relationship with the sugar industry and require industry to cover salary and operating costs
- NCEA has capabilities in enabling technologies and machinery-based systems
- BSES is the lead organisation for extension – this is complemented in the area of new farming systems by the QDPI&F component of FutureCane
- Reef Rescue program is likely to require input from industry and NRM bodies, although the final form is not yet known

Then followed an outline of RD&E programs currently underway within the different organisations. These were grouped to reflect the different foci and concluded with a set of proposed new initiatives. The presentations (Appendix 3) were:

- Farming systems – BSES – Salter
- Farming systems – QDPI&F – Bell
- Nutrient management – BSES – Schroeder
- Nutrient management – CSE – Thorburn
- Atmospheric N – Terrain – Reghenzani
- Pest management – BSES – Samson
- Weed management – BSES - Callow
- Water management – CSE – Attard
- Water management – BSES/Canegrowers - Davis
- Precision agriculture – CSE – Bramley
- Engineering – BSES – Whiteing
- Engineering – NCEA – Baillie
- Extension – BSES – Cairns
• FutureCane – QDPI&F/BSES – Sing
• New developments
  o Remote sensing – DPI&F – Bell
  o Eco-accreditation – Terrain – Reghenzani
  o Energy Cane – Terrain – Reghenzani

Observations of day 1 were canvassed from all participants and grouped under a set of headings:

• **Program efficiency**
  o There have been significant changes within the sugar industry over the last 40 years. In the early days, expertise was all in-house.
  o Expertise and knowledge is diluted and lost by lack of funding and by moving individuals to other organisations.
  o Things have not changed very much, i.e. canegrub projects – why is this work still needed as this research was established in the 1990s? – dynamic system
  o Is it too patchy ‘bits and piecey’
  o Is it too researcher driven? Or is it someone saying I really want “service X”?

• **Integration**
  o Collaboration occurs when people want to collaborate
  o What is the value of working together?
  o Collaborative working is already in place / Good collaboration at grass roots level / Do need to realise that there is a lot of interaction going on
  o Coordination could be better in many ways – limited amount of funding available for R&D. We are all competing for the same funding which is becoming more limited
  o Skills set mixed both across organisations and within organisations - which ones are missing? Are there problems in particular areas/fields? If so, are they fixable?
  o Integration is a key driver for moving forward
  o Are we making sure that the impact of each research project is integrated, i.e. does Project A link to Project B?
  o YDJV provided a model but this model could be improved upon
  o Where is the next joint venture going to come from? Restricted due to the difficulty with the provision of funding for each organisation and resource management.

• **Usefulness of networking/information gathering**
  o Broad range of skills and the knowledge of what other organisations are doing - this might assist in future projects
  o Find out more about what others are doing
  o CRCSIIB used to have annual meetings which were also good venues for networking and information gathering. Served as a stimulus for collaboration and cooperation
  o Institutional foci vary and this is a proactive element. However, if it is not viewed as proactive it can be seen as a negative influence
• **Increasing adoption**
  - Non-adoption versus rapid adoption of practices is a money issue
  - Individual growers will not adopt the practices required to monitor canegrubs, so is there a role for an outside consultancy?
  - Need to package knowledge – but differentiate between package and dissemination of information.
  - Too great a reliance on individuals in the sugar industry – this skill is lost when a person leaves the organisation
  - Opportunities of bringing differing elements of research together?
  - Find a way to deliver a cane growing system as an integrated package rather than in individual elements.

• **Funding**
  - Not very much duplication of research projects – a positive outcome
  - Investment funding on the decline
  - How do you stop doing what you don’t want to do anymore?
  - Needs agency to assist in coordination of projects.
  - Different approach to funding, i.e. SRDC commissioning work once review of the expertise in this field has been audited. Rather than competition for the funding among individual organisations
  - Do we sell ourselves sufficiently well to secure funding? Review of R&D found that $1 invested gave $7 return for the industry
  - NRM push coming along there could be some dollars in this we should have a coordinated to approach to making the best out of this for the industry
  - Organisations such as CSIRO will require full salary, operating, etc, to come from external funding, i.e. they will not co-fund these components

• **Recruitment and retention**
  - Attracting people and succession planning for the sugar industry is a huge problem
  - True succession planning is not happening with the industry
  - In terms of succession planning - stop talking about do it and just do it

• **New research**
  - Engineering element to enhance overall projects is an opportunity for NCEA
  - Blue sky and technology-enhancing projects - need to focus some on these
  - Make greater uses of the resources within the sugar industry
  - Varieties and matching to farming systems could be linked together with physiology work.
  - Nitrogen approaches – three different projects of note already discussed today
  - Root systems of cane is a little researched area
  - Gap in soil biology and roots in future farming systems – skills are short and difficult to find – this needs to be addressed

• **New challenges**
  - How do we marry the NRM focus with the profitability and maintaining the viability of farms? This is collectively our greatest challenge. There has to be common goals between these two areas
4.2 Day 2

In day 2, participant groups were asked to firstly to:
1. Identify future R&D major opportunities
2. What do you see as major opportunities for coordination/integration of R&D?
3. What methods for coordination/integration could be used?

Report-back presentations from each group are given in Appendix 4.

Comments arising from discussion of syndicate group views

Group A
- NRM bodies to feedback to other organisations
- Looking for unbiased capacity of an organisation – SRDC is an existing established structure which is why it was targeted as an organisation to use to coordinate research
- GRDC openly commissions projects, call and priority areas, scoping ideas (perhaps a new project may come out of this over time)
- If you commission research within a core theme for along period of time and a continuity of funding, you have an ability to look into the long term, maintain people and sustain continuity and momentum. Length of time of projects could be reviewed
- Effort generated into project proposals – inefficient and time consuming. This is why commissioned research could be an improved approach.

Group B
- Packaging – how do we get all the great work into extension and disseminated in field
- Projects addressing issues with collaborators identified – this could be done now
- Process of Sugar R&D Plan – ASA Committee target is to develop a plan, but they have been looking at the structure as a priority and not looked so closely at the plan as yet. Need a plan and structure before you will achieve alignment.

Group S
- Impact of cropping systems research can be stronger than varieties research, i.e. fuel usage per hectare if it is reduced has a huge economic impact on growers
- Have we sold ourselves well enough – and if we do this better is the funding environment likely to be better?
- Survey BSES did with 400 cane growers – everyone knew BSES produced varieties, but growers did not connect that BSES was involved in nutrition, pests, etc. Is this because we had not sold this enough?
- Problem with selling yourself is that you need to know your target audience. This difficult, as each audience you target will be impacted by different ideas
- How do we package things? It is a key question to address.
- There are some organisational barriers to discussing R&D

Adopting BMP – is this going to deliver NRM outcomes? Everyone is hoping that they will overlap and this is an assumption
• We need to change the environment under which we operate in order to move forward.
• This involves a behaviour change in growers and there is resistance by some growers to this.
• Change is occurring and it is important not to forget this – it may be rate of change that we need to focus on and not volume.

**Broad comments, observations and conclusions**

- Climate change not mentioned at all by any group – despite it appearing in some organisations’ key focus
- People struggle with climate change as an issue – how do you respond in a 5-10 year project cycle when climate change is a longer term issue, i.e. over 50 years.
- Climate change often addressed in a hidden way in new farming systems and water-use efficiency projects rather than as a direct approach to climate change.
- We have a client base but we struggle to identify our needs and how we add value
- Strategic Plan – strategic approach to R&D required
- Disparate clients - disparate needs
- How important is the ASA Committee in answering some of these questions? Should these questions from the workshop be fed to the Committee to address?
- YDJV was successful because it started with a perceived issue. So, if you use an issue-based approach you have more chance of success, even if you don’t know where you are going.
- More expansive vision but with better focus
- Common driver will be production
- Food producers and energy capturers – we need to collaborate and integrate with these areas to expand the ‘cake’ for sugarcane growers – these areas are interwoven
- Active facilitation and coordination of R&D is wanted, whether SRDC is the organisation to achieve this or not (but not to define the direction of the research)
- How does the industry give guidance to SRDC regarding the research the industry would like? They used to have regional industry meetings. How do we get more buy in from everyone to set the direction of research?
- SRDC supports the production of regional plans but they cannot set this direction. However, SRDC could assist like CRDC does in the cotton industry in setting this direction.
- Brokering role for research is an ideal role for SRDC - SRDC does already have a coordination role but often this is after the expressions of interest have been received.

### 4.3 General summary of both days

- **R&D priorities**
  - Sustainable sugarcane industry with different products as part of a complex of crops sustaining local communities
    - NRM outcomes
    - Profitability and productivity
    - Inter-related components
    - Changing economic and climate environments
– Difficulty in getting change
– Need to grow the RD&E cake

**Opportunities**
- Systems analysis of benefits of alternative products from cane, particularly ‘energy’ canes
- Novel techniques for gathering, interpreting and disseminating information about sugarcane crops to aid management
- More diversified cropping in cane areas – integration options in the whole farming system
- Most appropriate natural resources management and overall farm management that ensure viability and reduce environmental footprint
- Packaging information to make it more useful
- Better understanding of basic capability of the sugarcane plant and of the interaction of plant, environment and other biota needed to underpin new advances

**Methods**
- Better ‘brokering’/commissioning in the development of new projects
- Need clearer directions of what industry wants/needs are – but with regional input
- Funding needed over broad areas over longer time frames
- At project level, relationships are the driver for integration, but helped by brokering
- At higher level, there is no driver for more formal arrangements, except for co-location
- Research providers such as CSIRO will require funding providers to fully fund salaries, operating and travel

### 5.0 POST-WORKSHOP ACTIVITY

Given that the workshop did not identify a driver for more formalised arrangements among RD&E providers, so ‘formal’ meetings of “a small, representative working party” envisaged in the project proposal were not undertaken. There were, however, informal discussions among participants on the outcomes of the workshop and how these might be progressed. These concluded:

- There is no formal driver for an overarching joint-venture model similar to the BSES-CSIRO variety improvement joint venture. Rather there should be a range of engagement arrangements on a project-by-project basis and with some co-location.

- The ‘industry’ needs to develop a clear vision of what it wants from RD&E and the important issues that need to be addressed – this is potentially a role for the Australian Sugar Industry Alliance. It is then up to the RD&E organisations to address these needs.
• Funders should move to commissioning/brokering more RD&E over broader areas with timeframes longer than 3 years – this is a role for SRDC.

• Cropping systems RD&E should focus on four areas:
  o Conventional farming systems;
  o The ‘new’ farming system
  o Integration of sugarcane with alternative crops
  o Development of systems for production of sugarcane for non-sucrose uses, eg ‘energy’ canes.

• If RD&E is viewed as a continuum of activities, then in conventional farming systems this needs to focus on the E component, in new farming systems the focus needs to be on the D and E components, whilst in integration of sugarcane with alternative crops and in the development of alternative-use sugarcane crops the emphasis needs to be in the R and D components. Sitting above these is the need to reduce the industry’s environmental footprint and to minimise input costs.

• Outcomes need to be packaged much better and their impacts need to be promoted better to the industry to demonstrate value.

• Meetings such as this workshop are useful forums for updating others on what is happening, developing closer personal contacts, and developing new collaborations and ideas. These need to be repeated regularly, perhaps annually.
### APPENDIX 1 – Welcome presentation

<table>
<thead>
<tr>
<th>Integrated cropping-systems program</th>
<th>Developing an integrated cropping-systems RD&amp;E program for the sugar industry</th>
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<tbody>
<tr>
<td><strong>Aim:</strong></td>
<td>Develop industry-wide integration of cropping-systems RD&amp;E to maximise the effectiveness and efficiency of industry RD&amp;E expenditure and expertise</td>
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<tr>
<td><strong>BSS314</strong></td>
<td><strong>Why?</strong></td>
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<tr>
<td><strong>Why?</strong></td>
<td><strong>Why?</strong></td>
</tr>
<tr>
<td>- Sugar cropping systems RD&amp;E is highly fragmented</td>
<td>- 'New' players, such as NRM groups and WWF, who have sugar interests find it difficult to form partnerships necessary for impact in this scattered landscape</td>
</tr>
<tr>
<td>- Some good relationships</td>
<td>- Benefits of industry coordination obvious in BSES-CSIRO plant improvement and CRC-SilB</td>
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<tr>
<td>- Main providers (BSES, QDPI&amp;F, CSE, QDNR&amp;W, NCEA, CSR, etc) have limited knowledge of other's goals, resources and activities</td>
<td>- Time for cropping systems to be better integrated</td>
</tr>
<tr>
<td>- Generally, come together only on specific projects</td>
<td>- Looming skills shortage</td>
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<td>- Often come together only for a brief period following SADC funding call</td>
<td>- More difficult institutional support</td>
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<tr>
<td>- Needs integration across disciplines</td>
<td>- Need to 'package' for extension</td>
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<tr>
<td>- BSES integrated cropping systems with extension as QCrops – need to integrate that with other providers</td>
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<table>
<thead>
<tr>
<th><strong>How?</strong></th>
<th><strong>Will it make a difference?</strong></th>
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</thead>
<tbody>
<tr>
<td>- This meeting</td>
<td>- Hopefully!</td>
</tr>
<tr>
<td>- Identify scope of current programs of work</td>
<td>- If organisations are committed, then:</td>
</tr>
<tr>
<td>- Identify gaps and synergies</td>
<td>- We'll have learned to work together better</td>
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<tr>
<td>- Identify new areas/opportunities requiring RD&amp;E</td>
<td>- High-level support from our 'masters' for a coordinated approach</td>
</tr>
<tr>
<td>- Develop an integrated RD&amp;E vision with a smaller, representative group – next few months</td>
<td>- Planning using an agreed coordination framework – better planning</td>
</tr>
<tr>
<td>- Recommend how this can be formalised and progressed - by end August</td>
<td>- Best-possible leverage for RD&amp;E investors</td>
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<td></td>
<td>- Better packaging of R&amp;D results for extension and adoption</td>
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APPENDIX 2 – Organisational aims and targets presentations

**Sugar Research and Development Corporation**

Government & industry priorities
R&D investment strategy

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**Key drivers for a future industry**

The Australian sugarcane industry is strongly influenced by:
- globalisation and competition;
- climate change;
- societal pressure to be more environmentally and socially sustainable;
- safety and health implications of processes and products;
- human capital;
- and the availability of new enabling sciences and technologies.

2018 SRDC Regional Workshops

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**R&D Investment Strategy**

- **Regional Futures** (Resource Allocation 69-65%)
  - Implementation of innovative, farming, harvesting, transport, milling and marketing systems
  - Tailored to the needs and opportunities of each region
  - Delivery of enhanced economic, environmental and social performance

- **Emerging Technologies** (Resource Allocation 20-25%)
  - Rapid translation of relevant frontier technologies
  - High risk, long timelines and potentially high payoffs
  - Enhancement of the sugarcane industry’s competitive edge in the global market place

- **People Development** (Resource Allocation 15-20%)
  - Building capacity for change learning and innovation
  - Development of individuals and networks across the sugarcane industry and research community

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**08/09 New Investment by Arena**

- **Regional Futures** 58%
- **Emerging Technologies** 28%
- **People Development** 14%

Note: Percentages are based on budgeted new 08/09 investment for Research projects alone

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**08/09 New Investment by project type**

- **Research Projects** 72%
- **TLCPs** 13%
- **GGIPs** 12%
- **Scholarships** 6%

Note: Percentages are based on budgeted new 08/09 projects alone and do not factor in ongoing budgets of continuing projects

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**SRDC challenges & future approach**

- **Dramatically reduced budget**
  - 40Mt crop reduced to 32Mt crop
  - zero deficit budget going forward

- **Bigger research projects needed**
  - high overhead costs with many small research projects
  - need ‘big’ projects with high potential return
  - re-evaluation of entire project portfolio

**New call for projects to be approved by Board in July**
- Expected that Research projects, TLCPs, GGIPs and scholarships will be called for.

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**New SRDC Board**

- Mr Tim Knap AM (Chairman)
- Dr Peter C Behnke (Executive Director)
- Mr David Ousby
- Mr Michael Braude
- Mr David Campbell
- Ms Caroline Cappo
- Mr John Ellers
- Ms Angela Williams
# IMPROVED CROPPING SYSTEMS PROGRAM

**Objective**

Development of appropriate farming systems packages that contribute to improved sugarcane productivity, profitability and sustainability.

- Improved farming systems
- Integrated weed management
- Integrated pest management
- Improved harvesting practices and engineering enhancements
- Sustainable nutrient management
- Effective irrigation and drainage (mostly extension orientated)

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### BSES participants

**Agronomy:**
- Alan Clark, Glen Park
- Alan Hurley
- Graham Kingston, Monica Amirk
- Barry Salter, Jason Perma, Emilie Fillola
- Bernard Schroeder, John Panitz, Phil Nietz
- Barry Callow

**Entomology / Pests:**
- Peter Samson, Tim Stibor, Allen Eaton
- Keith Chandler, Research Assistant (vacant)
- Mohamed Ballam
- Brendan Dyer (fat management)

**Engineering:**
- Cam Whitton, Research Engineer (vacant), Technician (vacant)

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### Strong linkages to extension

- Individual projects often have extension, delivery and adoption phases.
- Extension officers linked to various sub-programs and projects.
- Recent appointments of extension agronomists (John Panitz and Barry Callow)
- Contribution to BSES Strategic Plan Action 4 objectives:
  - 80% of cane produced with best-management practice by 2009.
  - 20% increase in sugarcane yield by 2009.
  - Regional targets achieved for adoption of improved technologies that deliver benefits to industry.
CSIRO & sugar farming systems R&D

Peter Stone
Program Leader, Agricultural & Tropical Landscapes Program, CSIRO
18 June 2003

What is CSIRO here for?

CSIRO exists to undertake scientific research to:
- Assist Australian industry
- Further the interests of the Australian community
- Help to meet the national and international objectives of the Commonwealth
- Do whatever the Science Minister wants, including encouraging & facilitating the use of research

Our effort must materially contribute to these goals

Science and Industry Research Act, 1945

How do we plan to do it? - CSIRO's Strategic Plan

1. Address national challenges & opportunities faster and better
2. Focus and strengthen our core science capability & delivery
3. Strengthen our enterprise and enhance our operational excellence

If our effort doesn't meet these criteria, it ceases

Our modus operandi

- Salary & operating: industry partner pays
- CSIRO does not pay for salaries or operating
- co-investment demonstrates industry bona fide
- co-investment strengthens path to impact

Total cost of CSIRO research project

- Divisional overheads
- power
- phones
- buildings
- Corporate overheads
- computers
- libraries
- CSIRO cannot participate in work unless it receives funds to cover salaries and operating

The need for impact

1. CSIRO is a national organisation
2. It assesses the impact of a given body of science against a wide range of national possibilities
3. 20 years of sugar research has delivered patchy impact
   - Significantly influenced the science agenda
   - Limited practical impact
4. We are currently assessing that impact against alternative use for our people and $$$
5. That could change the nature of our relationship with the sugar industry

Prospects for impact

1. CSIRO attempts to provide underpinning science for others to interpret and apply
2. We prefer the use of existing delivery networks to deliver impact
3. Short-term planning horizons and the pursuit of private benefit reduces the relevance and potential impact of underpinning science
4. Existing delivery networks are primarily concerned with shorter term profitability

Impact is more project-specific than structural

Our future role in sugar R&D

1. The "national challenge" relating to sugar is primarily one of its impact on the environment
2. The off-site impact of nutrient, chemical and sediment flows on national assets warrants attention
3. We will seek to participate in projects that address these issues
4. Research informing regulations and incentives may become as prominent as farm practice research

We will engage in projects where the path to impact is clear & consistent with national priorities

Thank you
BSES Integrated Cropping Systems (ICS) R&D Workshop
Craig Baillie & Erik Schmidt

NCEA Key Program Areas - Non Sugar
- Enabling technologies (Machine Vision)
- Irrigation Management
- Machinery Based Systems

Machine Vision
AgVision Agricultural Guidance Systems (AusIndustry)
Development of low cost guidance technologies for agricultural vehicles

Machine Vision cont...
Macadamia Yield Monitor (HAL)
Imagery analysis techniques to count nuts collected on a pin wheel macadamia nut harvester.
- Fusion of multiple low cost sensors
  - vision sensors, ground speed radar, radio frequency identity tags, and GPS.
- Mapping
  - Incorporation of the information into freely available forms e.g. Google Earth (e.g. yield map colour overlay)

Irrigation Management
Real Time Automatic (Adaptive) Irrigation Control (CRDC; CRCIP; Cotton CRC)
Sensing, Decision Support and Control

Machinery Systems
Harvesting & Post Harvest
Harvester performance (SRDC) optimisation i.e. feeding material, cleaning, handling and processing
Grain Drying Modelling (GDPi)

Machinery Systems cont...
Biomass Chipper (RIRDC)
Improved energy efficiency and better chip quality from mallee eucalyptus harvester.

Machinery Systems Other Opportunities
Minimum Tillage
Planting (minimum tillage)
Development of minimum tillage equipment to support farming systems research, i.e. new farming system.
Reef Rescue

Objectives
Gain faster adoption of best management practices to improve the condition of regional natural resources.

Planned outputs
Through industry monitoring, maps and records of adoption of best management practices demonstrating that the investment was worthwhile.

Extension linkages
Ensure a close relationship between participants and adequate investment in extension to deliver on the incentives effectively.

REEF RESCUE INCENTIVES

Area:
Gaining faster adoption of best practice in industries feeding into catchments adjacent to the Great Barrier Reef by the use of financial incentives for growers

Participants/Organisations
Industry, regional NRM bodies, extension deliverers, Federal and State government and farmers. Final form not yet signed off

Area: Environmentally, economically and socially sustainable sugarcane industries in FNQ

Projects:
1. Atmospheric N fixation
2. Eco accreditation for premiums
3. Energy cane for paper pulp
APPENDIX 3 – Program presentations

**Improved cropping systems – Barry Salter**

**Program/Projects:**

- **Farming systems (SYDJV)**
  - Small plot trials (tillage x row spacing; fallow species x tillage x N)

- **Variety x Row spacing**
  - Small plot trials (4 varieties x 3 row configurations; 48 clones x 3 row configurations)

**Participants and Organisations**

- **Farming systems**
  - BSES QCrops
  - Mike Bell and FutureCare (DP&F)
  - Phil Dobson (DPIFW)
  - Graham Stirling
  - SRDC (Grower reference group)

- **Variety x Row spacing**
  - BSES QCrops
  - Vic Breeding (BSES QCrops)
  - Mike Bell and FutureCare (DP&F)
  - Geoff Mean-Bambia (CSE)
  - SRDC (Grower reference group)

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**Objectives**

- **Improve the sustainability of the industry**
  - Improved farming systems (soil health)
  - Better varieties (suited to improved farming systems)

**Planned outputs**

- **Variety x Row spacing**
  - Increased knowledge, outputs unknown, hopefully changes to the selection system

- **Farming systems**
  - Increased knowledge, outputs unknown

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**Extension linkages**

- **BSES extension and productivity services**
  - Shed meetings, general extension

- **Extension activities**
  - Information at shed meetings

- **SRDC extension projects**
  - New farming systems (BRS269)
  - Establishing the second crop cycle into permanent beds (BRS306)

- **SRDC Grower group projects**
  - Assistance to groups (trial design, data collection and analysis)
Sugar farming systems
Plant Science/Delivery, DPI&F

Farming systems & soil health work teams – 2 current projects

- Improving the integration of legumes in grain and sugarcane farming systems in southern Queensland – GRDC and SRDC (2008-2012)
- Healthy soils and sustainable farming systems for northern broadacre cropping industries – L&WA and GRDC (phase 2 ???)

Project participants

Burnett and southern coastal farming systems
J Barnes (PO4) - Kingaroy
N Haipin (TO5) - Bundy
W Rehein (OO3) - Bundy
G&M Stirling Biol Crop Prtnr - Brisbane
P Moody - NRWindoocoopility

Soil health
K Klepper (PO4) - Too ba
L Smith (temp TO3) - Too ba
D Lawrence (PO4) - TOO ba
N Seymour (PO4) - TOO ba
R Robson (PO4) - K'roy
N Christodoulou (PO4) - Too ba
P Moody - NRWindoocoopility

Cross regional technical support
G Harth (TO4) - Kingaroy
P Want (TO4) - Kingaroy

Objectives – farming systems

- Practical management strategies that maintain or improve soil health through optimisation of soil carbon storage, use of appropriate fertilisers and soil ameliorants and the minimal use of tillage. Rotation crop species that minimise soil biotic constraints will be assessed.
- Provide strategies and decision support tools that allow growers and advisors to optimise the choice and duration of crop rotations, tillage systems, residue management and land use mix to ensure profitable farm business returns.
- Guidelines for optimising the value of rotation crops to coastal sugarcane cropping systems, including development of reliable legume inoculant application strategies, soil ameliorant and species choice to avoid food safety issues and flexible agronomic strategies to maximise other system benefits.

Objectives – soil health

- Improved understanding of the contribution of different soil C fractions to the functions of a healthy soil.
- Developing a low cost diagnostic capacity to determine soil C fractions using MIR.
- Developing management strategies to maximise the retention of soil C in profitable cropping systems.
- Understanding the role of soil C and N dynamics in the development of suppressive soils.

Planned outputs

- Farming systems - Grain legumes and sugarcane are fully integrated in new profitable and sustainable farming systems, with management practices to optimise performance. The farming system is supported by skilled farmers and agribusinesses.
- Soil Health - The interaction of physical, chemical and biological components of soil health is better understood by growers and advisors, with soil C cycling and storage recognized as being one of the keys of a healthy soil.

Extension linkages (coastal)

- Locally in the coastal Burnett via grower groups (Target 100, SSPAg, Bundaberg Precision Farming Group, Grain in Cane Bundaberg, Maryborough 85in5)
- Statewide links via FutureCane (DPI&F and BSES)
- Agribusinesses, consultants and industry groups (AOF, PCA, BGA etc)
Sustainable Nutrient Management

Developing and delivering best-practice nutrient management guidelines: Australian sugar industry

Bernard Schroeder, Andrew Wood, Phil Moody, Barry Saltor, John Panitz, Alan Hurney, Jason Perma, Glen Park, David Calcino and Tim Wrigley.

Extension officers at various centres

Overall objectives (various projects)

- Modify general recommendations into soil-specific nutrient management guidelines for use at district level.
- Deliver the concept of sustainable nutrient management to industry – sets of district-specific guidelines, booklets.
- Facilitate the use of best-practice nutrient management on-farm – short-courses, nutrient management plans, demonstration strip-trials.
- Further refine system – take on board results from related work to ensure compatibility with the ‘new farming system’, on-going investigations, developing computer-based packages.

RD&E activities

Components

- Knowing our soils
- Establish soil reference sites
- Nutrient management guidelines
- Delivery process
- District-specific booklets
- Demonstration strip-trials
- Future developments

Delivery mechanism

SIX EASY STEPS approach

1. Knowing our soils.
2. Understanding / managing nutrient processes & losses.
3. Soil testing regularly.
5. Using leaf analyses to check on the adequacy of nutrient inputs.
6. Keeping good records

Nutrient management plans

Current and future developments

- Further refining modified nutrient management guidelines.
- Improving our knowledge on the constraints to the adoption of best-practice nutrient management.
- Facilitating the use of nutrient management plans at block and farm scales.
- Developing a Soil Constraints & Management Package (SCAMP).
- Assessing the risks of on- and off-site impacts (SafeGauge for Nutrients).
- Developing an integrated SIX EASY STEPS Nutrient Management Package (possible combination of the SIX EASY STEPS framework, NutriCalc, FertCalc, SafeGauge for Nutrients and a FEAT-based application).
- Input into investigations relating to Precision Agriculture (PA).
Tropical Landscapes
Sustainable Agricultural

Staff & scientific capabilities
- Peter Thorburn
- Sarah Park
- Emma Jakku
- Ian Biggs
- Tony Webster
- Jed Biggs
- Elizabeth Meier
- Karen Bees
- Soil science (climatic processes, hydrology, physiology, Modelling & prediction)
- Crop ecology, agronomy, climate change
- Sociology (science & technology uptake, Technology adoption)
- Plant physiology, biochemistry, soil biology
- Agronomy, horticulture, extension processes
- Modelling, chemistry
- Soil N & C cycling in the wet tropics: Measuring & predicting
- Sociology – barriers to uptake of sustainable farming practices

Outcome areas
- GBR Water Quality Improvement Plans
- Quantitatively evaluate impact of management practices on water quality, especially sugarcane
- Reducing environmental impacts of nitrogen fertiliser management
- Adopting techniques to increase uptake of sustainable practices
- Climate change impacts on sugarcane and horticultural industries
- Sustainability of sugarcane value chains
- Biofuel
- Greenhouse gas emissions and carbon trading

Partnerships
- SRDC
- BSES
- Sugar milling companies
- NRM Boards
- QUT-SRI
- JCU & UQ
- Canegrowers

Management practices for improving quality of water leaving Burdekin cane lands

Atmospheric N fixation

Participants
- (ARC Linkage Grant) TerrainU of Sydney/CANEGRROWERS/Pod services
- (Wider project) Extension/breeding/agronomy/milling/farmers

Objectives
- Isolate bacteria with responsive varieties
- Improve economics and energy efficiency
- Less N loss and improved crystal quality

Outputs
- A farming system needing 1/5 of current recommended rates without loss of production

Extension not an issue
BSES Pest Management – 1 of 5
Canegrub management in new farming systems (BSS265)
- **Who**: Samson, Chandler, Sallam - BSES; Bayer, Becker Underwood; Crop Care
- **Aim**: Provide cost-effective canegrub management in new farming systems.
- **Outputs**: Guidelines for grub management (e.g., influence of crop rotations, reduced tillage), insecticide efficacy data in NFS; monitoring procedure for canegrubs.
- **Extension linkages**: Related NFS projects, interaction with grower groups.

BSES Pest Management – 2 of 5
Risk assessment and decision support systems for greyback canegrub (BSS257)
- **Who**: Samson, Chandler, Sallam - BSES; FutureCane; Drummond – U Maine.
- **Aim**: Develop monitoring systems and tools to allow growers to make good grub management decisions.
- **Outputs**: Knowledge of risk factors, quantification of risk, framework for data collection, statistical predictive models, economic tools, new GrubPlan booklet, population model.
- **Extension linkages**: Productivity Services, BSES extension, direct to growers through GrubPlan.

BSES Pest Management – 3 of 5
Grower groups – canegrubs and soldier flies (GGIPs)
- **Who**: Samson, Sallam - BSES; growers at Mulgrave and Mackay.
- **Aim**: Work with growers to validate and improve greyback decision-making processes; validate and improve management options for soldier fly.
- **Outputs**: Improved grower knowledge/skills, grub management plans for farms, evaluation of effectiveness and economic feasibility of a grub monitoring/predictive service; directions for further soldier fly research (farming systems, varieties, insecticides).
- **Extension linkages**: Direct to growers.

BSES Pest Management – 4 of 5
New products
- **Who**: Chandler, Samson, Sallam - BSES, Crop Care, Sumitomo etc.
- **Aim**: Develop new products, mainly for canegrub control.
- **Outputs**: New insecticide registrations, product maintenance.
- **Extension linkages**: Often confidential for data protection purposes.

BSES Pest Management – 5 of 5
Rodent management - *Melomys*
- **Who**: Dyer - BSES
- **Aim**: Study habitat and dietary preferences, harboursages and migration times of *Melomys* spp.
- **Outputs**: Improved IPM strategy for climbing rats.
- **Extension linkages**: Close with Productivity Services (e.g., Rat Monitor, techniques, autopsies), BSES extension.
Integrated Cropping Systems
Brisbane-2008

**Project Description**
Development of an Integrated Weed Management (IWM) system for sugarcane farming systems.

**Participants/ organisations**
- BSES - Extension staff
- Grower participants, grower groups- e.g. canecheck, canetalk
- NRM groups- BMRG, BBIFMAC, MWNRM, TERRAIN.
- Agri-business representatives
- QDP&F- Burdekin
- SRDC- Travel and Learning.

**Objectives**
- Develop IWM systems which:
  - Facilitate the uptake of timely weed control techniques. (timing, early planning, weed ID)
  - Reduce reliance on herbicide technologies which impact on downstream aquatic ecosystems (application timing, weed control methods, drift management)
  - Minimise herbicide resistance development.
  - Reduce yield losses from weed competition

**Outputs**
- Reduce the weed seedbank and increase crop competition.
- Develop an "Easy Steps" guide to facilitate the planning and uptake of IWM programs on-farm.
- Improve regional productivity, profitability and sustainability for growers and millers.
- Reduce environmental impact of on-farm weed management practice.

**Extension linkages**
- Existing SLA and weed control initiatives
- Updated extension and advisory staff on
  - IWM techniques and outcomes
  - Application technology
  - Drift management
- Develop closer working relationships with NRM groups and agri-business sectors.
Cropping Systems Capability

Integrated Cropping Systems Workshop
18th & 19th June 2009
Bradford Conference Centre
Mt Coot-tha, Brisbane

Cropping systems monitoring & modelling

WaterSense

Delivering web-based irrigation scheduling (BRDC – B85297, June 09)
- BSSG – Tony Linville, Tony Anderson, Dave Burgess
- BSS – Mark Meares, Shane Sturley
- CSE – Geoff Bamber, Shaun Vanetti, Steve Atllad

Developing linkages (CRCF, June 2008)

Objectives
- Train a number of extension officers in WaterSense;
  - increase the number of irrigators in each region using WaterSense;
  - assess value of WaterSense to the sugar cane industry;
  - assess the commercial potential of WaterSense;
  - raise awareness of WaterSense across the industry.

Linkages:
- Nowra
- CRCUW
- Land and Water Management Plan
- Nobby Sugar

Output/Outcomes
- WaterSense is:
  - providing sensible, accurate & reliable information on crop water use;
  - quick and simple to use;
  - very helpful in limited water situations (there is no other tool);
  - helping to reinforce the fundamentals of irrigation SNIP.

Delivery method(s) for adoption
- CRCUW agree that WRU can assist farmers with compliance (e.g., Land & Water Management Plans)

Extension Linkages
- Each IC decides what is best for their region (Tablelands – weekly SMS text to 50 irrigators; Bundaberg – articles in local newspaper and industry publications)

Cropping systems monitoring & modelling

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Rural Water Use Efficiency

- Rural Water Use Efficiency started in 1999
- Three different Rural Water Use Efficiency programs have been run throughout this time
- RWUE3 is scheduled to finish in May 2009

Project Aims

- Improve water and environmental management in the sugar industry
  - Improve irrigation efficiency
  - Support nutrient management programs
  - Reduce chemical losses
  - Promote new farming systems
  - Assist in the development of Land and Water Management Plans and whole of farm plans

Achievements and Activities

- 60% of Bundaberg growers have completed a LWMP through the RWUE project
- 14 bores were installed, through the RWUE incentive, in the Burdekin to help reduce groundwater rise
- Water Quality kits and testing workshops distributed throughout the North and Central Regions
- Free leaf tests for growers who attend nutrient workshops in the north

Project Funding and Organisations

- Rural Water Use Efficiency is funded by the Department of Natural Resources and Water
- Funds are administered through CANEGROWERS
- Extension Services are coordinated and delivered through BSES Limited

Participants

- Primary Target: Growers to implement on ground changes
- Organisational Linkages:
  - Regional and State CANEGROWERS
  - National Centre for Engineering in Agriculture
  - Natural Resource Management Bodies
  - Department of Primary Industries and Fisheries
  - Department of Natural Resources and Water
  - Irrigation Association of Australia
  - CSIRO
  - Super Services
  - Target 100
  - NSW Department of Primary Industries
CSE022 - Background

- The sugar industry has been a rapid adopter of guidance technologies and has viable access to enabling technologies (e.g., GPS networks).
- Whilst machine guidance and controlled traffic certainly facilitate Precision Agriculture (PA), since neither require nor generate any spatial information other than GPS coordinates, they do not assist with agronomic decision-making and so are not themselves PA.

- Adoption of PA in the sugar industry has generally been ad hoc and has been poorly supported by appropriate technical expertise.
  - e.g., Yield monitoring.
  - Farmers want to know how to make appropriate use of the information provided by PA.

CSE022 - Objectives

- Coordinate and integrate an evaluation of PA technologies (i.e., yield monitoring and mapping) in collaboration with leading farmers, with emphasis on economics, case studies, communication and extension led by the key farmers;
- Provide the appropriate specialist integrative and interpretive skills to complement existing research and developing PA technologies;
- Provide input into investigations aimed at ‘ground-truthing’ apparent variability within specific blocks of sugarcane;
- Develop standardised data collection, management and analysis protocols;
- Improve capabilities of EOs and to provide technical support via links to appropriate specialists.

CSE022 Extension linkages / Outcomes

- A key first task will be meetings with stakeholder groups in the Herbert, Burdekin and Bundaberg regions.
  - Growers, Extension Personnel, Agriculture Business, Researchers (e.g., BPS001), Regional Groups (e.g., productivity services), etc...
- The research approach will be participatory and will involve on-going interaction with the above groups.
- Outcomes:
  - An enhanced knowledge and understanding amongst EOs and growers of the appropriateness of various PA applications for use at particular locations or for addressing particular problems, leading to
  - An increase in the number of EOs able to provide assistance on PA to growers, and
  - Enhanced adoption of PA throughout the industry.

CSE022 - Outputs

- Development of a core ‘centre of expertise’ for PA in the sugar industry.
- Advice on appropriate means of sugarcane yield mapping and the calibration of yield monitors with the mill weighbridge.
- Standardised protocols for PA data collection, management and analysis.
- Identification of areas requiring further RDE and development of coordinated proposals as required.
- Descriptions and reports of sugar PA case studies from the Herbert, Burdekin and Bundaberg regions including economic assessment of the merits of PA.
- Associated with all of the above, a communication plan covering sugar industry PA research.

Supplementary information
- e.g., Remote sensing, Digital elevation model, soil and drone testing, hull mapping (Grid 7), EMM 9, geostatistics 7, Crop assessment.

How precision agriculture works

Observation
- Yield map (or image 7)
- Crop movement

Interpretation

Implementation
- Targeted management plan

Evaluation
Engineering Program

Boosting industry viability through Harvesting Best Practice to reduce sugar losses and improve harvest efficiency

Engineering Program Areas

- Updating Harvesting Best Practice
- Harvester trials will be conducted in Burdekin, Herbert, Tully & Mackay by BSES and productivity board staff
- Develop HBP guidelines for newer harvesting technologies
- Promotion of new guidelines by engineering/extension staff will enable operators to reduce sugar losses at harvest

Engineering Program Areas

- Development of a single drum chopper system
- NSW Sugar, JCU, BSES Limited
- Aim: design/build prototype chopper with reduced sugar loss/billet damage at short billet lengths to improve bulk densities in a whole crop harvesting scenario
- Technology extended industry wide to minimise sugar losses

Engineering Program Areas

- Measurement of in-field sucrose loss by automated refractometry
- BSES Limited, QUT/SRI and CQU
- develop an accurate & mobile system for measuring harvesting losses infield
- Such a system could be used industry wide by extension staff to assess harvester performance and fine tune operations

Engineering Program Areas

- Harvesting Technology Review FSA001
- FSA Consulting, BSES Limited, Booker Tate
- Review of opportunities to improve the design and performance of sugarcane harvesters
- Will provide direction to SRDC on future funding needs/opportunities
BSES Integrated Cropping Systems (ICS) R&D Workshop
Craig Ballie & Erik Schmidt

NCEA Key Program Areas in Sugar

Precision Agriculture
- NCA010 Development of a precision spray system using image analysis and plant ID
- CS6022 A coordinated approach to Precision Ag R&D for the Australian Sugar Industry

Irrigation
- Canegrowers - Training & Tech Support to RWUE 3

On Farm Operational Energy Use (GHG)
- QFF - Opportunities to Enhance Energy Efficiency and Minimise Greenhouse Gas Emissions (GHG)

NCA010 Development of a precision spray system using image analysis and plant ID

Participants / Organisations
- Ian Dart, Mike Smith
- Bundaberg Sugar Ltd

Objectives
- Discriminate targeted weeds from sugarcane (shape, colour and spectral differences)

Outputs
- Field prototype image analysis system integrated with a spot spray platform
- Evaluation of field prototype under field conditions

Linkages
- Potential commercialisation
- Other opportunities to use skills for developing enabling technologies

Canegrowers – Irrigation training and tech support to RWUE 3

Participants / Organisations
- Joseph Evans, BSES RWUE 3

Objectives
- Add value to the sugar industry RWUE initiative by assisting in the implementation of improved irrigation system performance

Outputs
- Support irrigation efficiency field evaluations, irrigation system audits
- Support use of technologies at field sites and demonstrations
- Provide support and mentoring to sugar IDGs
- Assist in the delivery of research findings and training amongst grower groups

Linkages
- Industry service providers facilitated by BSES and Canegrowers

QFF - Opportunities to enhance energy efficiency and minimise GHG

Participants / Organisations
- Sugarcane, Horticulture, Cotton, Nurseries, Aquaculture

Objectives (Tactical)
- Review and assess available tools and technologies for on farm energy assessments
- Assess energy efficiency of current practices

Outputs
- Scope Prototype Energy Efficiency Toolkit
- Conduct On-farm Energy Assessments

Linkages
- QFF, Growcom, Canegrowers, QDO, QGII
Best Practice Extension

- Deliver tailored solutions to increase adoption of R&D by different customers in different regions to improve grower and miller profitability
- Achieve regional targets for adoption of improved technologies that deliver benefits to industry
- Agree and deliver specific productivity improvement programs for regions, mills and/or industry (Service Level Agreements)
- Actively market BSES value proposition
- Improve skills base of extension officers through targeted training

FutureCane

- Planned Outputs/Evaluation:
  - Area under new farming systems

- Extension linkages
  - DPI&F agronomists in four regions
  - BSES staff in all mill areas.
  - Links to SYDJVP & its successors.

FutureCane

Area:
Cane farming systems in Queensland focusing on:
- Controlled traffic
- Reduced tillage
- Legume fallows

Participants: BSES and DPI&F

FutureCane

Objectives
1. Promote economically and environmentally sustainable farming systems
2. Farmers make farm management decisions based on economic criteria.
Remote sensing capability
Andrew Robson, Healthy Soils and FutureCane agronomy teams

Individual fields from space

- False colour image: IR, Red, Green
- NDVI: IR and red bands. Ratio removes shading effects and highlights vegetation
- Classified Image: red indicates high nitrogen, green to blue indicate low

Detailed focus on a study region
eg. Maryborough
Quickbird multispectral satellite imagery (2.4m resolution)
- Satellite imagery to detect in field crop variability
- Soil health assessments to identify causes
- Zonal management options as part of a farming systems response

Soil constraints

- False colour
- NDVI
- Classified NDVI (white data sample area)

Biotic constraints/poor root health

- Commercial assays for nematodes and Pachymetra
- Interpretation difficult when root systems vary so much
- Often similar pathogens but much fewer/poorer roots in poor growth areas

Lodging

- False colour image
- Classified NDVI image
- Area lodged (black) is 0.32ha or 9.6% of the crop

Weed infestation

- False colour image
- NDVI image: weed infestation displays higher IR reflectance
- Area of weed infestation (white) is 0.15ha (5% of crops)

Varietal differences – a classification issue

- Different cultivars
- False colour image
- NDVI image: one cultivar displays higher IR reflectance
- Classified NDVI image
**Prior land use**

- False color image
- NDVI image - prior culture has lower IR reflectance.
- Classified NDVI Image

**Other applications**

- Insect cane grub
- Poor irrigation
- Evaporation

**Benefits of temporal images**

- Identify inherent variability in crop vigour within specific paddocks - occurs year to year (i.e. soil type)
- Identify within season variability that may only occur in a specific rotation (i.e. soil borne pathogen).

**Variability occurring between seasons (i.e. result of cane grub, soil borne pathogens)**

- 06 Feb 2005
- 12th March 2008
- 27th Feb 2007

**Regional Forecasting**

- Total cane crop area within the extent of this image 9022ha - 9,900ha
- Total peanut crop area (red) - within the extent (later) of this image was 1,470ha
Eco-accréditation for premiums

Participants
- Mossman Mill, Canegrowers, MAS, KFSU

Objectives
- Diversification of products from cane
- Improved environmental performance
- Greater industry return (premium payments) and improved viability

Outputs
- An eco-accréditation scheme for cane lands
- Accredited production of human dietary fibre
- Pilot scheme (MAS)
- Incentives and premium payments

Energy cane for paper pulp, etc

Participants
- Farming for the Future (Babinda)
- Millers, DPIE, Griffin Thomas & Assoc
- BSES/CSIRO/CSR plant breeding?

Objectives
- Diversification of products from cane
- Release of high biomass canes
- Improve economics and energy efficiency
- Greater industry return (premium payments) and improved viability

Outputs
- Paper pulp and other products
- Extension to be developed

Sustainable Industries Unit

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APPENDIX 4 – Group outputs

Group A

Attard (Anderson, Beasley, Calow, Reghizzi, Schroeder) Group
The overall issue: A sustainable sugarcane industry (growing and value-adding (millers or others)) as a platform for a sustainable community. Will sugarcane be the major crop or the ‘break crop’ within this system

Future major R&D priorities
Immediate / medium term priority – rotational cropping
- Integrated cropping system – what cropping systems are complementary
  - What are the crops?
  - What are the risks of growing these (environmental, agronomic, climatic, profitability, etc.)?
  - How do we fit these crops into the sugarcane cropping system?
- What are the economics of the rotational systems?
- What are the most appropriate natural resources management and overall farm management issues that will enable sugarcane enterprises to remain viable (productivity, profitability, social, extension, delivery and adoption methodologies).

Major opportunities for co-ordination of R&D
- Co-ordinated projects (e.g. BVD/M type project)
- Integrated processes to consider full range of factors

Longer-term priorities:
- Vision for the sugarcane industry (expands the ‘value’ including economics)
- Do we know enough about the sugarcane plant (components e.g. sucrose vs fibre), growth habit, harvesting season, countries issues
- What are the most appropriate natural resources management and overall farm management issues that will enable sugarcane enterprises to remain viable (productivity, profitability, social, extension, delivery and adoption methodologies). Farm to industry scales

Key recommendations for methods to integrate / co-ordinate R&D
- SRDC:
  - Take a more proactive approach and to truly industry bodies (CANE growers, ASA), NRM Groups and other R&Ds and government agencies. for overall industry direction and co-ordination of R&D
  - Co-ordinate and foster linkages (not direction setting)
  - Play an active facilitation role
  - Commission research for specific projects (industry endorsement of core themes)
- NRM bodies
  - Research / industry organisations to get together to consider future issues and R&D needs

Next steps to advance recommendations
- Report to SRDC from this meeting to get their views, inputs and support.
Group B

Future R&D Priorities

- **Alternative** products from cane and integration of other crops to complement cane growing
- Research into:
  - practices (pest management, nutrient management, harvesting, herbicides, soil management, etc.)
  - harvesting technology – now and 10 years (including alternative uses)
  - transport (issue? if it is an energy crop)
  - harvest design has an influence on NRM outcomes

- Develop varieties of cane aimed at producing products other than sugar (at least 10 year lead time)
- Whole of system model – inter relation of components (energy, cost of production)

Opportunities for coordination and integration within research groups

- Varieties - better co ordination between breeders and crop scientists – breeding for changing farming systems
- Harvest/transport logistics, involves millers, engineering
- Farming systems – aligning NRM groups and industry needs
- Scoping of benefits of coordinating other inputs & groups (missing skill sets)

Methods

- Single Industry Overseeing Body
  - Whole of Sugar R&D Plan
- Regional R&D plans feeding in
- Identification of key R&D areas and skill sets
- Co location of key R&D areas and skill sets
  - Co location of sugar RD&E has many benefits

Next Practical Steps

- Communication framework to ensure the outcomes from this workshop can be tracked
- Process for development of Sugar R&D Plan
- Develop plan
- Alignment of organisations strategic plans
- Projects addressing issues with collaborators identified
Group S

Future R&D and major priorities

- Systems analysis of alternative products from cane
  - Benefits/contraints of
  - Economics, environmental, farming systems
- Novel techniques for gathering & disseminating information about sugarcane crops to aide management
  - Examples
  - Remote sensing, yield monitoring (PA), etc for gather info
  - WaterSense for delivering info
- More diversified cropping in cane areas – integration options in the whole farming system
  - Better information on +ve & -ve interactions
  - E.g. maize in rotations; legumes = 16-in crop
  - Diverse, intensive hort impacts (currently low).
- Linking crop management to NRM outcomes
  - Testing/verifying assumptions in current analyses
  - Issues at multiple scales

Major opportunities for coordination/integration

- Systems analysis of alternative products from cane
- UtilisAR (products & technologies), BSES (farming systems info), CDE quantifying farming systems, ICA, State Govt
  - State development type people
- Novel techniques for gathering & disseminating information about sugarcane crops to aide management
  - NCEA (sensing technologies), DPMP (remote sensing), CDE (GIS, web delivery), BSES & Prod Boards (interpretation of info, etc.); ICA (modeling, etc.
  - NRM (data storage, distribution; –), NRW, GIS (data layers)
- More diversified cropping in cane areas
  - DPMP (agronomy, economics), CDE (systems modeling), BSES (crop impacts), NRW (crop health)
  - Linking crop management to NRM outcomes
  - NRW/CLV (modeling), DPMP (economics), CDE & CLV (modeling & evolution), BSES (management systems)
- Need (out:crop?): Partnering in both R&D providers and stakeholders, policy people, etc.