BSES Limited

FINAL REPORT – SRDC PROJECT BSS260

ENHANCED DELIVERY OF PROSPER TO ACHIEVE ADOPTION OF BEST MANAGEMENT PRACTICES IN THE QUEENSLAND SUGAR INDUSTRY

by

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SD06001

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SUMMARY

The late 1990s and early 2000s saw declining productivity and profitability within the Australian sugar industry. This decline was driven by a combination of adverse climatic conditions, declining terms of trade, pest and disease outbreaks, and declining soil health. To survive, all sectors of the industry needed to become more profitable. The key to this was a more reliable and increasing cane supply with the minimum of input costs.

BSES Limited developed the PROSPER initiative specifically to target a more reliable and increasing cane supply. The program's focus was directly on BSES' mission to "Deliver realised value in strategic and applied research and extension services to growers, millers and customers".

PROSPER was based on the premise that research by BSES and other organisations had already identified many ways to improve profitability and that the dedicated resources of the PROSPER program would hasten the adoption of these advances. It particularly recognised the importance of a reliable and increasing cane supply, but also addressed more efficient and cost-effective production. It accepted that different regions have different needs and wants, but focused on driving change in key farming issues, such as:

- Improvement of fallow management;
- Best use of varieties;
- Optimisation of crop establishment through advances in mechanisation;
- Adoption of best-practice methods of crop management;
- Timeliness of weed management;
- Efficient and effective use of water;
- Adoption of best harvesting practices;
- Capitalisation on breeding advances such as new plant-tissue-culture propagation technology;
- Improvement in communication affecting farm finance decisions;
- Broadening the use of programs such as the COMPASS initiative to improve industry sustainability;
- Understanding how climate affects productivity.

This project aimed to enhance the delivery of PROSPER by:

- Increasing the capability of the industry to cope with adversity
- Building skills in:
    - On-farm evaluation of innovative technology;
    - Economic evaluation of alternative cane-farming practices;
    - Delivery of best management practices to the industry.

The project linked to local productivity initiatives and used a world-class extension program facilitated by group-participation processes to drive change.

Outputs range from the production of printed material through local newsletters, booklets, trial reports, radio reports, press releases, and industry newspapers/magazines, to conduct of group meetings, to training courses, to establishment of 'best-bet' blocks, to completion of case studies, to support and encouragement of group development. All of these have maintained a high profile for the project.

Examples of some of the changes influenced by this project are:

- More than 30% of Queensland growers have completed the COMPASS program;
- 102 participants attended harvesting best-practice workshops;
- 49% of Northern fallows include a legume crop, and 14% planted with zero tillage;
- 88% of Northern growers consider reduced tillage a viable option, and 70% are actively trialling options;
- 34 far-northern growers used controlled-traffic in 2004-05;
- 70% of Herbert growers are using various forms of reduced tillage in the current farming system;
- 98 Herbert growers (14% of the region's cane growers) have implemented some form of the new farming system (sprayout, legume-fallow spray out, preformed beds, double-disc opener, or controlled traffic);
- > 1000 ha of Herbert fallow have a legume crop following the 2005 crushing, despite the late end to the crushing that restricted legume planting, and enquires to BSES on legumes have increased by 30% since 2004;
- Herbert commercial soil test system has increased throughput by 15% since 2004 and BSES soil pH testing for legume planting has increased by 35% in 2005;
- 27% of Burdekin growers are using the Paddock Journal to record farming operations;
- Area ploughed-out/replanted in the Burdekin reduced from 6054 ha in 2002 to 2594 ha in 2004;
- Area planted in the Burdekin with minimum tillage increased from 370 ha in 2002 to 2200 ha in 2005 and 2500-3000 ha expected in 2006 – this is 20% of the area planted each year in the Burdekin.
- 18% of Burdekin growers now using legume fallows in 2004, and 1300 ha planted to soybeans (36% of fallow area) by Southern growers;
- Area planted in the Mackay Sugar areas to controlled traffic rose to 1236 ha in 2005 with an additional 500 ha of 'improved farming system' in Proserpine and 400 ha at Sarina;
- 30% of Southern growers now using air inducted/inclusion/low-drift herbicide nozzles;
- 50% of Bundaberg cane planted with wide-throat planters;
- 14% of Southern growers have moved to controlled-traffic planting;
- 73% of Southern growers have recently changed their farming system;
- 46% of the area planted in 2005 in the Southern region was to the new variety Q205$^{\Phi}$ and 29% was to Q188$^{\Phi}$.

The most graphic example of the impact of group-participation activities comes from the Burdekin. Here, the net earnings per hectare of growers attending CPI initiatives were compared with those of growers not attending – the difference between these two groups has increased dramatically over pre-CPI levels, indicating that the program has had a real impact.

Two areas of considerable success within the project, the value of the group-facilitation process, and the widespread adoption of best management practices, will continue. BSES has implemented a range of processes to ensure continued use of group facilitation, albeit with other services that deliver specific advice to individual growers, and the continued adoption of BMP across industry. These include regional business plans, service-level

agreements, farm productivity assessments, and upgrading of the BSES web site. BSES has sub-branded its activities into QCanes, QCrops and Sutech Solutions to provide clarity to BSES' owners and investors on what it delivers. Coupled with prudent cost control and an increase in service fees, BSES can continue as the principal supplier of RD&E services to an increasingly profitable, productive and sustainable Australian sugar industry.

1.0 BACKGROUND

The late 1990s and early 2000s saw declining productivity and profitability within the Australian sugar industry. A combination of adverse climatic conditions, declining terms of trade, pest and disease outbreaks, and declining soil health drove this decline. All sectors of the industry faced acute financial hardship – the question was 'how can the industry survive at a price less than $220 per tonne of sugar? Alternatives to raw sugar were an obvious answer, but the industry needs to be profitable to allow investment in other areas, such as product diversification, etc.

The industry recognised that it could do little to directly influence sugar prices.

However, production costs, both on-farm and in mills, could be reduced through more efficient practices and through a more reliable and increasing cane supply. A range of industry bodies, including the CSR productivity initiative and BSES Limited's Regional Planning and Advisory Committee meetings, identified that cane supply was a major issue for both the growing and milling sectors of the industry to address.

Numerous studies had identified that improved farm management practices could increase productivity and profitability (eg Hurney and Bown's BSS159 Final Report; FNQ Sugar Industry Task Force Productivity Options Report; CSR and McKinsey's productivity report; RCS and BSES benchmarking studies in BSS91 and BSS222; Macarthur Agribusiness Burdekin Sugar Benchmarking Analysis; Peter McGuire's grower survey in Condong mill area). 'Silver bullet' solutions to improving industry profitability have become increasingly unlikely, but significant gains should be made by implementing best-management practices (BMP) in several areas of farming and harvesting. Factors such as timeliness of farming operations (eg in weed and pest control) invariably separate the top producers from the average.

A SRDC-funded survey indicated that growers believed that a lack of economic information was inhibiting the rate of adoption of improved technology and practices. There needed to be increased emphasis on the costs of production and on costs and returns of different farming system options, with the overall aim of increasing whole-of-industry profitability. The focus had to be on gross margins of sugarcane (and cane fallow) aspects of farm income and expenditure, and not on other crops or off-farm enterprises of the participating growers. Involvement of all industry investors in identification and demonstration of more-profitable farming and harvesting systems (best-management practice, BMP) was likely to result in greater ownership of the results and higher adoption rates.

However, the profitability/productivity goals of the industry and the community goals needed to be compatible. The industry needed to respond positively to criticism that canegrowing was environmentally damaging. BMPs for sustainable production were ideal vehicles for this, as these, by their inherent natures, enhance environmental values. BMP for rat control, for example, includes revegetation of riparian and other non-crop areas that are dominated by grass weeds. BMP harvesting aims to reduce cane and sugar losses, with consequent reduction in contamination of waterways with BOD materials. BMP for reversal of yield decline involves trash retention, minimum tillage, and well-grown cover crops on fallows over the wet season, all of which minimise soil erosion,

reduce chemical fertiliser and pesticide applications, and improve soil health. Demonstration of a commitment to implementing BMP (environmental as well as economic) and the triple-bottom-line benefits flowing from this could go a long way towards ensuring that canegrowing would remain a major industry on the eastern Australian coast.

As the industry's key research and development provider, BSES Limited developed the PROSPER initiative to target a more reliable and increasing cane supply. PROSPER was a $10 million investment by BSES and the industry. It was targeted specifically at improving the prosperity of the entire sugar industry through a reliable and increasing supply of quality sugarcane. The program's focus was directly on BSES' mission to "Deliver realised value in strategic and applied research and extension services to growers, millers and customers".

PROSPER was based on the premise that research by BSES and other organisations had already identified many ways to improve profitability and that the dedicated resources of the PROSPER program would hasten the adoption of these advances. It particularly recognised the importance of a reliable and increasing cane supply, but also addressed more efficient and cost-effective production. It focused on key farming issues, such as:

- Improvement of fallow management;
- Best use of varieties;
- Optimisation of crop establishment through advances in mechanisation;
- Adoption of best-practice methods of crop management;
- Timeliness of weed management;
- Efficient and effective use of water;
- Adoption of best harvesting practices;
- Capitalisation on breeding advances such as new plant-tissue-culture propagation technology;
- Improvement in communication affecting farm finance decisions;
- Broadening the use of programs such as the COMPASS initiative to improve industry sustainability;
- Understanding how climate affects productivity.

The resources applied to the program came from a BSES commitment of $5 million over 3 years, funded mainly from the sale of the remainder of the Eight Mile Plains pathology farm. Matching commitment from industry came mainly through a contribution by SRDC of $771,000 in this project, particularly to fund salaries and operating expenses for delivery. PROSPER also incorporated other extension initiatives, such as Rural Water Use Efficiency Initiative and NRMW's Change Management Initiative.

BSES recognised that different regions face different productivity problems and have different industry relationships. It consulted with industry to allow BSES Regional Planning and Advisory Committees and other bodies to define particular issues that needed addressing in each region. Differences in industry relationships also defined how the program was implemented in each region, for example: in the Burdekin and Herbert regions, the program was implemented through the Cane Productivity Initiative; on the Tablelands through the TAP program; and in Bundaberg through Bundaberg Cell Group activities.

Protracted negotiations occurred before the project was in a format suitable to all participants. After all parties accepted the project details, the project agreement was signed by BSES and SRDC. However, due to changing circumstances, QDPI withdrew from participation in the project and the project was renegotiated between BSES and SRDC. As a result, the final project agreement was not signed until December 2002. To implement the project for the 2002-2003 cropping season, BSES established and continued to fund the project from its own reserves. Had this investment not occurred, the impact of this project on the 2004 cane crop would have been marginal.

2.0 OBJECTIVES

The project aimed to achieve prosperity in the sugar industry through a reliable and increasing cane supply in a sustainable production system.

The objectives of this project were to enhance the delivery of PROSPER to the Queensland sugar industry by:

- Increasing the capability of the industry to cope with adversity
- Building skills in:
    - On-farm evaluation of innovative technology;
    - Economic evaluation of alternative cane-farming practices;
    - Delivery of best management practices to the industry.

That objective was achieved by linking to the BSES PROSPER initiative to enhance adoption of locally defined best-management practices by cane growers and harvester operators in:

- Fallow management;
- Crop establishment;
- Variety management;
- Crop management;
- Weed and pest management;
- Harvesting and transport;
- Landscape management.

These objectives were achieved through a world-class extension program facilitated by group-participation processes to drive change.

3.0 PROCESS

3.1 Project philosophy

McKinsey had previously been contracted by CSR to identify issues associated with declining productivity in the sugar industry. We generally used the model that they had developed for implementation of best-management practice. The McKinsey model identified three areas where resources should be concentrated to maximise impact.

Firstly, the BMP Implementation module involved developing small-group networks within each of the regions. These groups were developed as discussion groups where growers to learn from growers with similar intrinsics. Groups were to be facilitated by trained professionals and were to use the indigenous knowledge of the group to define and discuss BMP.

The R&D Adoption module was designed to demonstrate research and development outcomes in all of the regions. The McKinsey model identified that growers adopt R&D by seeing the results in their own locality, and the benefits had to be demonstrated locally. Hence, those staff involved in that module established demonstration sites using the most relevant technology.

Thirdly, a Harvesting and Logistics module was designed to demonstrate BMP harvesting and to investigate the most efficient logistics from the farm to the factory.

This meant that BSS260 staff and other BSES/CPPB(CPS) BMP staff were integrated and allocated to tasks in each of the modules.

In addition, the project linked to other important initiatives, for example the Sugar Yield Decline Joint Venture, COMPASS, Rural Water Use Efficiency, Change Management, and many SRDC-supported projects. This means that it is difficult to apportion outcomes to particular projects – those outlined in Section 5 are no exceptions.

As might be expected, the implementation of such a project was different in different areas, mainly to address local needs and conditions. An example of the structure of the group-facilitation process, as adopted by the Mackay area in 2004 and jointly supported by BSES Limited and Mackay Area Productivity Services (MAPS), is given in Figure 1.

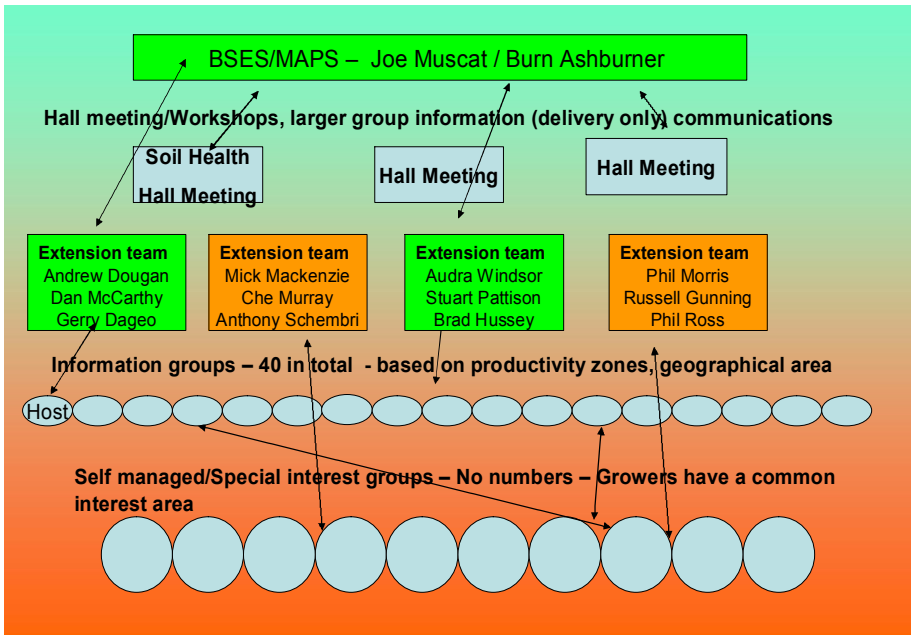


Figure 1 Mackay group-extension process

The Group Extension Program could address different options to deliver information to growers within the region. The program also allowed a more coordinated process to which growers could relate. The program essentially had two components (Figure 2): staff-driven groups, which met with encouragement of the extension teams and operate well with that encouragement; and grower-driven groups led by growers that are leaders in their specific fields.

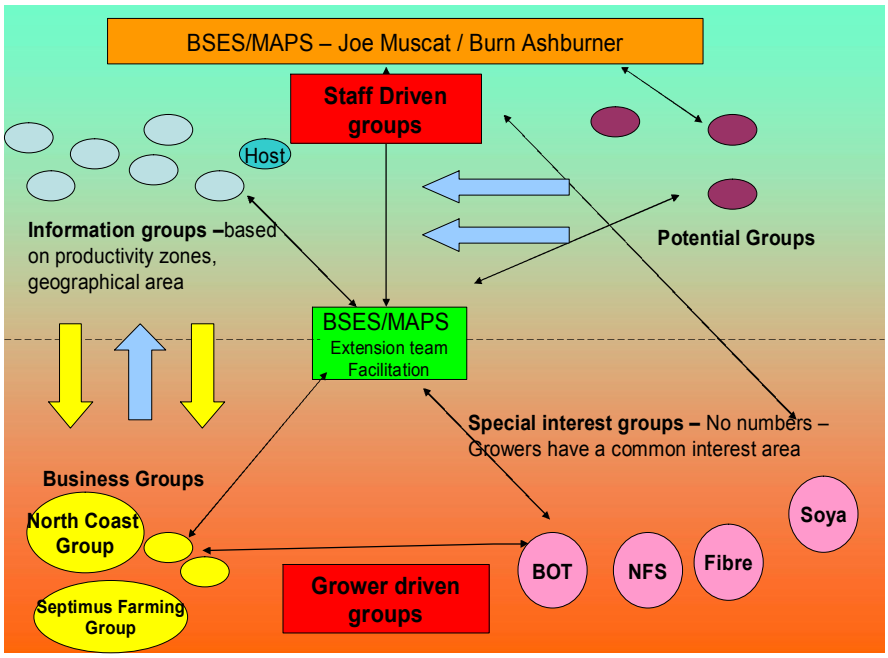


Figure 2 Program components at Mackay

Extension teams were organised for each mill area and each comprised one BSES extension officer and two MAPS productivity officers. The extension teams have encouraged group activities, and arranged mini field days, short bus trips, field walks and demonstrations. In a normal round of shed meetings, there is considerable follow up work for the team members. The joint BSES/MAPS approach has been a major factor in ensuring the success of group extension and has paved the direction for the future of the program.

Hall meetings allowed the transfer of information on particular issues, eg canegrub management, Yield Decline Joint Venture outcomes, etc, to many growers at the one time. Most were stand-and-deliver presentations, with minimal interaction between presenters and growers. However, they were useful in delivering information to a large number of growers in a very short period.

Information Groups or Shed Meeting groups were linked to productivity zones, meaning that within a productivity zone each grower had a productivity ranking and a history within that zone. Productivity zones were formed in relation to soil type and geographical location, and each was limited to 12 growers to allow for good discussion at the meetings. It was obvious that many growers were not comfortable in discussing any topic if the

group was too large. Each group has a host that provides the meeting venue, contacts the remaining members, and canvasses the members for topics of interest. The hosts met regularly with the program coordinators and extension teams, and were kept updated on emerging issues. Mackay grower hosts have undertaken a study tour and will attend the 2006 ASSCT conference.

To transfer information more effectively, growers need to learn from growers; researchers delivering information to growers and growers can respond to researchers to create an effective transfer of that information. As the project developed, groups have evolved from discussion groups to organized activities – this has promoted action learning (growers learning from growers) from leading growers. This has been evident by the increase of adoption of soil-health and controlled-traffic principles.

Specialist groups have also evolved from the Group Extension Program. These groups are made up of growers, industry and community people that have a common interest in a particular topic. They have no geographical boundary and they are very much driven by growers and participants within the group. The Mackay region has several specialist groups:

- Young Farmers' group;
- Mackay Fibre Producers;
- Soybean group;
- Peanut group;
- North Coast Grower group;
- Septimus Farming group;
- New Farming Systems group;
- Wide-swath Harvesting group;
- Back on Track.

Most specialist groups have been very active and have met several times each year - one group meets monthly. The Soybean and Peanut groups have undertaken specific training programs delivered by Future Cane and aimed at producing better crops. Mackay Fibre Producers have undertaken business-planning training to develop a business plan. Mackay Fibre Producers, Young Farmers' group and Wide-swath Harvesting groups have undertaken specific study tours to develop their areas of interest. Capacity building for members of the specialist groups is ongoing and is self driven. The North Coast Grower, Back on Track and Septimus Farming groups have attracted funding to conduct specific work and run their own projects.

Other areas carried out the project in similar ways.

3.2 Project staffing

The project aimed to operate in all Queensland sugar districts:

- Southern (Rocky Point to Bundaberg);
- Central;
- Burdekin;
- Herbert;
- Northern.

BSES appointed dedicated project officers to the Southern, Central, Burdekin and Herbert regions and these were operational by October 2002. In the Northern area, QDPI were to provide an officer to be stationed at BSES Meringa. Following their withdrawal, BSES funded one full-time equivalent from the northern extension staff.

Difficulties in retaining BSES' well-trained staff meant that some positions were filled by different staff and under different arrangements as the project progressed.

In addition, specialized input from researchers from BSES and other organizations, especially Dr AL Garside (Sugar Yield Decline Joint Venture), was available to the project.

3.3 Local facilitators

Facilitators (BSES staff) for each of the modules of the program (BMP Implementation, R&D Adoption, and Harvesting and Logistics) were identified for each region.

In addition, staff from BSES and CPPBs (now Cane Productivity Services) were identified as facilitators for each of the mill areas participating in the PROSPER program. Mill areas covered were Mulgrave, Innisfail, Tully, Herbert, Burdekin, Proserpine, Mackay, Sarina, Bundaberg, Isis and Maryborough/Rocky Point.

The particular staff assigned to these positions changed over time, but the concept remained the same.

3.4 Project steering groups and priorities for workplans

To develop the project program of work it was necessary to determine which issues were relevant to each area, those issues on which the program could have an impact, and the prioritization of those issues. In each area, the process was different - it was considered important that the project should add value to current activities rather than duplicate processes already occurring, as well as using the action-learning model with the local industries.

In the CSR mill areas, Herbert, Burdekin and Plane Creek, the major issues had been identified in the McKinsey process. Figure 3 gives an example of issues identified by McKinsey for the Burdekin program.

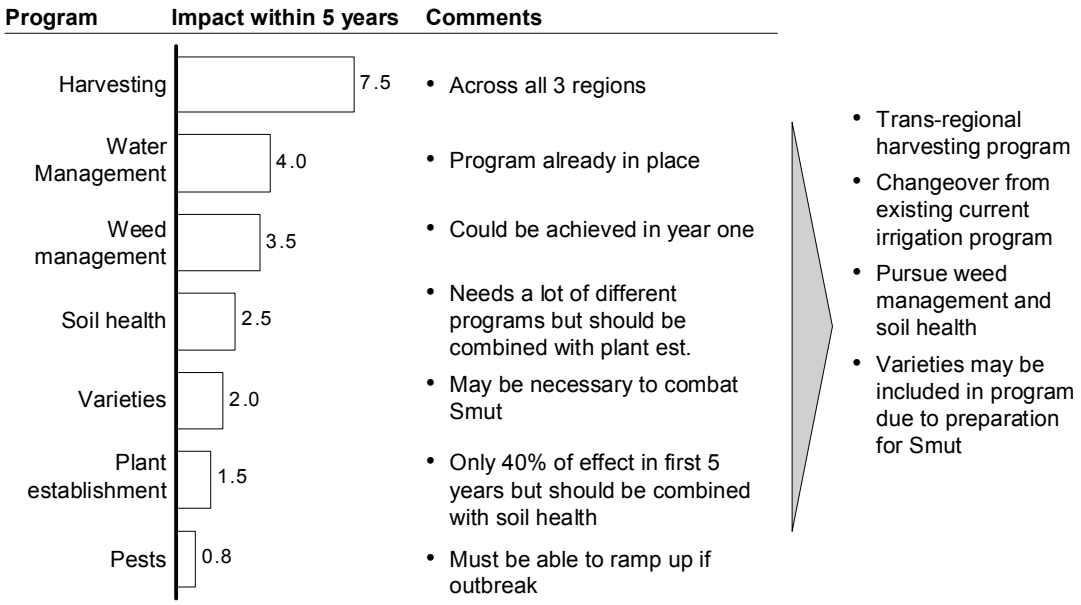


Figure 3 Issues identified for the Burdekin program, as identified by McKinsey (impacts are improvements in cane yields (t/ha))

The work program for the R&D module of the CSR mill areas, as identified by McKinsey across all CSR mill areas, is given in Figure 4. Much of the program was built on BSES data and was strongly correlated with the issues identified by the local BSES RPACs (Regional Planning and Advisory Committees).

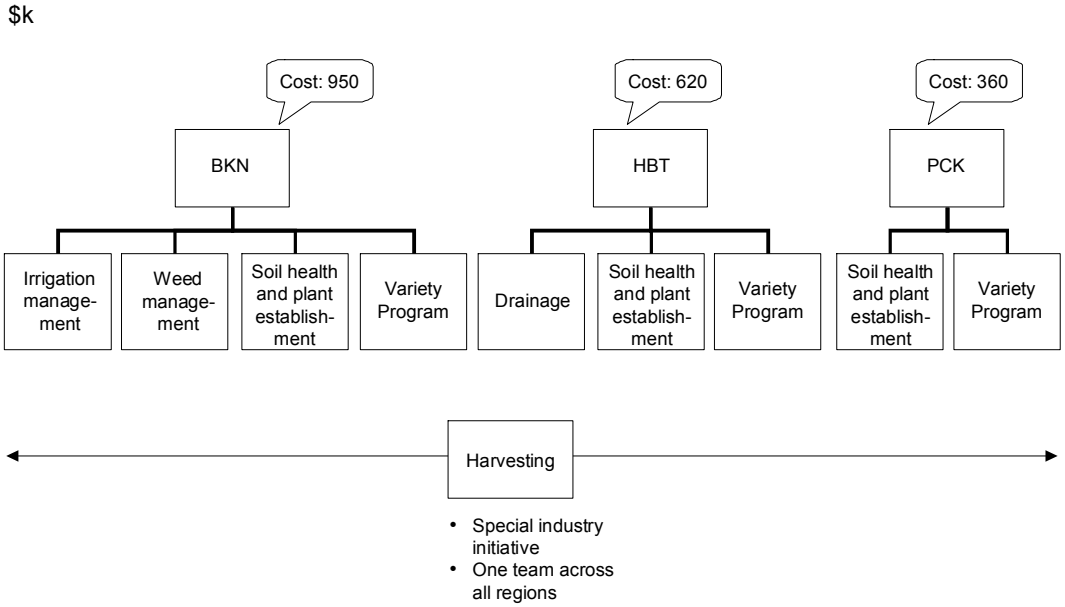


Figure 4 Work program for the R&D module of the CSR mill areas

In the Central region, the RPAC planning process was used to identify the key issues and a survey of growers reaffirmed the issues.

The Southern region was fixated on increasing the water supply through the development of a new dam. The region was characterized by an extremely large number of small growers and limited number of very large growers, with many seeing small cropping as a saviour to the financial dilemma. However, the local state member, Trevor Strong, had developed a strategic planning group for the local sugar industry. This group nominated a subcommittee to identify the issues that could have a positive impact on productivity in an environment of severe drought. The top six priority issues identified were: water; harvesting and transport; industry profitability; short-term crisis management; economies of scale; RD&E. These issues reflected the issues identified by the local RPAC, as well as being similar to those identified by McKinsey in CSR areas. PROSPER officers were considered to be important in harvesting and transport, industry profitability, and RD&E issues and worked at revamping the cell-group structure and adding demonstrations to underpin the groups.

In the Northern region, the withdrawal of QDPI initially necessitated formulating a work program in a more negotiated manner. This region initially focused on group extension, improved variety management, and water management.

The initial general priorities for the BSS260 officers in each area were as below. These obviously differed among areas, as the project focused on adding value to current activities rather than duplicate processes already occurring.

Northern Region

- Promoting the use and returns possible from applying irrigation. Bundaberg Sugar identified water management as a major issue for the continued viability of the Tableland industry. This is demonstrated by the Tableland average yield for the 2002 crop being 80 tonnes/ha.
- Adoption of new varieties through establishment of strip trials throughout the district, extension of results, development of variety packages, and coordination of the approval and release procedure. This was a continuation of the work conducted by BSES in a previous BMP project.
- Maintaining the group extension process commenced in Mulgrave and Tully, as well as establishing a group program in the Innisfail district.

Herbert Region

- Adoption of new varieties through establishment of strip trials throughout the district, extension of results, development of variety packages, and coordination of the approval and release procedure;
- Soil health and plant establishment, focusing particularly on minimum tillage and alternative crops to minimize yield-decline problems – integrating with the Yield Decline Joint Venture;
- Extension of nutrition BMP;
- Extension of water-management BMP;
- Training for industry in management of crop diseases;
- Coordination of harvesting and haulout courses;

- General support on crop management and pest management and provision of technical support to 26 productivity groups.

Burdekin Region
- Irrigation, particularly in demonstrating BMP scheduling and surge irrigation, and water quality;
- Soil health and plant establishment, particularly in fallow management and row profile – integrating with the Yield Decline Joint Venture;
- Crop protection, focusing on canegrub management, weed management and perhaps nematodes;
- Adoption of harvesting BMP;
- Extension of variety management.

Central Region
- Trial and demonstrate new 'vigorous' varieties that appear to require less nitrogen fertilizer on good soils;
- Demonstrate that yield is not improved by ripping and that cost savings can be made by not ripping, or demonstrate that ripping is required on some soil types to maximize yield;
- Assess the most cost-effective break crops for the Central district, and extend benefits to growers – integrating with the Yield Decline Joint Venture;
- Demonstrate outcomes and costs of weed management practices, focusing on pre-emergent herbicides, cultivation, and knockdown herbicides combined with cultivation;
- Provide good extension material on water-quality data.

Southern Region
- Improving weed management by increasing grower knowledge on BMP weed control and developing an integrated weed-management package;
- Identifying problems and opportunities in planting operations by undertaking a planting survey;
- Completing the Rocky Point irrigation trial and extend the results to growers;
- Assisting the Gold Coast City Council with preparation and coordination of Farm Management plans.

3.5 Modification of processes based on project learnings

The above priorities were negotiated with the local industry (through the project steering groups) each year and changed somewhat over the life of the project. For example, in the Southern region they changed to:
- Maximising the benefits of rainfall and improved farming systems;
- Minimising harvesting losses;
- Improved weed management;
- Sustainable nutrition management;
- Effective pest management;
- Effective use of varieties.

In all areas, most noticeably there was an increased emphasis on gaining adoption of the new farming system developed within the Sugar Yield Decline Joint Venture.

3.6 Training in group facilitation

Early in the project, BSES staff members Warren Hunt and Steven Garrad developed a training program in group facilitation. Both Steve and Warren used their exceptional group-facilitation skills and were able to share their experiences in dealing with cane growers. Two training programs were run in the first year of the project, one in Meringa and the other in Proserpine; the program for the Proserpine workshop is given in Appendix 1. All PROSPER officers, including all group facilitators, attended the workshops.

Although no formal evaluation of the workshops was undertaken, informal evaluation of the workshops was extremely positive. All staff involved used the skills learnt at the training workshop in various aspects of the project.

Complementing this was the active encouragement of all extension officers to complete the Certificate IV in Assessment and Workplace Training. This equipped them in a course designed against core competencies and to measure progress towards acceptable standards. Such expertise in extension is recognised as a high-value resource to BSES.

To assist the learning development of groups in the Central region, training in group-facilitation skills was carried out in February 2005 by Raylene Hansen of DPI&F and Doug Graham from University of Queensland (Gatton). The training program delivered by Raylene Hansen related to how to run successful meetings and the need to ensure there is an outcome from the meeting. The program delivered by Doug Graham was more comprehensive in dealing with meeting processes. His program covered topics in understanding people behaviour, adult-learning principles and facilitative leadership.

Feedback from the three teams in relation to training provided was very positive. All members became more confident in leading meetings and understanding how to ensure that all attendees can gain the most benefit from meetings.

Following from lessons learnt in the facilitation training, the team members underwent a planning workshop prior to the programmed March 2005 grower meetings. At this workshop, the four teams developed processes and procedures that all future grower meetings would follow thus ensuring that meetings had a purpose and an outcome.

The objective of having team members undertaking group facilitation training was to progress grower groups from discussion groups to growers driving the relevant issues in their farming business. While some groups were receptive to this concept, the majority of groups were not ready for this level of commitment.

3.7 Agricultural economics expertise

An agricultural economist was initially appointed to this project in conjunction with project BSS217. This was to allow a closer integration of the two projects. A Farm Business Management Package was developed and used within this project and Department of State Development Change Management program.

Following the development on the FutureCane initiative, agricultural economics expertise was delivered through the DPI&F economists attached to the Future Cane team. Business planning opportunities were offered at group meetings and via Centrelink and CANEGROWERS' advertisements inviting growers to develop business plans. Farmers' spouses were particularly invited to group meetings, as they often are more involved in the business activities of the farming enterprise.

With low sugar prices in 2004 and 2005, business-planning workshops have been held across the region at Bundaberg, Isis and Maryborough. At the Bundaberg workshops, 46 people, including 22 wives of cane growers, attended. This number was encouraging and followed on the work in encouraging greater involvement of women in the industry. This effort culminated in a SRDC travel and learning trip by the *Women in Sugar* group to the cotton industry in Narrabri. This group was able to meet with their peers from the cotton industry and swap ideas on common issues that affect each of their industries especially those relating to social issues in times of low prices, poor yields and drought.

3.8 Training in economic analysis

Training in economic analysis was initially to be provided by QDPI, but with their withdrawal from the project meant that alternative arrangements had to be made.

After viewing the RCS, McArthur and various other sugar-industry economic models, CSR and other local participants in the Burdekin felt that none of those provided a simple economic farm model for growers to use. As a result, BSES and CSR developed a model that was approved by the Burdekin Regional Industry Board (growers and millers). This model was circulated to all staff in the CSR regions as well as other BMP staff. All staff were instructed in the use of this model and it was made available on the CSR Burdekin website.

The model was used by Burdekin staff at productivity meetings to develop the cost of production and demonstrated uses of the model. It was sent to all project staff to be used for the economic comparisons between changed practices.

Following the instigation of the FutureCane initiative, Trish Cameron of DPI&F developed the Farm Economic Analysis Tool (FEAT), designed specifically for cane farmers to compare different farming systems. It enables growers to assess, as accurately as possible, the economic impact of a change before making on-ground changes. FEAT can be used to compare an historical farming system to a current farming system to give a reasonably accurate economic result of the changes. This is done by applying current input prices to both the current and historical farming practices. The same commodity

price is applied to both farming systems. In other words, this approach shows what the return on investment would be today, had the grower not made any changes.

3.9 Other training

As well as other locally based training, extension staff attended a workshop in 2005 facilitated by the Asia Pacific Extension Network (APEN) that focused on building leadership skills of young extension staff. Workshop participants came from a broad range of industries. The workshop was very useful in not only improving leadership and facilitation skills of extension staff, but also in building a network of contacts across a number of industries and organisations in Queensland. Individual staff have maintained personal contact with extension staff who have similar interests and are kept up to date on extension issues through the APEN newsletter.

Growers and extension staff used funding from the Rural Water Use Efficiency Project, CANEGROWERS, BSES and SRDC to attend the Australian Controlled Traffic Farming Conference in Gatton in July 2005. Dissemination of their experiences was through newsletters, newspaper articles and presentations at grower-group meetings.

In the Northern region, extension officers undertook a two-day training accreditation course on BMP nutrient management titled *Six Steps to Better Nutrient Management*. The program was operated by the northern RWUEI2 and allows attendees to conduct accredited nutrient courses under ACTA.

3.10 Paddock Journal

A major initiative of BSES was the production of the BSES Paddock Journal. It was developed to address the need to assist growers with keeping accurate farming records in order to make better business decisions. This journal allows growers to record information regarding activities such as varieties planted, chemical application, cultivation date, harvest details and nutrition management. It also provides information on occupational health and safety, calibration of spray rigs and quarantine areas and regulations.

The journal easily shows growers the difference in time spent on field activities following the change to new farming systems, and is available free of charge to all growers who pay the BSES service fee.

3.11 Herbicide-residue booklet

BSES produced an herbicide-residue booklet to assist growers when applying herbicide to cane crops. The booklet highlights the effect herbicides may have on rotation crops, and looks at the effects of rotation crop herbicides on cane. A copy is attached as Appendix 2.

3.12 Case studies and associated workshops

Case studies provide a novel way of showing growers what other growers have achieved and the economic benefits of the changes they have made. These case studies are presented to growers in workshops that outline the benefit of having undertaken new farming practices.

Two studies from northern Queensland have been completed and published (Appendices 3 and 4) and are available on the SRDC website at:

- www.srdc.gov.au/ProjectReports/BSS260_CS05001.pdf; and
- www.srdc.gov.au/ProjectReports/BSS260_CS05002.pdf

Three case studies have been completed in the Southern region, with two presented to growers. Geoff and Maureen McCarthy of Isis presented their case study to 46 growers at a grower night organised in Childers by Isis Target 100.

The second case study presented was an economic comparison between a 1.5 m conventional cane system and 1.9 m dual row system at Warren Glass's property. This was presented at Moore Park - Bundaberg in December 2005 to 12 growers. The numbers were down due to growers still being very busy with farm work, but the case study has been printed in a shortened version and distributed to local growers in a BSES Newsletter. Final preparation of the formal case study publication is currently underway and this will be posted on the SRDC website.

The third case study completed compares the financial and social aspects of changes made to Des Schulte's cane farm at Bundaberg. 10 years ago, Des realised that substantial changes needed to be made in order to remain viable and this presentation details these changes. It is planned to present the results of this study to growers in 2006 CaneTalk meetings.

In all case studies the spreadsheet 'Farm Economic Analysis Tool' (FEAT**)** developed by FutureCane economists was applied to calculate the whole of farm economics and determine a comparison of gross margins before and after changes and also to determine the return on investment these changes produced.

A fourth case study has been prepared as an ASSCT paper to be presented in Mackay in May 2006 (Appendix 5). This compares changes made in the Loeskow family farming operation in Bundaberg, including the use of GPS technology.

In the Central and Burdekin regions, QDPI&F economists have advised that some of the project studies were either not suitable for analysis or the practices to be analysed were not best practice.

3.13 Best-practice harvesting

Some of the most significant gains in profitability can be achieved by enhancing harvesting practices. From cane and juice loss and high extraneous matter levels to stool damage, poor harvesting practice is among the most serious problems confronting the

industry. During this project, BSES undertook a major extension program to optimize harvester feedtrain operations and improve the quality of the cane supply reaching the factory. Reports from contractors suggest this work has been highly regarded and very beneficial in improving profitability for the industry.

Harvesting BMP was the focus of eight workshops involving 102 participants. These were conducted throughout the industry.

In addition, a comprehensive harvester survey was conducted by one BMP officer and results disseminated as BSES Report PR04003. A copy is attached as Appendix 21.

3.14 Reviews of the project

3.14.1 Reviews of CPI/PROSPER initiative

Jeff Coutts and associates reviewed progress towards objectives in the CPI/PROSPER initiative in May 2003, September 2003, December 2003 and May 2004. Recommendations made in the second and fourth of these reports were particularly relevant to this project.

3.14.1.1 September 2003 report

This report gave feedback on the activities within the initiative and provided the results of a web survey, which was undertaken during August/September 2003, as well as a grower survey administered by productivity group facilitators in the Burdekin.

The main purpose of the web survey was to receive feedback from those directly involved in the CPI/Prosper Initiative who are in organisational or farmer leadership roles in the Herbert, Burdekin and Plane Creek districts. This survey aimed to take the pulse of the initiatives from the perspectives of those involved in 'making it happen' - to see if they thought that it was on track and to look for opportunities to improve its implementation, activities and support.

The review found, that as the initiative had been operational for only 1 year, it was too soon to measure significant productivity gains from activities. However, the indicators were that it was moving in the right direction.

All growers surveyed in the Burdekin thought that the Productivity Groups were a good way for them to get information on how to improve their productivity.

In the survey of those closely involved with the initiative, respondents were asked to rate how they viewed its success to date. On a scale of 1-10, where 1 = struggling and ineffective and 10 = running well and effective, the Plane Creek respondents rated the success of the initiative the highest at 7.3. The Burdekin followed with 6.4 and the Herbert District rated it at 5.7. This was quite a positive reflection of progress, given that it has only been one year into the program.

The cross-organisational interaction and cooperation occurring during the implementation of the initiative was rated as good by 56% of the respondents. 20% of the respondents rated it as excellent.

Specific production-related impacts reported included:

- Greater success for cooperatives in relation to harvesting and planting;
- Adoption of ridge planting and inter-row irrigation;
- Gains from improved irrigation scheduling;
- Better variety adoption;
- Improved harvester fan speeds and resulting harvesting efficiency; and
- Adoption and benefits from controlled traffic.

68% of growers from the Burdekin survey said they discussed the topics covered in productivity meetings with other growers outside of the productivity-meeting format.

When asked what extra support or skills would be useful to contribute more effectively to the initiative, there was a variety of responses. BSES staff generally indicated that more training in facilitation was needed, as was more funding. Cane growers' comments varied from wanting more advanced understanding of economics of milling and growing sectors, to wanting more farm trials. CPS staff expressed a desire for ongoing training in group facilitation, as well as more human resources. CSR staff overall expressed a need for more resources.

3.14.1.2 May 2004 report

This reported on activities, changes and impacts of the CPI/Prosper initiative in the Herbert, Burdekin and Plane Creek sugar regions. The monitoring and evaluation approach was based around three levels: 1. Activities; 2. Direct effect on those involved; and 3. Impact on industry. The overall messages in that report were:

- All of the planned structures and activities of the CPI/PROSPER Initiative had been put into place and had started producing outputs likely to lead to improvements. These were consistent with extension best-practice. The initiative was on-track to achieve the outputs and *potential* outcomes that it was set up to achieve.
- It was still early days in which to find and define productivity improvements as a result of CPI/PROSPER. Overall, regional productivity trends are affected by climate, disease and pests and it is difficult to capture impact at that level so early into the program. Analysis after the third year of harvesting will better discover whether the overall productivity gains sought are on track.
- There was statistical evidence that those who attended Productivity forums/groups in the Burdekin have increased their calculated incomes (productivity) over those who have not attended groups. This also indicated that the program impacted on average productivity for the region. This reinforced the value of these groups and the potential benefits in on-going training and sharing amongst facilitators to maximise the value of this approach.
- Efforts needed to be put into understanding the specific changes that have resulted in improvements to productivity for *attenders* in the Burdekin and the factors

supporting this. Future effort should be put into those practices that resulted in the highest gains rather than only mirror priorities perceived by growers and staff.

- Productivity calculated in the report did not include reduced costs and other measures to enhance sustainability and this required further exploration.

3.14.2 Overall project – May 2004

The program was more widely reviewed in May 2004 by a panel comprising Dr Jeff Coutts of Coutts J&R Pty Ltd, Mr Chris Sounness of DPI Victoria (expertise in transfer of agricultural R&D outside the sugar industry), Mrs Desley Vella (canefarmer, Babinda) and Ray McDowell (Mulgrave Central Mill). Andrew Barfield (SRDC director) and Dr Peter Allsopp (BSES) accompanied the panel.

The review took place over 3 days, and, so, was very intensive. The panel visited Mackay, Burdekin and Meringa and heard progress towards objectives from Southern, Central, Burdekin, Herbert and Northern staff, as well as an overview of the program from Dr Allsopp. The panel also visited some demonstration sites.

The terms of reference were:

1. Report on the appropriateness of BSS260 and PROSPER objectives, processes and planned outcomes as specified in the project proposal, given the current status and future outlook of the Australian sugar industry environment (eg, sustained low sugar price), with particular reference to the delivery of outcomes across each cane-growing region in Queensland.
2. Report on progress of BSS260 and PROSPER towards delivery of outcomes sought by BSES' PROSPER program and the SRDC R&D Plan 2003-08 and in particular analyse the findings to guide future R&D investment.
3. Identify examples of successful outcomes of BSS260 and PROSPER for promotion across the Australian sugar community, as well as identify examples of unsuccessful outcomes and document these in terms of lessons for improvement of BSS260 and future BMP adoption programs.
4. Comment on how strategies and processes used to deliver BSS260 and PROSPER project outputs and outcomes compare with world's best practice in extension and adoption of improved agricultural practices and technologies and provide recommendations for improvements in the conduct of BSS260 during 2004/05.
5. Provide recommendations for future investment to achieve world's best practice in the area of maximising adoption of best management practices for cane growing and harvesting that will improve the economic and environmental sustainability of the Australian sugar industry. This will include recommendations on the most appropriate structure for the future delivery of extension to maximise adoption of best management practices for cane growing and harvesting that will improve the economic and environmental sustainability of the Australian sugar industry.

The panel found:

- Overall, PROSPER has provided (staff) resources and a realignment framework, which has resulted in an improved direction and ramping up of extension activities in BSES. The SRDC-funded BSS260 has provided specific support positions in most regions that have clearly defined roles. It was designed to 'fill evident gaps', and

these positions have been seen essential for the critical mass needed to realign extension and support activities.

- The BSES extension effort, as presented through PROSPER and the support funding of BSS260 is, overall, impressive and up with best practice in extension.
- In some areas, PROSPER and its accompanying local initiative (for example the Cane Productivity Initiative in Burdekin and Herbert) have resulted in significant changes in the emphasis of extension activities. The high level of effort into productivity groups/forums as opposed to occasional shed meetings is an example of this. In other areas, PROSPER and BSS260 funding has allowed the existing extension effort to continue by maintaining staff and resources with less change in emphasis. This latter situation needs further attention.
- The quantitative analysis of improvements in productivity in the Burdekin, which shifted to a very strong emphasis on grower groups with over 60% of growers involved, has indicated that this strategy is on the right track.
- Where clear goals and benchmarking was apparent, there appeared to be a stronger focus and this should be broadened to all regions.
- There were good examples of increased cooperation across industries and significant increased group activities with a high level of grower involvement in some areas. Regions that had a central office and where BSES staff were in close proximity to other organisations had networking advantages over more dispersed regions.
- The use and management of grower groups was quite variable among different regions – with varied understanding of 'adult learning', 'action learning' and 'grower driven'. There was further scope to improve group activities and increase grower to grower sharing and learning across most regions. It was evident that further staff and grower participant training (group and facilitation skills) are needed to move groups more strongly to a grower lead 'action-learning' orientation. Recruiting new and younger staff was also seen to add to the rate of change in this extension direction.
- Industry political, structural and resourcing issues were major limitations to the effectiveness of extension and the Prosper initiative.
- The decrease in the grower service fee for BSES and the impact on extension activity and sustainability following the ramp-up and progress over the previous two years was cause for concern. Growers that were spoken with during the review also expressed their concern. In the Panel's view, and in light of the documented impact of the extension activities and impact on the industry, even at 10 cents, the service fee was too low. The comparison with the CANEGROWER membership fee of 28 cents/tonne highlights the inadequacy.

The panel's report was accepted by the BSES board. Their 19 recommendations were analysed and influenced future activities in this project. These and on-going and future activities are summarised below.

Recommendation 1: *Clear short (annual) and medium term (3-year) goals should be developed in all regions together with a practical evaluation plan to measure against these goals.*
This is the basis of Service Level Agreements that BSES has developed, or is developing, across all mill areas.

Recommendation 2: *The emphasis on grower groups should continue and be developed further in areas where they are underdeveloped. Different groupings could also be used to*

a greater extent - eg environment group, women's group, young farmers' group, innovation group, water-quality monitoring group.
Group processes are effective in delivering BMPs, and BSES is an ideal vehicle to facilitate these processes given the skills of its extension staff, its 'embedding of extension in QCanes and QCrops, and its experience of being a connector between researchers and growers. BSES and SRDC have continued an emphasis on this.

Recommendation 3: *Increased training should be provided to staff and grower leaders in the management and facilitation of grower-driven groups.*
BSES has undertaken such training and will continue to do so. This has also been the focus of some recent SRDC projects.

Recommendation 4: *A budget line should be included in Prosper to provide funds for extension staff (i.e. BSES and other staff from industry involved with extension) to meet together on a state-wide basis to share approaches and learnings as well as to receive further training together. It may be appropriate to use the ASSCT conference as a forum for this process.*
This was done within the project and will continue to be done by BSES. BSES has held annual meetings of all extension staff over the past 2 years and regularly holds meetings where both researchers and extension staff get to exchange ideas on research required.

Recommendation 5: *COMPASS and the Farm Management System should be a major thrust for benchmarking Best Management Practice and state-wide strategies should develop broad industry support and involvement and support extension officers in their delivery. An SRDC-funded project should be developed which compiles BMP and FMS Benchmark Booklets specific to each region.*
BSES is developing region-specific components within its Farm Productivity Assessment (FPA) program that is based on gaining adoption of BMP. Further roll-out of COMPASS has seen > 30% of growers completing the course. BSES are developing BMP booklets covering different stages of the cropping cycle in conjunction with CANEGROWERS and Queensland Environmental Protection Agency.

Recommendation 6: *A full range of latest BMP information should be available to all sugar growers via the internet.*
This is being developed through the BSES website and through the FMS project.

Recommendation 7: *A broader view of capacity building and 'increasing the capacity of industry to cope with adversity' should be taken to include leadership, critical thinking and planning skills.*
Noted by BSES and, presumably, by SRDC.

Recommendation 8: *Greater attention should be placed on monitoring cost reductions in the extension program and in measuring its impact. Regional successes should be picked up by other regions.*
This forms a component of BSES' CROP and FPA programs and the DPI&F-BSES FutureCane project. The latter has seen the development of the Farm Economic Analysis Tool (FEAT).

Recommendation 9: *The quantitative analysis and benchmarking used in the Burdekin should be copied in other mill areas where possible. Annual surveys of practice change linked to research indications of impact should also be used to establish areas of greatest gain*.
Considerable thought and negotiations have focused on this, but no other mill area has taken the concept up. Some benchmarking is included within the Service Level Agreements.

Recommendation 10: *There should be a process of peer review of extension programs to assist in focusing programs against regional priorities rather than the strengths of the extension officer.*
BSES' Service Level Agreements focus the delivery of R&D outputs through extension to deliver agreed outcomes. They provide an excellent mechanism for determining the impact of extension.

Recommendation 11: *There should be an opportunity for all growers to be able to attend productivity groups in all regions. This may be a mixture of 'host' invited attendees as well as cross-geographical groups. BSES administrative resources and communication mechanisms should assist in ensuring that participants know about group meetings in plenty of time.*
BSES has noted this and endeavoured to implement the recommendation in all areas.

Recommendation 12: *Appropriate charges should be developed state-wide for such services as soil testing. If this means that growers go elsewhere for these services, then this should be accepted as appropriate market forces which free staff up for other activities. When defining what services BSES charge for, these should be clearly highlighted to growers. It is important to work closely with productivity groups and other industry groups so that the roles the different groups play are complementary and that any changes to the way services are offered are not undermine.*
This is covered within BSES service-fee agreements with individual growers and with the SLAs with industry groups. The new BSES structure clearly differentiates between products and services that deliver an industry-wide benefit (and that are included in QCanes and QCrops and that are supported by service fees) and those that deliver individual benefits (and that are costed appropriately and delivered through Sutech Solutions.

Recommendation 13: *Tools and approaches for benchmarking and comparing costs and returns should be pooled across regions for broader industry benefit.*
Undertaken as part of the DPI&F-BSES FutureCane program.

Recommendation 14: *SRDC should provide resources to pilot the development of a farmer-led research and extension group. The group would need to be led by a farming community with support provided by BSES, productivity groups, mills etc, but leadership coming from the community.*
Undertaken by SRDC. These often require facilitation and expertise input from BSES.

Recommendation 15: *BSES and SRDC should assess the viability of piloting an FM500 group or groups in the various regions. FM500 targets growers who are very keen to stretch their capability in farm and financial benchmarking.*

Not specifically undertaken by BSES, although BSES' approach to 'market segmentation' will see greater emphasis on larger and more responsive growers.

Recommendation 16*: A project should be designed which explores the strengths and weaknesses of using market segmentation to design tools and material which allows the targeting of both full time farmers and cane farm owners who spend large amounts of time away from the farm earning income. This could build on the unfunded proposal to SRDC from the Northern Region.*
BSES' approach to 'market segmentation' will see greater emphasis on larger and more responsive growers. COMPASS is now available on-line, allowing part-time growers easier access to the program.

Recommendation 17*: SRDC and BSES should work closely with all parties to design a media strategy of good news stories to promote the sugar industry and their efforts to improve productivity and environmental dimensions to overcome the myths that abound both within their communities and to wider Australia.*
Not specifically done, but recent issues of the *BSES Bulletin* has focused on people making changes. The Case Studies developed in the later stages of this project also convey good-news stories. Extension staff also regularly use the ABC rural reports to convey good news stories.

Recommendation 18: *The scope of PROSPER should be extended to include the total farming system including Work Place Health and Safety, keeping farm records, environmental audits etc.*
Partially addressed through the development of the BSES Paddock Journal. WH&S is also covered within the COMPASS program.

Recommendation 19: *Given the evidence of impact of the activities undertaken through Prosper and the support by BSS260 and the need to maintain the momentum to realise the full benefits to the industry, the Panel recommends that BSES continues to fund Prosper at its current levels and that SRDC continues with its support funding for BSS260 for at least a further funding cycle.*
BSES continues to consider extension as its highest priority issue and has proposed a further project to SRDC - this proposal was not successful. BSES' new structure, where extension is 'embedded' in QCanes and QCrops, will see the program better able to deliver outcomes that are needed and wanted by industry.

4.0 OUTPUTS

This project has significantly enhanced adoption of locally defined best-management practices by cane growers and harvester operators in:

- Fallow management;
- Crop establishment;
- Variety management;
- Crop management;
- Weed and pest management;
- Harvesting and transport;

- Landscape management.

These changes have resulted from a combination of a world-class extension program using the range of tools outlined in Section 3, but particularly incorporating group-participation processes.

Outputs range from the production of printed material through local newsletters, booklets, trial reports, radio reports, press releases, and industry newspapers/magazines, to conduct of group meetings, to training courses, to establishment of 'best-bet' blocks, to completion of case studies, to support and encouragement of group development. All of these have maintained a high profile for the project.

Some examples of participation are:

- Through Queensland in 2004-05, 905 growers attended farming-systems workshops and 377 attended business workshops.
- Throughout Queensland, 102 participants attended harvesting best-practice workshops.
- In the Mackay region, 25% of growers have been involved with the project and there is certainly a flow-on effect to other growers.
- In the Southern region, 52 growers have attended herbicide BMP workshops, 300 have attended herbicide demonstration sites, 35 have attended shielded-sprayer demonstrations, 80 have attended field days at 'best-bet' blocks, > 100 have attended business-planning workshops, 30 have attended variety workshops, 45 have attended water-winch workshops, and 70 have completed nutrition workshops.

5.0 OUTCOMES

This project has contributed significantly to ensuring a reliable and increasing cane supply in a sustainable production system by:

- Increasing the capability of the industry to cope with adversity; and
- Building skills in:
    - On-farm evaluation of innovative technology;
    - Economic evaluation of alternative cane-farming practices; and
    - Delivery of best management practices to the industry.

Examples of some of the changes influenced by this project are:

- More than 30% of Queensland growers have completed the COMPASS program;
- 102 participants attended harvesting best-practice workshops;
- 49% of Northern fallows include a legume crop, and 14% planted with zero tillage;
- 88% of Northern growers consider reduced tillage a viable option, and 70% are actively trialling options;
- 34 far-northern growers used controlled-traffic in 2004-05;
- 70% of Herbert growers are using various forms of reduced tillage in the current farming system;

- 98 Herbert growers (14% of the region's cane growers) have implemented some form of the new farming system (sprayout, legume-fallow spray out, preformed beds, double-disc opener, or controlled traffic);
- > 1000 ha of Herbert fallow have a legume crop following the 2005 crushing, despite the late end to the crushing that restricted legume planting, and enquires to BSES on legumes have increased by 30% since 2004;
- Herbert commercial soil test system has increased throughput by 15% since 2004 and BSES soil pH testing for legume planting has increased by 35% in 2005;
- 27% of Burdekin growers are using the Paddock Journal to record farming operations;
- Area ploughed-out/replanted in the Burdekin reduced from 6054 ha in 2002 to 2594 ha in 2004;
- Area planted in the Burdekin with minimum tillage increased from 370 ha in 2002 to 2200 ha in 2005 and 2500-3000 ha expected in 2006 – this is 20% of the area planted each year in the Burdekin.
- 18% of Burdekin growers now using legume fallows in 2004, and 1300 ha planted to soybeans (36% of fallow area) by Southern growers;
- Area planted in the Mackay Sugar areas to controlled traffic rose to 1236 ha in 2005 with an additional 500 ha of 'improved farming system' in Proserpine and 400 ha at Sarina;
- 30% of Southern growers now using air inducted/inclusion/low-drift herbicide nozzles;
- 50% of Bundaberg cane planted with wide-throat planters;
- 14% of Southern growers have moved to controlled-traffic planting;
- 73% of Southern growers have recently changed their farming system;
- 46% of the area planted in 2005 in the Southern region was to the new variety Q205$^{\Phi}$ and 29% was to Q188$^{\Phi}$.

The most graphic example of the impact of group-participation activities comes from the Burdekin. Here, the net earnings per hectare of growers attending CPI initiatives were compared with those of growers not attending – the difference between these two groups has increased dramatically over pre-CPI levels (Figure 5), indicating that the program has had a real impact.

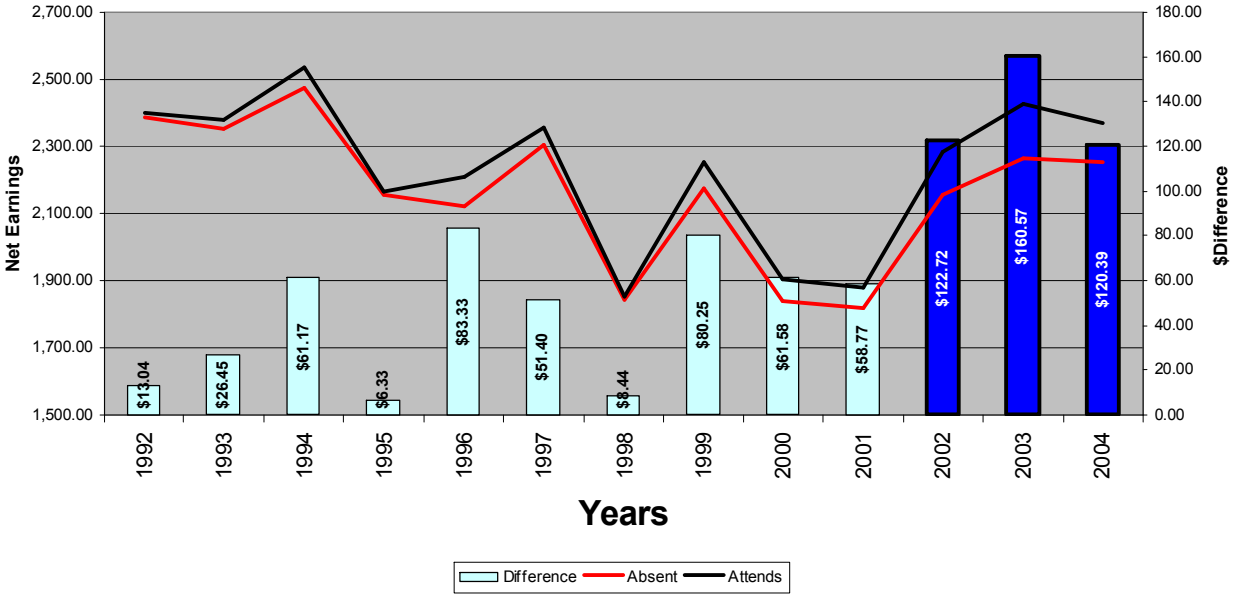


Figure 5 Comparison of net earnings per hectare for Burdekin growers attending or not attending CPI initiatives

6.0 PROCESS FOR THE FUTURE

The project has seen two areas of considerable success: the value of the group-facilitation process, and the widespread adoption of best-management practices. These have led to BSES implementing a range of processes to ensure continued use of group facilitation, albeit with other services that deliver specific advice to individual growers, and the continued adoption of BMP across industry.

Group-facilitation processes throughout this project have been instrumental in growers and service-industry providers improving their knowledge of new farming concepts. Group meetings have provided the opportunity for growers to share their problems and experiences, as well as understand how they have solved problems along the way. This process has led growers to form smaller specialist concept groups in which they have trialled new farming systems, often in conjunction with BSES staff. Using SRDC-funded travel and learning grants, growers have also been able to visit other areas to look at new farming concepts, again often facilitated by BSES staff.

Many growers throughout this process, however, have not been confident to go ahead and trial the new farming practices. Some of these growers contacted BSES expressing their concern and, with one-on-one extension support, growers gained confidence in being able trial new farming practices on their farms. This support and the confidence gained from initial successes have encouraged farmers to review their total farm operation and look at what changes could be made to increase profitability and sustainability.

Some farmers are now taking this a step further through the employment of BSES on a consulting basis to provide detailed regular and ongoing agronomic advice to their

farming operation. This advice has led to dramatic increases in yield and reductions in operating and input costs.

To gain better adoption of BMP, BSES has radically changed the way that it delivers extension services. In all regions, BSES has implemented regional business plans that identify the main issues needing to be addressed to advance profitability and sustainability for both growers and millers. These plans are developed in consultation with industry on a mill/region basis, and they reflect the goals of the current BSES Strategic Plan. They are approved by the BSES board and are reviewed each quarter. The plans identify the goals and objectives to be met, who is responsible for carrying out the work, and the time frame for completion.

The plans provide a focus for extension and research staff in delivering to industry a broad range of outcomes. A major focus of each of the plans is partnering with mills/productivity service companies in reviewing mill data to assess the impact of activities, eg variety management.

The duplication of services and activities has been a major problem of many regional plans. BSES' consultations with mills, productivity service companies, and government agencies in reviewing industry needs have eliminated much of this duplication.

BSES receives funding from millers and growers and, to ensure both these groups are receiving value from their contribution, the company is establishing Service Level Agreements (SLA) with these bodies. These SLAs follow on from the regional plans and establish the outcomes that BSES will deliver for the service fees paid in each mill area. They allow BSES to concentrate on the outcomes required in each mill area, rather than being caught up in trying to do everything and please no one. Extension staff have a focussed plan to ensure that value is delivered to industry.

BSES through the FutureCane program in conjunction with DPI&F have been able to continue to promote the finding of the Sugar Yield Decline Joint Venture. These findings relate to breaking soil monoculture by planting legume break crops, zonal tillage and controlled traffic. By obtaining equipment for farmers to use, more and more farmers are trialling these practices on their farms. Survey results are showing there is increased number of farmers who are now adopting these practices.

BSES is also undertaking an innovative farming project in the Herbert in conjunction with Queensland Environmental Protection Agency that identifies three groups of growers, known as early, mid and late adopters. This project follows the path of these three groups of growers in implement these best-management farming practices. The results of this project will be available following harvest in 2006.

Another important step for the industry has been to be able to discuss production costs and have these promoted so other growers can then look to changing their farming operations based on this knowledge. BSES, in conjunction with FutureCane economists, is undertaking cost analysis of growers' production systems to gain a better understanding of the impact that changed farming practices have had. This work will continue, and is it believed growers will become better equipped to review their own practices it they able to acknowledge and review other more efficient farming systems. BSES will also look to

further train extension staff in using the Farm Economic Analysis Tool (FEAT) developed by DPI&F economists to assist further with this work.

BSES has developed a web-based program 'Farm Productivity Assessment' (FPA). This program allows BSES extension staff to review an individual grower's total farming operations and then provide tailored recommendations on ways to improve farm profitability and productivity. The continued development of this program may lead to growers being able to use this program for a farm-management system and development of land and water management plans. The program is being delivered in different ways across the industry, as some mill areas see a greater impact from having all growers complete the program. Both the Mackay and Proserpine areas have partnered with BSES to carry out this program over the next 2 years. This program will also form part of the service-level agreements with some mills.

The FPA program follows from the CROP (Combined Recommendations on Productivity), a partnership between BSES and Suncorp-Metway. Suncorp, as one of the leading financiers of cane growers, were concerned for the viability of their customers, and they requested BSES to carry out reviews of customers' farming practices. This project has provided both Suncorp and the growers with detailed reviews of the growers' farming operations. It identifies a list of actions that the grower can undertake to improve productivity and profitability. The grower, as part of the review, lists those actions that they will implement. Extension staff then provide ongoing assistance in assisting the grower to implement the actions. Suncorp has seen significant changes in their customers in terms of farm decision-making and farming practice, and has advised that will continue the program until all interested customers have completed the program.

BSES will look to identify other companies who they can partner with to bring about industry best-management change. It is important that growers see the need to continually review and monitor their farming operations to ensure the best outcomes, not only in terms of profitability and productivity, but also socially and environmentally.

BSES has also upgraded its web site to assist farmers in gaining the most up-to-date information on cane farming. This site will also provide details to growers on activities that are happening in their area such as field days, training productivity forums and workshops. With more and more information becoming available, growers need to have quick and easy access to it - this can be achieved by utilising the web. There will also be links to other sites that can provide growers with useful information. The information will be provided free to all BSES members.

Into the future, BSES is well placed to deliver a farm management system (FMS) or components of an FMS to the industry. A FMS can supply a benefit to the individual and meet any regulatory requirements. BSES through its FPA program and through programs such as Compass, Chemcert and tools such as the Paddock Journal is able to provide training and advice to growers on records to be kept and knowledge required to meet the requirements of a FMS. Whilst the delivery of the FMS program to industry is still undecided, BSES, through its extensive network of offices and staff, is well placed to deliver this program to industry. Further consultation will continue to take place.

One of the recommendations from May 2004 review of BSS260 was for BSES extension staff to meet regularly to discuss industry issues and learn from each other how to help industry become more profitable and sustainable. BSES has implemented this program with two conferences already being held. These conferences have been extremely beneficial, not only to new staff, but also to allow the older staff to gain knowledge of the skills and experience that the new staff bring to the company. The focus was on the better delivery of best-practice management within the sugar industry and included training in the Farm Productivity Assessment program. This program will continue as we strive to keep pace with the ever-changing programs required in delivering extension knowledge to industry.

BSES, like many other industries, is feeling the effects of a tightening labour market place and increasing difficulties in attracting and retaining the high-quality employees that are needed to deliver its services. A recent survey of industry attitudes towards BSES has shown that there is strong support for BSES and the services it delivers to the Australian sugar industry. However, current industry funding is inadequate to continue current levels of these services. Industry is prepared to increase its contributions, but wants to see value for its investment and clear demonstration of what BSES provides. One response has been to sub-brand BSES' activities into QCanes, QCrops and Sutech Solutions to provide that clarity to BSES' owners and investors. Coupled with prudent cost control and an increase in service fees, BSES can continue as the principal supplier of RD&E services to an increasingly profitable, productive and sustainable Australian sugar industry.

7.0 RECOMMENDATIONS FOR FUTURE RD&E

- Adoption of best-management practices (BMPs) is vital to productivity, profitability and sustainability of the Australian sugar industry – SRDC should continue to promote the further adoption of BMPs.
- Group processes are effective in delivering BMPs, but require funding and provision of facilitators – SRDC should continue to direct funding to promote group processes and provision and training of facilitators.
- BSES is an ideal vehicle to facilitate group processes given the skills of its extension staff, its 'embedding of extension in QCanes and QCrops, and its experience of being a connector between researchers and growers – Industry should continue to support BSES activities.
- Service Level Agreements provide an ideal mechanism for delivering agreed outcomes to industry – BSES should continue to develop these agreements.
- Farm Productivity Assessments offer a new and more focused method for highlighting BMPs appropriate to individual farms – BSES should continue to progress the development of FPAs.
- Discussion and analysis of production costs are underutilised in making decisions on farm profitability – Industry, including SRDC, should give further support to the development and use of economic tools, especially within the DPI&F-BSES FutureCane program.

- Websites are a growing source of information for growers and industry partners on BMP and other issues – Industry should give support for the development and maintenance of up-to-date, user-friendly websites.
- Group facilitation and the delivery and adoption of BMPs are dependent on a cadre of well-trained, experienced extension staff – Industry should give a high priority to the retention and training of new and existing staff.

8.0 PUBLICATIONS

Outcomes of the project were promoted across industry through regular local newsletters, trial reports, radio reports, press releases, and industry newspapers/magazines.

Each region produced newsletters that are sent to all growers, as well as local industry bodies and media outlets. Newsletters were issued at least quarterly.

More 'substantial' publications include:

- Herbicide residue booklet (Appendix 2);
- Case studies (Appendices 3 and 4);
- Loeskow, Cameron and Callow 2006 ASSCT paper - Grower case-study on economics of an improved farming system (Appendix 5);
- Agnew J. 2003. Farming in a low-income environment. *BSES Bulletin* 84: 14-15 (Appendix 6).
- Agnew J. 2005. Using and looking after your hand-held refractometer. *BSES Bulletin* 7: 26-28 (Appendix 7).
- Bonaventura P. 2004. The move to minimum till – how one grower did it. *BSES Bulletin* 1: 7-8 (Appendix 8).
- Bonaventura P and Matthews R. 2005. Burdekin zero-till planting trial. *BSES Bulletin* 8: 14-15 (Appendix 9).
- Bonaventura P, McGregor D and Poggio M. 2004. Saving weed control dollars. *BSES Bulletin* 2: 12-17 (Appendix 10).
- Calcino D. 2004. A row too far? *BSES Bulletin* 1: 19-21 (Appendix 11).
- Callow B. 2005. Beating the weeds in sugarcane. *BSES Bulletin* 5: 8-9 (Appendix 12).
- Callow B. 2005. A 'best bet' block. *BSES Bulletin* 8: 12-13 (Appendix 13).
- Cox M and Wallis D. 2004. Choice quality – choosing and managing the best variety for your farm. *BSES Bulletin* 2: 3-5 (Appendix 14).
- Garrad S. 2005. Best management practice for farms. *BSES Bulletin* 5: 6-7 (Appendix 15).
- Jeppesen M and Staier T. 2005. New farming systems: Central district growers taking up the challenge. *BSES Bulletin* 7: 18-21 (Appendix 16).
- Poggio M. 2003. Effective weed control. *BSES Bulletin* 84: 3-5 (Appendix 17).
- Poggio M. 2005. Towards better, safer pest and weed management. *BSES Bulletin* 5: 10-12 (Appendix 18).
- Shannon G and Poggio M. 2005. Farming systems update – Herbert. *BSES Bulletin* 7: 17 (Appendix 19).

- Wallis D. 2003. Northern growers point the way to sustainable, profitable farming system. *BSES Bulletin* 84: 8-13 (Appendix 20).

APPENDIX 1 - Program for Group Leadership and Facilitation Workshop.

Date: Friday 12 July

Duration: 8.30 am to 4.00 pm

Trainers: Warren Hunt & Steve Garrad BSES

Invited guests: Mark Bickoff - Bowen Landcare and proactive grazier
David Wallis BSES

Objectives:

1. Develop understanding of group process and how groups can be used in rural industry.
2. Introduce skills in conducting group meetings
3. To engender a sense of participation in staff involved in CSR or Mackay Sugar group initiatives.

8.30 am	Welcome, introduction and purpose (SG) R of PL, spell out objectives (OHP), our roles and the participants' roles.
8.40 am	Establishing guidelines + issues container (WH)
8.50 am	*Q. "Why do you think organisations are moving towards group-based extension?" [*Back-up Question *"What do you think facilitation means in group-based extension?']* (Brainstorm WH, scribe SG) –WH to explain process of this exercise (including guidelines).
9.10 am	Presentation: "*What are other industries doing with groups*?" (WH)
9.30 am	Perspective: *To be advised*
10.00 am	Perspective: *'Group work in Mulgrave'* – Steve Garrad
10.50 am	Perspective: '*Role of groups in the Variety BMP Project*' – David Wallis
11:20 am	Practical techniques for managing meetings / workshops. Managing the venue, welcomes and introductions, statement of purpose, guidelines or ground rules, expectations, issues container, use of smaller sub-groups, managing chatter, managing conflict, Q&A technique, evaluation techniques. (Participatory activity with demonstrations - WH & SG).
12.15 pm	Lunch
1.15 pm	Participants raise 5 topics of relevance in their area. Split into groups of 3-4 people. A facilitator nominated in each group to develop structure and process that will effectively deal with that topic and maximise participation for the purpose of facilitating change. (SG) Presentation of discussion by each group.
2.15 pm	Presentation – Putting things in context - *'Contemporary extension philosophy and theory.'* (WH) Development of agriculture in Australia, retention of knowledge and change, androgogy vs pedagogy, action learning.
3.35 pm	Evaluation of workshop
4.00 pm	Close

BSES
Sugarcane for the future

HERBICIDE RESIDUES

BARRY CALLOW
BSES LIMITED

2005




IMPORTANT NOTE: INFORMATION CONTAINED IN THIS BOOKLET WAS CURRENT AT TIME OF PUBLISHING

BSES LIMITED

WARNING: Our tests, inspections and recommendations should not be relied on without further, independent inquiries. They may not be accurate, complete or applicable for your particular needs for many reasons, including (for example) BSES Limited being unaware of other matters relevant to individual crops, the analysis of unrepresentative samples or the influence of environmental, managerial or other factors on production.

DISCLAIMER: Except as required by law and only to the extent so required, none of BSES Limited, its directors,officers or agents makes any representation or warranty, express or implied, as to, or shall in any way be liable (including liability in negligence) directly or indirectly for any loss, damages, costs, expenses or reliance arising out of or in connection with, the accuracy, currency, completeness or balance of (or otherwise), or any errors in or omissions from, any test results, recommendations statements or other information provided to you.

INTRODUCTION:




The Bundaberg/Isis agricultural region has always grown a variety of crop types.

This region has long been a major sugar cane producing area, with mixed horticultural cropping areas changing with market forces.

In more recent years, a much bigger swing to mixed rotational cropping has occurred, coinciding with the introduction of new generation residual herbicides registered for use in cane and for crops such as peanut and chickpea.

This has raised awareness of the need for better understanding of the life of the residual herbicides in the soil and the potential for such residues to damage rotation crops such as potatoes, tomatoes, capsicums, cucurbits, sweet corn, maize and soybeans, mung beans and adzuki bean.

Some of the questions uppermost in growers' minds when considering the use of a pre-emergent herbicide should be:

What is the next crop likely to be?

With good forward planning this question is more easily answered.

What is the past chemical history of the block?

Growers considering a new planting in any block should be able to consult the spray record diary. Even if leasing a block, records should be available. How long do the residual components persist in the soil and will the residue affect the following crop?

Is there danger of a crop failure?

The information regarding following crops is on each individual herbicide label, which should be read before purchase or use of any product being considered.

This booklet presents information on a range of herbicides used in a range of crops in the Bundaberg/Isis region. Weed Master Duo® is the only glyphosate product with a permit for use in interow spraying in cane. Glyphosate is included as use through hooded sprayers has resulted in much greater volumes being used in cane. Also included are 2, 4-D formulations, due to the potential for damage to non-crops from drift.

It is equally important to consider which herbicides had been used in rotation crops prior to planting back to sugar cane. These products are listed at the end as non-cane products.

HERBICIDE RESIDUES | BSES LIMITED | 2005

SUMMARY OF PRODUCTS BY ACTIVE INGREDIENT

CANE PRODUCTS:

IMPORTANT INFORMATION FOR FOLLOW CROPS

The following information was taken directly from manufacturers' labels and has not been tested, verified, interpreted or altered in any way. Users should read all of the product label or other information from the product supplier before using the product.

FLAME® Active ingredient = 240 g/L IMAZAPIC

FOLLOW CROPS

Under conditions which do not favour breakdown of this product, carry-over soil residues can affect susceptible follow crops.

As environmental and agronomic factors make it impossible to eliminate all risks associated with this product, rotational crop injury is always possible. The following minimum re-cropping intervals (months after application) should be observed.

Following use in sugarcane and peanuts:-

MONTHS AFTER APPLICATION

0	4	5	10	18	24	36
Mung beans, Peanuts, Soybeans, maize varieties with CLEARFIELD Technology ONLY: -Pacific Hycorn 62IT -Pacific Hycorn 53IT -Pioneer 3395IR	Chick peas, lucerne*, barley*, wheat* (except for wheat varieties with CLEARFIELD Technology ONLY)	Lupins, pasture legumes	Maize- (except varieties with CLEARFIELD Technology ONLY), dryland cotton	Sorghum	Irrigated cotton, sunflower	Any other crops

* The following additional requirements apply if it is intended to plant wheat (except for varieties with CLEARFIELD Technology), barley or lucerne during the next winter season.

  DO NOT apply FLAME in areas where rainfall from spraying to sowing of cereals is expected to be below 200 mm.

- The following additional requirements apply if it is intended to plant sorghum or maize (except for varieties with CLEARFIELD Technology), during the next summer season.

  (DO NOT apply FLAME in areas where rainfall from spraying to sowing of sorghum or maize is expected to be below 550 mm.

STOMP 330EC®, REBEL 330EC®, AGCARE PENDI 330®, CYCLONE 330EC®, FIST 330®, PENDIMETHALIN 330®, CHARGER 330®, GAZELLE 330®, METHLIN 330® Active ingredient = 330 g/L PENDIMETHALIN

RIFLE 440 ®, CYCLONE 440 EC® Active ingredient = 440 g/L PENDIMETHALIN

STOMP XTRA® Active ingredient = 455 g/L PENDIMETHALIN

FOLLOWING CROPS

In the event of crop failure the soil should be cultivated to a minimum depth of 15 cm to ensure any residues are evenly dispersed throughout the soil. If a maize crop fails due to weather conditions or some other reason, maize can be replanted the same year without adverse effects but seeding depth must be below the retiled area.

The following crops may be sown after a minimum interval of 2 months after application of STOMP Xtra: Carrots, parsnips, parsley, celery, potatoes, peas, French beans, transplanted brassicas, transplanted lettuce, transplanted tomatoes, transplanted capsicums.

The following crops may be sown after a minimum interval of 5 months after application of STOMP Xtra: Turnips, lettuce, radish, Brussels sprouts, cabbage, cauliflower, broccoli, onions, leeks, sweetcorn, pumpkins, squash, melons, cucumbers.

The following crops may be sown after a minimum interval of 12 months after application of STOMP Xtra: Redbeet (beetroot), spinach, silverbeet, poppy.

CREW®, TRIFLURALIN®, TREFLAN® Active ingredient = 330 g/LTRIFLURALIN

TRIFLURALIN 400®. Active ingredient = 400 g/L TRIFLURALIN

TRIFLUR 480®, TRIFLURALIN 480®, TRIFLURAMAX 480®, TREFLAN 480®, TRIFLURASIP 480®, TRICON 480®, TRIFLUR X®, T-REX 480®, TRIGEN 480® Active ingredient = 480 g/L TRIFLURALIN

TRIFLUR 500® Active ingredient = 500 g/L TRIFLURALIN

- DO NOT use in high winds.
- DO NOT exceed rates specified, to avoid crop damage.
- DO NOT plant sensitive grasses such as oats, sorghum, millets, phalaris spp, ryegrass or wheat for 12 months following the use of this product except where wheat follows wheat or other winter crops.
- DO NOT plant oilseed poppies when a detectable residue or trifluralin is present in the soil. Levels as low as 0.02ppm may interact with other unfavourable factors (moisture, stress, disease etc.) to reduce poppy growth and vigour.
- DO NOT apply to orchards & vineyards after first flush of growth or when residues can lodge on or in fruit.

Drift Warning: DO NOT apply under meteorological conditions or from spraying equipment which could be expected to cause spray drift onto nearby susceptible plants, adjacent crops, crop lands or pastures.

BALANCE® Active ingredient = 750 g/kg ISOXAFLUTOLE

CROP SAFETY

Chickpeas

Apply Balance 750 WG only to cropping areas which are to be left to fallow, or where the following crop will be either chickpeas, cereals or maize. For advice on planting following crops other than chickpeas, cereals or maize contact Bayer CropScience Pty Ltd.

SUGARCANE

There are 3 key guidelines for maintaining crop safety when using Balance 750 WG in sugarcane.

1. Do not apply to soils with a low binding potential, that is with a C.E.C. below 4.5 meg/100 g, or an O.C. of 1.0% or less (unless C.E.C. is greater than 9.5 meg/100g).
2. Do not apply to areas which have poor drainage or poor root development.
3. Add Paraquat to Balance to minimise foliar uptake when applying as a broadcast spray to plant cane.

Balance 750 WG is adsorbed to organic matter and clay particles in the soil. Soils with low organic carbon (O.C.) and cation exchange capacity (C.E.C.) have a reduced capacity to adsorb the herbicide in the soil, which may result in the herbicide leaching past the weed root zone into the cane root zone. Crop root uptake of Balance 750 WG may result in phytotoxicity, which is evident as bleaching of leaves.

To minimise the risk of crop root uptake, Balance 750 WG is not recommended for use on soil with a C.E.C. below 4.5 meg/100 g or an O.E. of 1.0% or less (unless C.E.C. is greater than 9.5 meg/100 g). These values should be determined through soil analysis prior to using Balance. Refer to your local reseller or Bayer CropScience representative to assist you with interpretation of your soil analysis results.

Balance 750 WG can be applied to hot and dry soils, without the risk of breakdown by sunlight. This ultraviolet stability removes the need for immediate soil incorporation of the product. Balance 750 WG is activated by rainfall or irrigation, which is required to carry the herbicide into the root zone of the germinating weeds.

VELPAR K4 DF® Active ingredients = 468 g/kg DIURON + 132g/kg HEXAZINONE

DIRECTIONS FOR USE RESTRAINTS:

- DO NOT spray over sugarcane or allow excessive spray contact as crop injury may result.
- DO NOT replant treated areas to any other crop within two years after last application as injury to subsequent crop may result.
- DO NOT use on light sandy soils as injury to cane may result.
- DO NOT use in water-logged areas.
- DO NOT use in young plant cane.
- DO NOT use equipment or spraying methods which cause spray or spray drift to contact the growing point of the sugarcane.

COMANCHE® Active ingredients = 533 g/kg DIURON + 67g/kg HEXAZINONE

- DO NOT spray over sugarcane or allow excessive spray contact as crop injury may result.
- DO NOT use equipment or spraying methods, which cause spray or spray drift to contact the growing point of the sugarcane.
- DO NOT replant treated areas to any other crop (with the exception of sugarcane) within two years after last application as injury to subsequent crop may result.
- DO NOT use in young plant cane.

NU-TRAZINE 500 FLOWABLE®, FARMOZINE 500®, ATRANEX 500SC®, FLOWABLE GESAPRIM 500 SC®, ATRAZINE 500®, ATRAMAX FLOWABLE®, ATRAZINE FLOWABLE®, ATRAZINE 500 SC®, Active ingredient = 500 g/L ATRAZINE ATRADEX WG®, NU-TRAZINE 900DF®, FARMOZINE 900 WDG®, GESAPRIM GRANULES 900 WG®, ATRAZINE 900 DF®, ATRAZINE 900 WG®, ATRAMAX GRANULES 900 WG®, ATRANEX 900 WG®, ATRAQUEST 900 WG®, ATRAGRANZ ® Active ingredient = 900 g/L ATRAZINE

The maximum rate of Atrazine application in all crops except plantation forestry is limited to an amount of product equivalent to 3 kg a.i. Atrazine/ha per year. DO NOT exceed this limit, especially when applying an Atrazine herbicide post-emergence, where an Atrazine herbicide has been applied pre-emergence.

The maximum rate of application in plantation forestry is an amount of product equivalent to 4.5 kg a.i. Atrazine per year in sandy soils and those defined as highly erodible, and product equivalent to 8 kg a.i. Atrazine/ha per year in clay loam and heavier textured soils.

PROTECTION OF WILDLIFE, FISH, CRUSTACEANS AND ENVIRONMENT

DO NOT contaminate streams, rivers or waterways with the chemical or used containers. This product is very highly toxic to algae and aquatic macrophytes. DO NOT apply this product within 60 m of natural or impounded lakes or dams. DO NOT use in channels or drains. DO NOT apply under meteorological conditions or from spraying equipment which could be expected to cause drift of this product or spray mix into adjacent areas, particularly wetlands, waterbodies or watercourses.

PROTECTION OF CROPS, NATIVE AND OTHER NON-TARGET PLANTS

DO NOT apply under weather conditions or from spraying equipment which may cause spray to drift onto nearby susceptible plants/crops, cropping lands or pastures, particularly wetlands, waterbodies or watercourses. DO NOT plant crops other than those recommended on this label for at least 6 months following treatments of this product at rates up to 1.4 kg/ha and for 18 months following treatments of 1.4 to 3.3 kg/ha. When rates exceed 3.3 kg per hectare plantings may not be possible for very long periods afterwards.

VIKING, AMETRYN® Active ingredient = 500 g/L AMETRYN

- DO NOT use in high winds.
- DO NOT allow spray to drift.
- DO NOT replant pineapples or sugarcane for 8 months after last application.

STARANE 200®, COMET 200®, AGAN FLUROXYPYR 200 EC®, TOMIGAN 200EC®, FLAGSHIP 200® Active ingredient = 200 g/L FLUROXYPYR

MINIMUM RECROPPING PERIODS

Plant-back periods for crops following the application of Comet 200 for rates up to 1.5 L/ha.

RATE L/HA	0.375	0.75	1.5
CROP	DAYS		
Barley	7	7	7
Wheat	7	7	7
Chickpea	7	7	7
Cotton	14	14	28
Soybean	7	7	14
Sunflower	7	7	7
Maize	7	7	7
Sorghum	7	7	7

NOTE: Before using Comet 200 in tank mixes with other herbicides, check the plant-back information on all product labels. The time between spraying and planting will be determined by the most residual product, ie. The product with the longest plant-back period.

DIUREX WG®, DIURON 900 DF®, DIURON 900 WG®, KARMEX DF®, DIURON 900 WDG®, Active ingredient = 900g/L DIURON
FARMOZ DIURON 800 FLOWABLE® Active ingredient = 800g/L DIURON
DIURON 500 SC®, DIURON 500 FLOWABLE®, DIURON 500® Active ingredient = 500 g/L DIURON

RESTRAINTS:

- DO NOT replant treated areas within 2 years of an application of Diurex WG except when otherwise stated on the label.
- DO NOT use on very light sandy soils as crop damage may occur.

REPLANTING RESTRICTIONS

Crop Rotations:
– DO NOT replant treated areas to any crop within two years after last spray unless otherwise stated.

Cotton & Lucerne:
– DO NOT replant treated areas to any crop within 1 year after last spray. Except cotton, corn or grain sorghum which may be planted in the spring of the following year.

Gladioli, Tulip, Daffodils;
– DO NOT replant treated areas to any crop within 1 year after treatment.

Pineapples & sugarcane:
– treated areas can be replanted to pineapple or sugarcane 1 year after last spray.

DUAL GOLD® Active ingredient = 960 g/L S-METOLACHLOR

WARNING - Brassica Crops: Crop retardation may occur where DUAL GOLD is used on soils that have low organic matter content and which contain more than 60% of fine sand and silt. On these soil types, use rates of DUAL GOLD towards the lower end of the rate range and apply onto moist soil. Irrigation after application should be limited to no more than 25 mm. DO NOT use more than once per year.

PROTECTION OF CROPS, NATIVE AND OTHER NON-TARGET PLANTS

- DO NOT apply under weather conditions, or from spray equipment, that may cause spray to drift onto nearby susceptible plants/crops, cropping lands or pastures.
- DO NOTplant crops other than maize, sweet corn, tobacco, cotton, soybeans, sunflowers, peanuts, broccoli, Brussels sprouts, cabbages, cauliflowers or Concep II treated sorghum within 6 months of application of DUAL GOLD.
- DO NOT irrigate to the point of run-off for at least 2 days after application.

PRIMEXTRA GOLD®
Active ingredients = 290 g/L S-METOLACHLOR + 370 g/L ATRAZINE

PROTECTION OF CROPS, NATIVE AND OTHER NON-TARGET PLANTS

- DO NOT apply under weather conditions or from spraying equipment that may cause spray to drift onto nearby susceptible plants/crops, cropping lands or pastures.
- DO NOT apply, drain or flush equipment on or near desirable trees or other plants, or on areas where their roots may extend, or in locations where the chemical may be washed or moved onto contact with their roots.
- DO NOT plant crops other than maize, sweet corn, sugar cane or Concep II treated sorghum within 6 months of application of PRIMEXTRA GOLD at rates up to 3.2 L/ha and for 18 months at rates of PRIMEXTRA GOLD above 3.2 L/ha. On soils with a pH (CaCl2) greater than 7, a bioassay or analytical test should be undertaken before sowing susceptible crops.
- DO NOT irrigate to the point of run-off for at least 2 days after application.

ROUNDUP®, GLYPHOSATE 360®, WIPE OUT 360®,WEEDMASTER DUO®, WEEDMASTER 360®, PLUS®, CREDIT®, GLADIATOR®, GLYCEL 360®, SANOS 360®, ROUNDUP BIACTIVE®,ROUNDUP DRY®, GLYMAC 360®
Active ingredient = 360 g/L GLYPHOSATE
ROUNDUP CT®, GLYPHOSATE 450®, GLYCEL 450®,GLYPHOSATE 450 CT®,
Active ingredient = 450g/L GLYPHOSATE
GLYPHOSATE 490® Active ingredient = 490 g/L GLYPHOSATE
TOUCHDOWN®, AGCARE KEN-UP GOLD 500®, Active ingredient = 500 g/L GLYPHOSATE
ERADICATOR 510®, GLYPHOSATE 510® Active ingredient = 500 g/L GLYPHOSATE
ROUNDUP POWERMAX®, CREDIT®, Active ingredient = 540 g/L GLYPHOSATE

Plant Information

Roundup is a non-volatile, water soluble liquid product with non-selective herbicidal activity against many annual and perennial broadleaf weeds and grasses.

Roundup may be used for weed control in agricultural land prior to sowing any edible or non-edible crop, but not prior to transplanting tomato seedlings.

Roundup is absorbed by plant foliage and green stems. It is inactivated immediately in the soil and does not provide residual weed control. Roundup moves through the plant from the point of contact to and into the root system. Visible effects on annual weeds take 3-7 days but on perennial weeds may not be obvious for 2-3 weeks or longer in some cases. Visible effects of control may be delayed by cool or cloudy weather at and following treatment.

Visible effects are a gradual yellowing and wilting of the plant which advances to complete browning of above ground growth and deterioration of underground plant parts. Delay application until vegetation has emerged to the stages described in the Weeds Controlled tables. Unemerged parts rising from unattached underground rhizomes or rootstock of perennials will not be affected by spray and will continue to grow. For this reason best control of most perennial weeds is obtained at late growth stages approaching maturity.

APPLICATION

Roundup is a non-selective translocated herbicide. Direct spray contact, or even slight drift, may cause severe injury or destruction of any growing crop or other desirable plants including trees. Clean all equipment after use by thoroughly washing with water.

AVOID DRIFT

DO NOT use with spraying equipment or under meteorological conditions which could be expected to cause spray drift onto nearby susceptible plants, adjacent crops, crop lands or pastures. Equipment settings which produce fine droplets (150 microns or less), winds over 8 km/h, inversion conditions, still air and hot dry days all contribute to drift.

Q. Does Roundup stay in the soil?

A. Roundup is completely biodegradable, breaking down into natural products in both soil and water. Any Roundup that makes its way to the soil sticks very tightly to the soil and will not move off the treatment site. Micro-organisms then break down the ingredients in Roundup to naturally occurring compounds.

TORDON 75-D® Active ingredient = 300 g/L 2,4-D + 75 g/L PICLORAM

Crops susceptible to Tordon 75-D include but are not limited to; peas, lupins, lucerne, navy beans, soybeans, and other legumes; cotton, fruit, hops, ornamentals, potatoes, safflower sugarbeet, sunflower, tobacco, tomatoes, vegetables and vines.

* DO NOT plant susceptible crops within 12 months of applying winter or summer cereal.

Use Rates of this product.

Cereal crops and grasses can be sown safely after using Tordon 75-D.

* Rates in excess of these will result in more persistent soil residues. Therefore, do not rotate susceptible plants until an adequately sensitive bioassay or chemical test shows that no detectable picloram is present within soil.
* DO NOT allow spray to drift onto susceptible crops. DO NOT apply under weather conditions or from spraying equipment that may cause spray to drift onto nearby susceptible plants/crops, cropping lands or pastures. Minimise spray drift by using low pressures and nozzles which do not produce a fine droplet spray.
* Avoid spray drift onto susceptible crops such as cotton, tobacco, tomatoes, vines, lupins, fruit trees and ornamentals.

AMICIDE 625®, AMINE 625®, Active ingredient = 625 g/L 2,4-D

Plant Back Periods (days) for Amicide® 625

Crop	Rates		
	Up to 560 mL/ha	560 mL - 1.1L/ha	1.1 - 1.7 L/ha
Balansa Clover	7	7	10
Barley %	1	1	3
Chickpeas #	7	14	21
Cotton	10	14	21
Faba Beans	7	7	10
Field Peas	7	14	14
Lentils	7	7	10
Linseed	7	7	14
Lucerne	7	7	10
Lupins +	7	14	21
Medics	7	7	10
Narbon Beans	7	7	10
Navybean	10	10	14
Oats	3	3	7
Perennial Ryegrass	7	7	10
Persian Clover	7	7	10
Phalaris	7	7	10
Canola/Rapeseed #	14	21	28
Rice	7	7	14
Safflower #	7	14	21
Sorghum @	3	7	10
Soybean	14	14	21
Sub-Clover	7	7	10
Sunflower @	7	10	14
Triticale %	1	3	7
Vetch	7	7	10
Wheat %	1	3	7
White Clover	7	7	10

IMPORTANT: WHEN APPLIED TO DRY SOILS AT LEAST 15mm (1/2 inch) OF RAIN MUST FALL PRIOR TO THE COMMENCEMENT OF THE PLANT BACK PERIOD.

NOTES:

% In Queensland, no rainfall is required to fall prior to commencement of Plant Back Period for wheat, barley and triticale.

In Queensland, planting of canola/rapeseed, chickpeas and safflower must be delayed for at least 14 days following rainfall of at least 15 mm.

@ In Central Queensland, when using 1 L/ha or less of Amicide 500, the Plant Back Period for sorghum and sunflower is 1 day irrespective of rainfall.

2,4-D AMINE 500®, AMICIDE 500®, AMIZINA 500®

Active ingredient = 500 g/L 2,4-D as dimethylamine salt

Drift Warning: Avoid spray drift onto susceptible crops such as cotton, tobacco, tomatoes, vines, fruit trees, vegetables, legume crops and pastures.

Plant back days for Nufarm Amicide 500

Crop	Rates		
	Up to 700 mL/ha	700 mL - 1.4 L/ha	1.4 L/ha - 2.1 L/ha
Balansa Clover	7	7	10
Barley %	1	1	3
Chickpeas #	7	14	21
Cotton	10	14	21
Faba Beans	7	7	10
Field Peas	7	14	14
Lentils	7	7	10
Linseed	7	7	14
Lucerne	7	7	10
Lupins +	7	14	21
Medics	7	7	10
Narbon Beans	7	7	10
Navybean	10	10	14
Oats	3	3	7
Perennial Ryegrass	7	7	10
Persian Clover	7	7	10
Phalaris	7	7	10
Canola/Rapeseed #	14	21	28
Rice	7	7	14
Safflower #	7	14	21
Sorghum @	3	7	10
Soybean	14	14	21
Sub-Clover	7	7	10
Sunflower @	7	10	14
Triticale %	1	3	7
Vetch	7	7	10
Wheat %	1	3	7
White Clover	7	7	10

IMPORTANT: WHEN APPLIED TO DRY SOILS AT LEAST 15mm (1/2 inch) OF RAIN MUST FALL PRIOR TO THE COMMENCEMENT OF THE PLANT BACK PERIOD.

NOTES:

% In Queensland, no rainfall is required to fall prior to commencement of Plant Back Period for wheat, barley and triticale.

In Queensland, planting of canola/rapeseed, chickpeas and safflower must be delayed for at least 14 days following rainfall of at least 15 mm.

@ In Central Queensland, when using 1 L/Ha or less of Amicide 500, the Plant Back Period for sorghum and sunflower is 1 day irrespective of rainfall.

SURPASS 300®, 2,4-D IPA 300®, ZULU 300®, AMINE 300®, GLYMATE 300®, ATTACK 300®, RODAMINE 300 ®.

Active ingredient =300 g/L 2,4-D as the isopropyalmine salt

CROP ESTABLISHMENT

Nufarm Surpass 300 is recommended as a herbicide additive to glyphosate for control of emerged weeds prior to crop establishment.

When Nufarm Surpass 300 is applied prior to crop establishment, certain Plant Back Periods should be observed to ensure that the herbicide has degraded sufficiently to allow safe sowing of the intended crop.This process is largely influenced by moisture, temperature and certain soil characteristics and may be delayed particularly when conditions are cold and dry.

Refer to the Plant Back Period table for specific information. In seasons of heavy weed growth, or where the following conditions apply, it may be necessary to further delay sowing until a suitable seedbed can be formed.

Conditions which can delay crop germination and seedling development include;

* Heavy green or decaying weed growth incorporated into the soil;
* Soil compaction or crusting;
* Cold and wet soils;
* Deep seeding;
* Prior use of residual or pre-emergent herbicides.

To minimise these effects it is suggested that:

* Weed bulk be reduced by grazing and cultivating to leave trash on the surface to dry out;
* A friable seedbed be produced by cultivation, where necessary;
* The use of pre-emergent herbicides to be avoided if they might contribute to reduced germination;
* A correct seeding depth be used.

The preferred alternative is to spray early to control any weeds in their less advanced stages and ensure the seedbed is in a suitable condition for early sowing when soil temperature is not excessively cold.

PROTECTION OF CROPS, NATIVE AND OTHER NON-TARGET PLANTS.

Drift Warning: Direct spray contact or even slight drift may cause severe injury or destruction of any growing crop or other desirable plants including trees and native vegetation.

– DO NOT use when breeze is blowing towards nearby desirable plants.

– DO NOT apply under meteorological conditions or from spraying equipment that may cause spray to drift onto nearby susceptible plants, adjacent crops, crop lands or pastures.

Equipment settings which produce fine droplets (150 microns or less), winds over 8 km/h, “still air” and hot dry days all contribute to drift.

Avoid spray drift onto susceptible crops such as cotton, tobacco, tomatoes, flowers, vegetables, vines, fruit trees, legume crops and pastures, oil seed crops or other susceptible crops and trees (eg Kurrajongs, Belahs, Eucalypts).

Plant back days for Nufarm Surpass 300®

Crop	Rates		
	Up to 700 mL/ha	700 mL - 1.4 L/ha	1.4 L/ha - 2.1 L/ha
Balansa Clover	7	7	10
Barley %	1	1	3
Chickpeas #	7	14	21
Cotton	10	14	21
Faba Beans	7	7	10
Field Peas	7	14	14
Lentils	7	7	10
Linseed	7	7	14
Lucerne	7	7	10
Lupins +	7	14	21
Medic	7	7	10
Narbon Beans	7	7	10
Navybean	10	10	14
Oats	3	3	7
Perennial Ryegrass	7	7	10
Persian Clover	7	7	10
Phalaris	7	7	10
Canola/Rapeseed #	14	21	28
Rice	7	7	14
Safflower #	7	14	21
Sorghum @	3	7	10
Soybean	14	14	21
Sub-Clover	7	7	10
Sunflower @	7	10	14
Triticale %	1	3	7
Vetch	7	7	10
Wheat %	1	3	7
White Clover	7	7	10

IMPORTANT: WHEN APPLIED TO DRY SOILS AT LEAST 15mm (1/2 inch) OF RAIN MUST FALL PRIOR TO THE COMMENCEMENT OF THE PLANT BACK PERIOD.

NOTES:

% In Queensland, no rainfall is required to fall prior to commencement of Plant Back Period for wheat, barley and triticale.

In Queensland, planting of canola/rapeseed, chickpeas and safflower must be delayed for at least 14 days following rainfall of at least 15mm.

@ In Central Queensland, when using 1.6L/ha or less of Nufarm Surpass™ 300, the Plant Back Period for sorghum and sunflower is 1 day irrespective of rainfall.

\+ In WA the Plant Back Period for lupins at all rates is 28 days.

PROPON®, ATLAPON® Active ingredient = 2,2-DPA

Drift warning:

- DO NOT apply under meteorological conditions or from spraying equipment which could be expected to cause spray to drift onto nearby susceptible plants, adjacent crops, crops lands or pastures.

Crop safety:

- DO NOT plant sensitive crops such as grass, small grains, corn or beans for at least 30 days after application.
- DO NOT use or allow drift onto pineapples or beneath fig trees or other sensitive crops.
- DO NOT allow water movement from sprayed irrigation channels onto susceptible crops for 7 days after application.

SEMPRA®, NUTCRACKER® Active ingredient = 750 g/kg HALOSULFURON- METHYL

FOLLOWING CROPS

The following crops may be planted at specific time intervals following application of approved rates of Sempra in approved situations. Use the time intervals listed below to determine the required time interval before planting.

Crop	Plant back interval after the last application of Sempra
Corn/Maize, Sorghum and Sugarcane	2 months
Wheat	3 months
Cotton	4 months
All other crops (except sugarbeet)	24 months
Sugarbeet	36 months

NON-CANE PRODUCTS:

GESAGARD 900WG®, PROMETRYN 900DF®, PROTON®
Active ingredient = 900 g/kg PROMETRYN

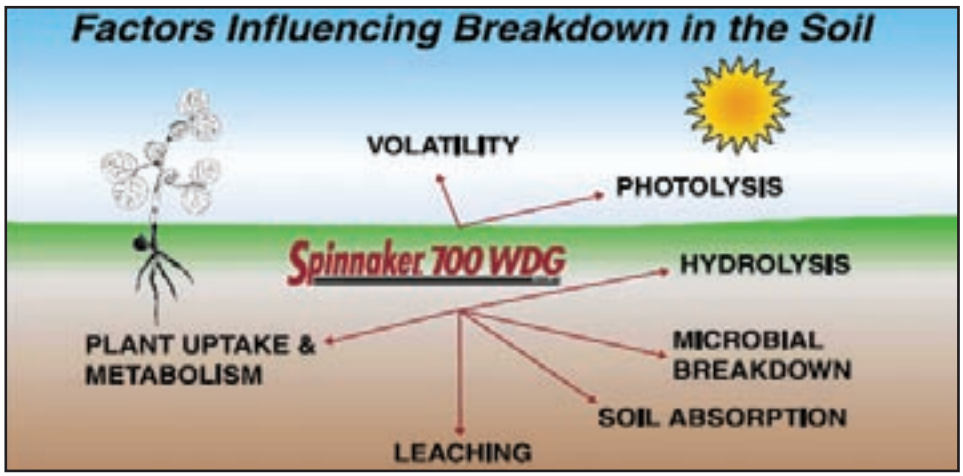
For the control of early competing weeds in carrots, chickpeas, cotton, potatoes, sunflowers, peanuts and other crops as per the Directions for Use Table.

- DO NOT plant crops other than carrots in GESAGARD treated cotton land for at least 6 months after the cotton crop has been removed.
- DO NOT plant crops other than transplanted celery, chickpeas or carrots in areas within 6 months following application of the product at rates above 1.2 kg per hectare.

GESAGARD 500SC® Active ingredient = 500 g/kg PROMETRYN

- DO NOT plant crops other than carrots in GESAGARD treated cotton land for at least 6 months after the cotton crop has been removed.
- DO NOT plant crops other than transplanted celery, chickpeas or carrots in areas within 6 months following an application of the product at rates over 2.2 L/ha.

SPINNAKER 700 WDG® Active ingredient = 700 g/kg IMAZETHAPYR



(Breakdown principally by microbial activity and plant activity)

Following use in winter crops:

MONTHS AFTER APPLICATION

0	10	22	34
Maize varieties with CLEARFIELD Technology ONLY: - Pacific Hycorn 62 IT - Pacific Hycorn 53IT - Pioneer 3395IR; wheat varieties with CLEARFIELD Technology ONLY; canola varieties with CLEARFIELD Technology ONLY; faba beans; field peas; chickpeas	Lucerne; lupins; pasture legumes; vetch; *triticale; *barley; *wheat (except varieties with CLEARFIELD Technology; see 0 months)	Oats; safflower	All other crops including canola (except varieties with CLEARFIELD Technology; see 0 months)

* The following additional requirements apply if it is intended to sow WHEAT (except varieties with CLEARFIELD Technology), BARLEY or TRITICALE during the next winter season.

- DO NOT apply SPINNAKER pre-emergence later than the end of June and post-emergence later than the end of July.
- DO NOT apply SPINNAKER in areas where rainfall from spraying to sowing or cereals is expected to be below 300 mm.

Furthermore:

- In SA and WA DO NOT use soils of pH 5.5 (Ca, Cl2) or less in areas where rainfall from spraying to sowing of cereals is expected to be below 400 mm.
- In NSW, Vic and SA DO NOT use the 100 g/ha rate in areas where rainfall from spraying to sowing of cereals is expected to be below 400 mm.

  If expected rainfall is not received following use of SPINNAKER, consult your local BASF representative before planting wheat, barley or triticale. (In calculating rainfall actually received, exclude single isolated heavy summer and autumn falls above 100 mm.

Following use in summer crops:- Irrigated only:

MONTHS AFTER APPLICATION

0	5	10	18
Maize varieties with CLEARFIELD Technology ONLY; - Pacific Hycorn 62 IT - Pacific Hycorn 53IT - Pioneer 3395IR; mung beans; peanuts; soybeans	Chickpeas; lucerne; lupins; pasture legumes; *barley; *wheat (except for wheat varieties with CLEARFIELD Technology); canola varieties with CLEARFIELD Technology ONLY	“Maize (except for varieties with CLEARFIELD Technology: see 0 months); “sorghum	All other crops (providing rainfall and irrigation exceeds 2000mm)

* DO NOT plant these crops unless interim moisture (rainfall plus irrigation) from application to sowing is at least 500 mm.

“ DO NOT plant sorghum if SPINNAKER rates higher than 100 g/ha were used in the previous crop.

RAPTOR® Active ingredient = 700 g/kg IMAZAMOX

FOLLOW CROPS

Under conditions, such as very dry seasons, which do not favour breakdown of this product, carry-over soil residues can affect susceptible follow crops. As environmental and agronomic factors make it impossible to eliminate all risks associated with this product, rotational crop injury is always possible. The following minimum re-cropping intervals (months after application) should be observed.

Following use in lucerne, legume-based pastures and field peas:-

MONTHS AFTER APPLICATION

0	10	21
Field peas canola varieties with CLEARFIELD Technology maize varieties with CLEARFIELD Technology wheat varieties with CLEARFIELD Technology *wheat (except varieties with CLEARFIELD Technology) *triticale	chick peas faba beans lucerne lupins pasture legumes vetch *barley	All other crops including canola (except varieties with CLEARFIELD Technology) oats sunflower

* The following additional requirements apply if it is intended to sow WHEAT, BARLEY or TRITICALE during the next winter season:

– DO NOT apply RAPTOR later than the end of August.

– DO NOT use RAPTOR in areas where rainfall from the time of spraying to sowing of cereals is expected to be below 200 mm.

Furthermore:

– DO NOT use on soils of pH 5.5 (CaCl2) or less in areas where rainfall from spraying to sowing of cereals in expected to be below 300 mm.

In late, short seasons where the soil is cold for most of the time it is wet, break-down will be slower and plant-back times will be extended. If expected rainfall is not received following use of RAPTOR, consult your local Crop Care representative before planting wheat, barley or triticale. (In calculating rainfall actually received, exclude single, isolated, falls which do not result in periods of continuous soil moisture to allow microbial breakdown to occur in the root zone).

Following use in summer crops:- Irrigated only:

MONTHS AFTER APPLICATION

0	5	10	18
Mung beans peanuts soybeans canola varieties with CLEARFIELD Technology maize varieties with CLEARFIELD Technology wheat varieties with CLEARFIELD Technology	*chick peas *lucerne *lupins *pasture legumes *barley *wheat (except varieties with CLEARFIELD Technology)	**maize (except varieties with CLEARFIELD Technology) **sorghum **cotton **oats **sunflower	All other crops (providing rainfall and irrigation exceeds 2000 mm)

* DO NOT plant these crops unless interim rainfall (rainfall plus irrigation) from application to sowing is at least 500 mm.

** DO NOT plant these crops unless interim moisture (rainfall plus irrigation) from application to sowing is at least 800 mm.

EXPRESS® Active ingredient = 750 g/kg TRIBENURON METHYL

Crop Options

Land previously treated with DuPont Express® herbicide may be sown to any of the specified crops after the interval indicated in the following table:

Minimum interval	Crops* *
3 days	Barley
	Oats
	Wheat
# 7 or 21 days	Maize
	Mung beans
	Sorghum
	Soybeans
	Sunflowers

NOTE: DuPont Express® is broken down in soil, primarily by chemical hydrolysis, but to a lesser degree by microbial degradation. Breakdown is fastest in warm, wet acid soils and slower in cold, dry alkaline soils. For the above summer crops, if minimum soil temperatures at planting depth are less than or equal to 15°C for three consecutive days, then plant back intervals should be extended to 21 days.

* * As a herbicide resistance countering measure, DO NOT use an ALS inhibitor herbicide in any of these crops following the use of DuPont Express® alone as a preceding fallow or pre-crop treatment.

PROTECTION OF CROPS, NATIVE AND OTHER NON-TARGET PLANTS

Injury to or loss of desirable trees, vegetation including aquatic plants may result from failure to observe the following:

Tolerance of other crops (grown through to maturity) should be determined on a small scale before resowing into larger areas.

– DO NOT apply under weather conditions, or from spraying equipment, that may cause spray to drift onto nearby susceptible plants/crops, cropping lands or pastures.

FLOWABLE SIMAZINE®, SIMAZINE 500 FLOWABLE®, SIMAZINE 500 SC®, GESATOP 500 SC®, SIMANEX 500 SC®, Active ingredient = 500 g/L SIMAZINE
GESATOP 600 SC® Active ingredient = 600 g/L SIMAZINE
SIMAZINE 900 DF®, SIMAZINE 900 WDG®, SIMAZINE 900 WG®, GESATOP GRANULES 900 WG®, SIMAGRANZ®, SIMANEX 900 WG®, SIMAQUEST 900 WG®, Active ingredient = 900 g/L SIMAZINE

To avoid Triazine carry-over:

On acid soils (pH less than 6.5) - The maximum rate of Nu-trazine or Simazine or a combination of the two products to be applied to the crop during the growing season is 2 kg a.i./ha.

On alkaline soils (pH greater than 6.5) - The maximum rate of Nu-trazine or Simazine or a combination of the two products to be applied to the crop during the growing season is 1 kg ai/ha.

Post-emergence use - It is recommended that Nu-trazine only be used, and at rates of 1 kg ai/ha or less, on both acid and alkaline soils.

PROTECTION OF CROPS, NATIVE AND OTHER NON-TARGET PLANTS:

- DO NOT spray foliage of desirable plants, except lupins (WA only).
- DO NOT make more than two applications during any one year in Asparagus, Berry fruit, Citrus, Almonds, Gladioli, Hops, Apples, Pears, Roses, Vineyards or Lupins.
- DO NOT use under peach, apricot, plum trees, ornamental prunus or near newly planted shrubs.
- DO NOT plant crops other than those recommended for at least nine (9) months following treatments at rates up to 2.5 kg/ha. At higher rates planting may not be possible for much longer periods afterwards.
- DO NOT use on sandy or porous soils near desirable plants or trees or where roots of such may extend or are near the surface. Crops such as red beet, lettuce, cabbage, tomato, cucumber and carrots are particularly sensitive to Simazine residues.
- DO NOT exceed highest rate recommended for any particular crop.
- DO NOT use on white or grey sands (WA only).
- DO NOT use in channels or drains where the roots of desirable plants may extend.

Drift Warning:
- DO NOT apply under weather conditions, or from spraying equipment, that may cause spray to drift onto nearby susceptible plants/crops, cropping lands or pastures.

ALLY®, ASSOCIATE®, HARMONY®, METSULFURON®, METSULFURON 600 WG®, LYNX 600® Active ingredient = 600 g/kg METSULFURON METHYL

CROP ROTATION RECOMMENDATIONS

Land previously treated with Associate should not be rotated to crops other than those listed in the table following.

Tolerance of other crops (grown through to maturity) should be determined on a small scale before sowing into larger areas. The Associate treated area may be replanted to any of the specified crops after the interval indicated in the following table:

Soil pH	Minimum Recropping Interval			
	10 days	6 weeks	9 months	14 months
5.6 – 8.5	Wheat	Barley Cereal Rye Triticale	Chickpeas Faba Beans Linseed Lucerne Lupins Medics** Oats Peas Canola Safflower Subterranean** Clover	Japanese Millet Maize Panorama Millet White French Millet Sorghum Soybeans Sunflower
8.6 and above	Tolerance of crops (grown through to maturity) should be determined on a small scale, in the previous season, before sowing into larger areas.			

GLEAN®, TACKLE 750 WP®, LUSTA®, CHLORSULFURON 750 WP®, CHLORSULFURON 750 WG®, CHLORSUN 750®, SUM-CHLOR 750®, KEN-CHLOR 750®, AGCHLOR 750®, Active ingredient = 750 g/kg CHLORSULFURON

Crop Rotation Recommendations

Land previously treated with Glean® should not be rotated to other crops other than those listed in the following tables.

Tolerance of other crops (grown through to maturity) should be determined on a small scale before sowing into larger areas.

The Glean® treated area may be replanted to any of the specified crops after the interval indicated in the following tables.

N.B. THE TABLE BELOW APPLIES TO ALL STATES

MINIMUM RECROPPING INTERVAL (MONTHS AFTER APPLICATION)

Soil pH*	0	3	6	9	12	18
6.5 or less	Triticale	Cereal Rye Wheat (Designated Imidazolinane herbicide tolerant Canola varieties only, such as Pioneer® 44C73 and 45C75)	Oats Canola	Barley	Canola/Rapeseed Subterranean Clover** Faba Beans Field Peas Linseed Lucerne Lupins Medics** Rapeseed Safflower	Maize Sorghum Soybeans Sunflowers

NB. THE TABLES BELOW APPLY TO QLD., SA., WA & TAS ONLY

MINIMUM RECROPPING INTERVAL (MONTHS AFTER APPLICATION)

Rainfall Requirement	0	3	9	15	18	22
					Minimum 700 mm	
Soil pH* 5.6 – 7.5	Triticale Wheat	Cereal Rye Canola *(Designated Imidazolinane herbicide tolerant Canola varieties only, such as Pioneer® 44C73 and 45C75)*	Barley Oats	Japanese Millet Maize Panicum Millet Sorghum Sunflower White French Millet	Cotton Soybeans	Canola/ Rapeseed Faba Beans Field Pea Linseed Medics** Rapeseed Sunflower Subterranean Clover**

MINIMUM RECROPPING INTERVAL (MONTHS AFTER APPLICATION)

Rainfall Requirement	0	15	18	24 months or longer Minimum of 700 mm
Soil pH* 7.6 – 8.5	Triticale Wheat	Japanese Millet Maize Panicum Millet Sorghum Sunflowers White French Millet	Barley Oats Cereal Rye	Rotate to crops other than Cereals (such as listed above) only if field test strip of the planted rotational crop has been successfully grown through to maturity in the previous season)
8.6 and above	Glean is not recommended for use on soils of pH 8.6 and above.			

BROADSTRIKE® Active ingredient = 800 g/kg FLUMETSULAM

MINIMUM RECROPPING PERIODS:

Cereal rye, medics, triticale, wheat, maize, soybeans:	May be planted at any time after application of Broadstrike
Barley, chickpeas, clover, field peas, lucerne, oats and peanuts:	Allow 3 months to elapse after application before sowing these crops
Canola, cotton, faba beans, fenugreek, lathyrus, lentils, lupins, serradella, sorghum, sunflowers, vetch (popany only):	On deep soils (with no impermeable sub-horizon), cotton, sorghum and sunflowers may be planted 3 months after application of Broadstrike. Canola, faba beans and lupins are more sensitive and may be planted 9 months after application of Broadstrike.
	On shallow, duplex, low organic matter soils with an impermeable sub-horizon within the root zone (30 cm deep or less), these crops should NOT be planted until 2 years after application of Broadstrike.

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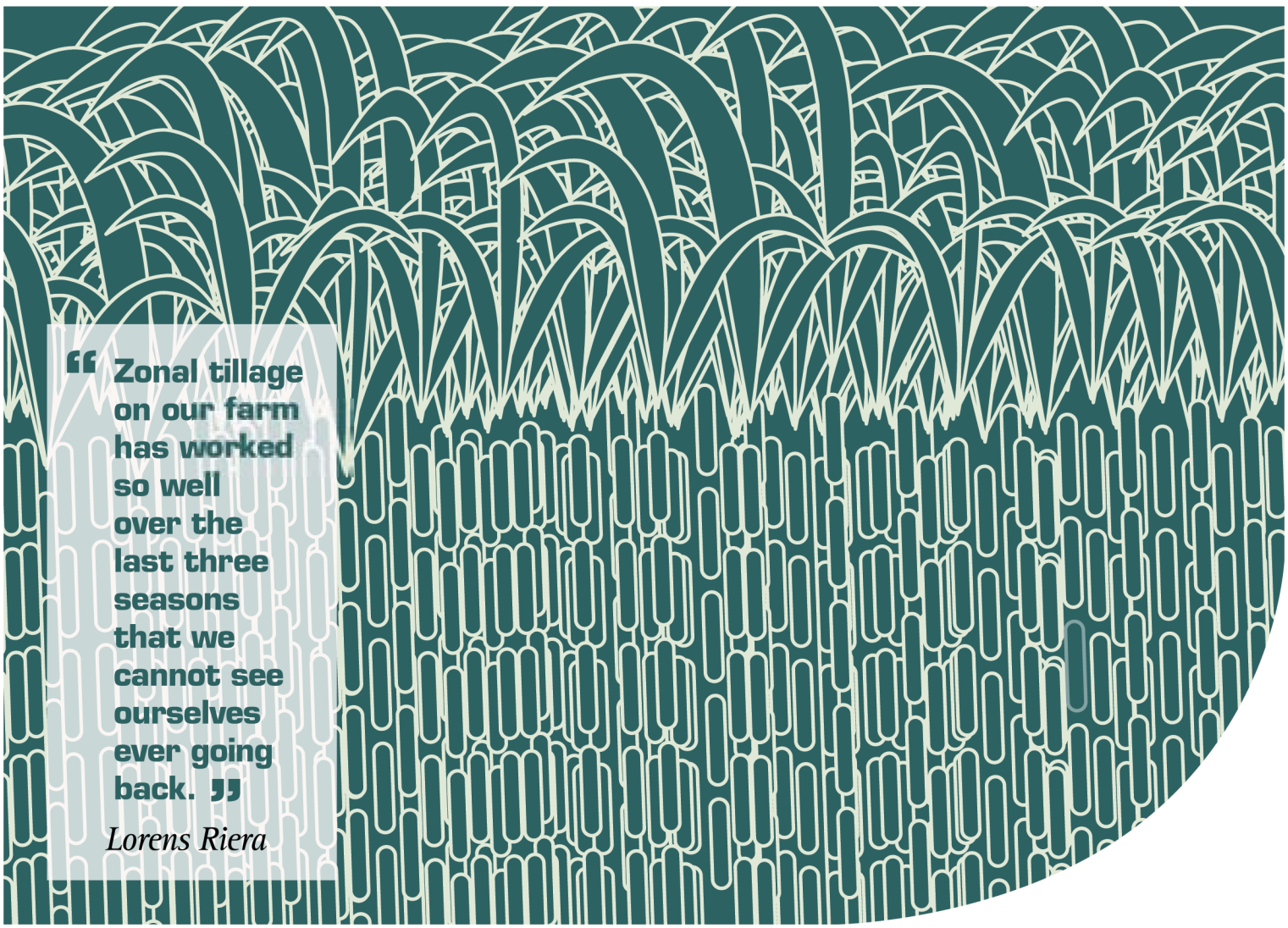
Sugar Industry CASE STUDY

(Left to right) Lorens Riera, Peppi Bertei (brother-in-law), and Robert Riera

The Riera Family



"Zonal tillage on our farm has worked so well over the last three seasons that we cannot see ourselves ever going back."

Lorens Riera

CASE STUDY The Riera Family

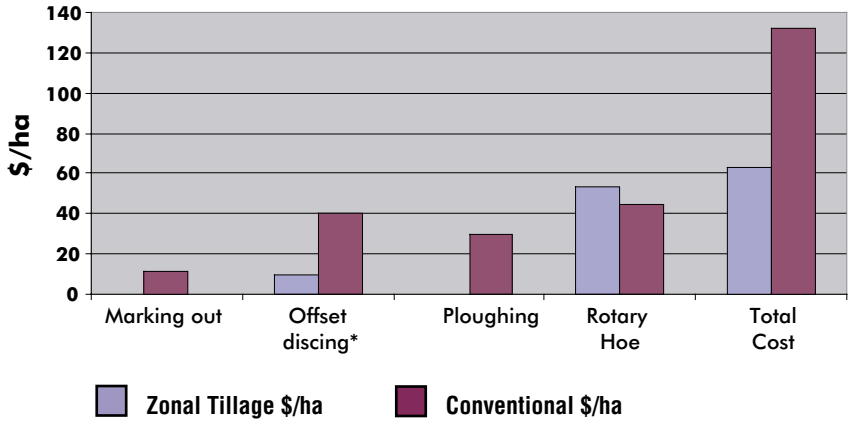
BACKGROUND

Juggling farming of 200 ha red basaltic soils (and some alluvial flats) with a busy harvesting business during the crushing season posed big challenges for the Riera family. Preparing the ground conventionally and replanting could only be done in rostered days off and weather could delay plans.

They had been involved in a local strategic tillage group where different ideas were tried and the principle appealed to them. Also they had observed other growers using the practice with no penalties in production and many obvious benefits.

Also, costs were being felt more, with the sugar price hitting a low of $180/t sugar in 2001. However, the 'clincher' was the smoke from burning their trash sometimes becoming a hazard on the South Johnstone Road. So with great apprehension and much discussion, they made a start.

Cost Comparisons - Zonal Tillage vs Conventional



	Zonal Tillage ($/ha)	Conventional ($/ha)
Offset discing*	10	40
Ploughing	0	30
Rotary Hoe	52	45
Marking out	0	11
Total Cost	63	132
Time hours/ha	1.85	4.38

Fuel is calculated at $1.30/L ***Discing and ripping is carried out twice**

Applying the principles...

They wanted to use their existing implements and machinery, while continuing the practice of ploughout and replant. However, to avoid making modifications that could stop a return to conventional farming, they bought another shaft for their rotary hoe (120 inch) to modify and left their original alone. They had flanges (longer than standard to maximise worked depth) fabricated, and welded them in the correct scroll pattern to leave the interspace untouched, yet not have the implement jump around. Rippers were mounted at the back with cowling modifications to allow for those times when the pin sheared.

It took a lot of thought and the result allowed them to cultivate just the row (640 mm wide, as opposed to other systems at about 750 mm). This left a wide enough interspace on which machinery, and especially the billet planter, could track. It has worked so well over the last three seasons that they cannot see themselves ever going back and the original rotary hoe shaft is gathering dust.

Time and money to ploughout and replant

Now the cost to ploughout and replant is just over $63/ha and less than 2 hours/ha. Previously, it was over 4 hours 20 minutes and $132/ha, due to four more cultivation operations than they now need to do.

Now they apply mill mud over the trash on the row, wait about two weeks and then proceed with the rotary hoe. This solves the problems caused by burning trash and may improve their soil's health.

However, they believe that they have been very lucky, believing seasonal conditions have favoured the changes. A return to wetter years may possibly throw up new challenges. Even so, they intend to make it work to keep their input costs down.

Putting a value on time

The Reiras now have time to do all that is necessary to finish planting by the end of August. Estimating and allocating the annual value from this timeliness from zonal tillage may be broken down as:

Saved costs (in ground preparation of 48ha for planting)	$3307
Saved labour (this is very important as they run a harvester business as well)	$2429
Improved yield (from better timing of crop planting)	$1323
Total	**$7059**

Some 'blind alleys' that others may avoid in the changeover

Some variations on the idea that turned out to be a waste of time included:

- trying to push the mill mud onto the rows - there is no problem from just leaving the mud as it was spread by the truck. They used hilling-up boards to push it onto the cane row and clear the interspace. It was an extra job that achieved very little;
- doing two passes over the old cane row with the modified rotary hoe. They did it as they could not believe one pass was enough, but it did not improve tilth.
- 'scratching' the centres before rotary hoeing, as they thought the ground would be too hard. Instead they lost traction when doing the actual working.

A big question remaining for the Riera family is whether their production will benefit enough if they go away from 100% replant to a fallow. However the big rewards to the Rieras from zonal tillage remain getting all operations done on time and cost effectively while at least maintaining cane yields.

> "Mill mud applied over the rows costs nearly $135/ha - cheap for the nutrients applied and the usefulness of it for rapid breakdown of trash before zonal tillage if the season is not too wet."

The tractor has to drive on the two rows to be worked by the rotary hoe. By leaving the trash to breakdown over 2 weeks makes it easier to work. The 140 HP tractor works 0.7 ha/hr at a cost of $52/ha.

Almost all the cane in this photo of the Riera farm was planted using zonal tillage.

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Sugar Industry CASE STUDY

(Left to right) Miles and Boysie Darveniza

The Darveniza Family

> "Cane farming businesses risk falling behind if cost saving changes are not made."
>
> *Miles Darveniza*

CASE STUDY The Darveniza Family

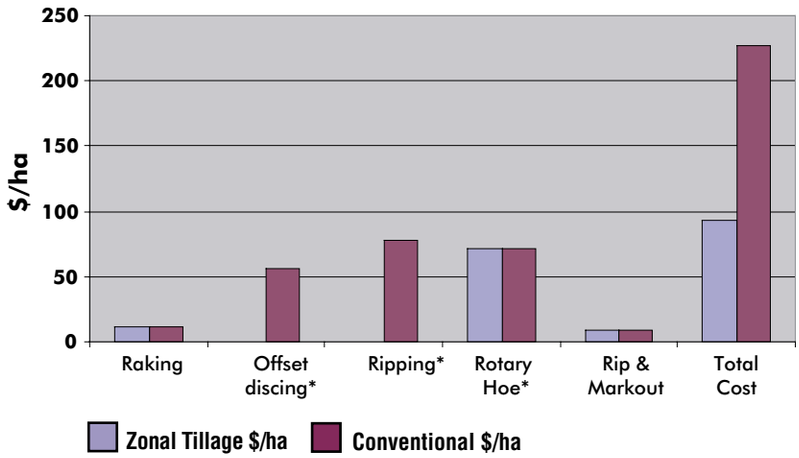
BACKGROUND

Miles is a fourth-generation farmer who owns and manages the 200 ha property with his dad, Boysie, who has been on the property for 50 seasons. They know that soil erosion would leave little of the farm's red sloping soils if they were continually worked and left exposed to the elements.

Changes such as green cane trash blanketing helped a lot. The next step was to make replant blocks less vulnerable.

Miles had been involved in a strategic tillage group in the mid-1990s, examining ideas about planting cane differently. The group achieved quite a lot and, when the funding ended, individuals, including the Darvenizas, started applying some of the ideas on their own farms.

Cost Comparisons - Zonal Tillage vs Conventional



	Zonal Tillage ($/ha)	Conventional ($/ha)
Raking	12	12
Offset discing *	0	56
Ripping *	0	78
Rotary Hoe	72	72
Rip & Markout	9	9
Total Cost	93	227
Time (hours/ha)	2.25	4.5

Fuel is calculated at $1.30/L ***Discing and ripping is carried out twice**

Applying the principles . . .

Miles looked at the experience of other growers who were trying to put the principles into practice. This includes Miles' uncle, John Darveniza, who had earlier made the switch to working only the cane row, and reaped the cost savings. Clearly, there is no set recipe to growing cane and everything done must be checked and evaluated.

Miles acquired a 4 m Howard rotary hoe and located a second-hand shaft on which to modify the scroll, aiming to only work the row of cane, and leave the interspace untouched. They now work three rows at once, with the tractor remaining where it should be – on the compacted interspace.

Their wholestick planter required no modification and it continues to plant effortlessly into the soil, even after only one pass with the rotary hoe followed by a ripping.

Mostly ploughout and replant on the Darveniza farm

As for most of the farms on red soils, growers grow cane on nearly 100% of their land and replace varieties by ploughing them out soon after harvest, working up the ground and planting a new variety.

Time is limited in the season, with a multitude of tasks needing attention. By using zonal tillage, Miles has not only greatly reduced the costs but also found more of those irreplaceable hours needed to keep on top of the farming operations and not compromise his cane yield.

Time and money to ploughout and replant

Now the cost to ploughout and replant is less than $93/ha and takes just over 2.25 hours/ha. Previously it was over 4.5 hours and $227/ha, due to four more cultivation operations than they now need to do.

They still have problems managing the trash, so it is raked into piles and burnt before they commence their zonal tillage. This is largely because they need to enter the block very soon after it has been cut and the trash is still fresh and fibrous.

Costs and time to plant the fallow

With zonal tillage, the cost to prepare fallow ground for planting is less than $154/ha and takes just over 2 hours/ha. Previously, it was over 4 hours and $260, again due to four more cultivation operations than now necessary.

As on any farm, there are times when Miles needs to give his soil a break from sugarcane. He generally employs a bare fallow to achieve this break but has recently trialled the planting of legumes. Miles is unsure whether doing so provided enough benefits to be worth the trouble; especially in blocks with a heavy burden of vine seed. At this stage and from past experience, he may stay with managing a good bare fallow.

. . . helped along by a grant

A grant from FNQ NRM of $5000 will assist Miles to modify his fertiliser box to vary the application rates as he covers the block. This way, he can account for the changes in soil type, drainage and variety in the nutrients applied, so that there is no wastage or deficiency by trying to use one rate to suit all cane situations across the farm.

Not only does this make inputs more efficient and reduce costs and time, but Miles hopes an improvement in soil health will see canegrub pathogens reduce these pests.

Further to go yet

The options available to Miles all involve waiting some time after harvest before getting into the task and perhaps moving away from a program of replanting to one that maximises the benefits of a fallow.

This fallow Miles, may include a minimum or zero-tilled legume as part of the system. This could involve direct drilling of the legume through the trash into the sprayed-out cane. Perhaps a straight-blade (or flail) on the rotary hoe may also be worthwhile.

> “The total cost of a spray-out fallow is $73/ha. This includes a second pass for a complete kill. In replanting though no herbicides are used - just zonal tillage.”

Blocks are zonal tilled with this three-row rotary hoe on a 230 HP tractor working 0.8 ha/hr at a cost of $72/ha.

Striking cane planted by Miles and Boysie Darveniza with zonal tillage. Note the traces of burnt trash.

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APPENDIX 5 - Loeskow, Cameron and Callow 2006 ASSCT paper - Grower case study on economics of an improved farming system

Ag28

GROWER CASE STUDY ON ECONOMICS OF AN IMPROVED FARMING SYSTEM

By

[1]N. LOESKOW, [2]T. CAMERON and [3]B.CALLOW,

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KEYWORDS: change, cane farming system, legume, controlled traffic, GPS, economics

Abstract

There has been a lot of research done by the Sugar Yield Decline Joint Venture providing insights and recommendations on how to improve the farming system to combat yield decline in cane fields. This paper explores a cane farming family's experience with implementing practices advocated by the SYDJV and describes the changes they have made to their farming system. This description includes the specific practices that they were using before implementing the recommendations, the changes they have made, and the economic, environmental and social impacts that these have had on their business. The new farming system includes controlled traffic, reduced tillage, peanut rotation, flood irrigation from new on-farm storage, with GPS technology linked to land levelling, planting, harvesting and fertiliser application. One significant finding was the changed farming system showed a return on investment on the old farming system of *minus* 10.8% improving to *plus* 5.9% for the new system. Cane gross margin per hectare on the old system was -$148 versus $1157 on the new system. The Loeskow family cannot stress enough the need to continually investigate improved farming practices and invest in new technology and equipment. A preparedness to continually change has been the key to the Loeskow family success.

Introduction

In recent years, growers have often been told that change is necessary in order to remain viable in their business. Cane farming is a business and change is inevitable, ongoing and challenging. Change means spending time and money, investing in new ideas, new technology and new equipment. In the 1970's sugarcane yields were decreasing and in the early 1990's the Sugar Yield Decline Joint Venture (SYDJV) was formed to investigate the reasons for the yield decline. Reasons such as poor soil health, poor soil structure and outdated farming practices were identified (Garside *et al*., 2002, 2005). Years of monoculture resulted in a build up of harmful pathogens. Mismatched heavy harvest and haul-out equipment badly compacted about 90% of the field each year, and excessive tillage operations destroyed soil structure. A new farming system has been developed which has three main components – controlled traffic, minimum tillage and legume rotation crops. Growers also have had to become more efficient managers of their main resource, land, as well as becoming better business managers. All operations have to be efficient, cost effective and timely.

Relmay Farms owned and run by the Loeskows made a major change to their farming system in 1992 by breaking the monoculture and introducing peanuts as a legume crop. Since then, they have moved to flood irrigation, controlled traffic, and reduced tillage. More recently, they have invested in global positioning systems (GPS) technology. In 1996, the decision was made to rake the trash into every second inter-row, doubling the trash in those inter-rows and leaving the other inter-rows free of trash. This was to facilitate effective water flow down the non-trash inter-row using the flood irrigation system as well as maintaining good drainage.

Farm description

The Loeskow farms produce cane on some of the most marginal coastal land in the region. Soils used for sugarcane production on the farm are generally classified as Mahogany, Alloway and Clayton (Donnollan *et al*., 1998). According to the Australian Soil Classification system they are categorised as Redoxic Hydrosols (Isbell, 1996). These soils have generally poor natural fertility and structure. They have since been modified with the addition of clay and other ameliorants. The average block size is 20 hectares and row length is 450 metres. Most blocks are laser levelled to 1% grade. This ensures a constant flow and infiltration rate avoiding uneven watering. The farm has extensive drainage and tail-water recycling. Ninety-five percent of local run-off from rain events is caught in the drainage system and collected in the on-farm water storages.

Production history

This paper will focus on the difference in the farming systems between 1992 and 2005, but it is of interest to briefly look at production changes over a sixty year period.

- 1946 – 20 hectare farm with 8 hectares producing 90 tonnes of cane, a yield of 11tc/ha.
- 1986 – total farm area 1435 ha with 228 ha developed and grew 16 000 tonnes of cane with a yield of 70 tc/ha.
- 1992 – total farm area 1435 ha, 350 ha developed with 280 ha under cane yielding an average of 53 tc/ha.

- 2005 – total farm 1500 ha with 943 ha under cane to produce in excess of 90 000 tonnes (a yield of 96 tc/ha), and 134 ha peanuts yielding a total of 700 t. Peanut area increased to 160 ha for 2006 harvest.

Major investments

In the late 1980s the Loeskows realised that there was a great need to change due to the negative impact of poor sugar prices, rising input costs and declining yields. Some of the major changes to infrastructure included:

- $1.3 million investment in ring tank and change to flood irrigation from overhead irrigation which was costing four times as much for applied water per hectare.

- Developed a further 753 hectares of land. This involved tree clearing, land levelling, drainage, amelioration of nutrient deficiency and improving soil structure.

- Implementing a three metre controlled traffic farming system requiring the purchase of 3 metre centred twin row harvesters (x 2), 3 metre centred tractors for fertiliser application and spray operations.

- More recently $205 000 has been invested in GPS technology.

Economic analysis of old versus new.

Economic analysis was conducted using the Farm Economic Analysis Tool (FEAT) (Cameron, 2005). The tool has been designed specifically for cane farmers to compare different farming systems. It enables growers to assess as accurately as possible the economic impact of a change before making on-ground changes. The tool can make accurate comparisons because it is based on a lot of detail such as kilograms of fertiliser or chemicals applied per hectare. Machinery costs are based on detailed costings using tractor size, fuel consumption, implement speed, width, efficiency and repairs and maintenance. FEAT can also be used to compare an historical farming system to the current farming system to give a reasonably accurate economic result of the changes. This is done by applying current input prices to both the current and historical farming practices. The same commodity price is applied to both farming systems. In other words, this approach shows what the return on investment would be today, had the grower not made any changes.

In the case of Relmay farms, the size of the operation increased considerably between 1992 and 2005, so economic comparisons in the Table 1 are shown in per hectare, per tonne and percentage terms.

Without change, Relmay would have lost $148/ha gross margin at today's input costs and price of sugar at $300/t. This is regardless of scale of operation. The return would have been negative even before paying off fixed costs which include labour costs. The low returns under the old system are largely due to low yield as well as higher growing costs. Under the current farming system, gross margin is now $1157/ha.

The amount invested in Relmay has increased 3.4 times from $4 542 000 to $15 500 000 in 2005 based on current market values. Had the Loeskows still been farming the same operation as they were in 1992, and paying today's input costs, the return on investment

would have been *minus* 10.8%. Under the current farming system, the return is *plus* 5.9% and is projected to be 8.0% in 2006.

As can be seen in Table 1 the much improved return on investment has been from a combination of factors. Cane yield has increased from 53 t/ha to 96 t/ha. Cane growing costs have dropped from $1262/ha to $703/ha. Peanuts now contribute a significant amount of income with a gross margin of $2543/ha at a payment yield of 5.34 t/ha.

An important factor in the reduced costs under the current system is that tonnes grown per man per annum has increased more than eight fold from 1137tc to an impressive 15084tc. Added to this, these same men look after 160 ha of peanuts, a crop that is far more demanding in labour terms. The number of hours spent on tractors in the cane operation has decreased dramatically from 15.12 h/ha to 1.12 h/ha. Part of the reason for this is that 2.4 h/ha is spent on preparing the land for peanuts. The total amount of time spent on tractors for the peanut crop is 7.47h/ha. The number of men employed has been reduced from eight to six even though area of land under the plough has increased from 280 hectares to 1103 hectares (943ha cane plus 160ha peanuts for harvest in 2006). In the Australian context of high labour costs, the efficient use of labour is particularly important.

While Table 1 shows the main economic indicators, more detail can be found in Tables 2 and 3 which show growing costs for cane and a gross margin analysis for peanuts respectively. Table 4 details the differences in farming practices between the two systems.

Table 1. Economic comparison of Relmay farming systems between 1992 and 2005.

	Old system (1992)	New system (2005)
Price per tonne sugar	$300/t	300/t
Average yield cane	53 t/ha	96 t/ha
Gross margin per hectare	$-148ha	$1157/ha
Gross margin per tonne cane	-$2.81	$12.06
Return on investment	-10.8%	+5.9%
Variable cost per tonne	$29.94	$13.23
Production per man per annum		
Cane	1837tc	15084tc
Peanuts	-	119t
Tractor labour h/ha cane	15.12 h	1.12 h*

* (2.4h/ha in peanut land preparation reducing amount required for cane).

Table 2. Cost of cane growing per ha and per tonne

	Old System		New System	
	$		$	
	Per ha	Per tonne	Per ha	Per tonne
Land preparation	75	1.43	4	.04
Planting	209	3.99	78	.81
Fertiliser	432	8.21	383	3.99
Weed control	90	1.71	123	1.28
Insect control	52	.99	9	.09
Disease control	6	.12	6	.07
Irrigation	398	7.59	100	1.04
Total Growing Costs	1262	24.04	703	7.33

Table 3. Peanut gross margin (2005)

Price	$897/t
Payment Yield	5.34 t/ha
	$
Gross Income	4790
Expenses	
Land preparation	164
Planting	444
Fertiliser	666
Weed control	146
Disease control	234
Irrigation	100
Harvesting & drying	334
Freight	159
Total Expenses	2247
Gross Margin	2543

Table 4. Practice differences between old and new farming systems

	Old system (1992)	New System (2005)
Cropping	Spring plant with bare fallow	Autumn plant cane in rotation with peanuts
Land preparation	2 x offset discs 2 x disc plough 2 x rotary hoe 1 x land plane 1 x ripper 1 x marking out	Peanut land preparation 2 x discs 1 x ripper 1 x square plough 1 x laser bucket 1 x ripper 1 x 8 row bed former Cane land preparation 1 x ripper
Row spacing	1.5 m	2 x 1.5 (3 m system)
GPS	None	GPS
Fertiliser (plant)	DAP, CK 50/50 S	Special Mix with micronutrients, CK 50/50
Fertiliser (ratoon)	CK 140(S), Urea	CK 140(S) applied in 2 applications.
Weed control	Cotton King plus chemical	Chemical using hooded sprayer – more efficient
Insect control	Temik (nematodes)	Nil because peanuts in rotation
Irrigation method	Over-head with high [1]R&M	Flood – low electricity and low R&M
Irrigation - amount	4 ML/ha	4 to 5 ML/ha
Trash blanket	Burnt cane, trash blanket	Green cut, trash blanket raked into every second inter-row for controlled traffic and drainage

[1]repairs and maintenance

Benefits of new over old farming system

Controlled traffic system

- Substantial improvements in efficiency due to increased speed and width of pass leading to reduced input costs.
- Significant reduction in percentage of area compacted. Reduced compaction leads to improved soil health and plant growth.
- Improved water infiltration due to reduced compaction and thus yield improvement
- Provides the potential to extend the number of ratoons.

GPS

- Ensures the accuracy of controlled traffic thus enhancing all the benefits of controlled traffic and precision farming.
- No overlap leading to more efficient coverage with fuel, oil, repairs and maintenance being reduced by at least 10%.
- Reduced chemical usage by at least 10%.
- Reduced stress for grower and employees due to not having to concentrate on driving as well as monitoring the equipment.

- Possibility of night time operations thus spreading the investment cost further. There is the added advantage of working when the air temperature is cooler for the driver and machines.

Peanuts in rotation

- Income – high gross margin especially with seed grade contract.
- Improved soil health – reduction of pathogens and increased microbe and earthworm populations
- Improved soil tilth for the following cane crops leading to improved water infiltration and aeration, reduced harvester damage to stool
- Potential to increase number of ratoons in cycle
- Improvement in yield of the cane and thus profitability
- Peanuts provide 60 kg/ha of nitrogen for the plant crop
- Only necessary to rip once after peanuts before plant cane.

Economic benefits

All the benefits above result in either improved productivity or reduced input costs leading to improved profitability and sustainability.

Environmental benefits

- Reduced fuel usage and the attendant effect on air pollution and global warming (as sought by Kyoto protocol)
- Reduced potential for nitrogen and phosphorus run off because of improved soil structure

Improved soil health and reduced erosion of soils

Social benefits of changed farming system

- Although the management team has a much larger farming operation, they are farming with less effort today than they were in the early 1990s. The changed economic circumstances of a much reduced debt and good return on investment, provides them with a great sense of achievement. Neville Loeskow is extremely proud of the achievements of his son, Jason, and sees a very bright future for him.
- Management and workforce have the added interest of a more challenging crop than cane, peanuts.
- With the introduction of GPS into the farming system, operator stress levels are much reduced and they now have the satisfaction of seeing work done with a high degree of accuracy.

Secrets to success

- Acknowledging the need to change continually to remain profitable and sustainable
- Attention to detail – eg calibrating equipment regularly and properly. In one example the fertiliser used was only 7 kg (or 0.001%) below the amount budgeted
- “Near enough is not good enough” attitude
- Excellent communication between partners and employees
- The mutual respect that exists between family members, especially between generations, has produced very positive results. For example when GPS was initially purchased, Neville Loeskow was uncertain as to its worth and place, but is now convinced that no future farming operation can exist without GPS assistance
- Judicious investment in technology and inputs – eg purchase peanut harvester
- “State of the art” farm machinery

- Maximising use of resources. For example, the main tractors do no less than 600 hours per tractor per year
- Very professional operation - "Taking control of chance"
- One of Neville Loeskow's mottos is "He who fails to plan, plans to fail"
- Looking to other industries and areas for ideas – eg cotton growers in Western Queensland
- Avoiding confrontation in all aspects of life
- Strong and fair with employees, knowing their strengths and weaknesses. The shortest serving (and youngest) employee has been with them for 11 years
- Ensured an adequate water supply by investing in a 3000 ML ring tank on-farm storage
- Doing everything on time – irrigate before the crop stresses. They prefer to waste electricity and water in the event it does rain, rather than allowing the crop to stress if it does not rain
- Attitude that "there is no such thing as standing still"
- The Loeskows are good farmers and good businessmen. Neville Loeskow believes that farmers are made not born and need to develop good business skills

Where to from here?

By 1st June 2006, the Loeskows propose to have total controlled traffic on 3 metre centres for all farm operations under their control (both peanuts and cane). The only operation not on 3 m centres will be cane in-field haulouts. However, these units only have one pass over ground with the 2-row cane harvester. The plan is for the contractor to purchase 3 m centered in-field haulouts some time in the next two to five years. This will be a major investment of around one million dollars for three units.

The projected cane production for 2006 is 103 700 tonnes with an average yield across the farm of 110 t/ha. At $300/t for sugar this will provide a return on investment of 8.0% based on a cane gross margin per ha of $1429. The outlook for sugar price is better than $300/t but this figure is used to make a fair comparison between 1992, 2005 and 2006.

The Loeskows are convinced they should be harvesting all of the cane from their poorer soils two weeks earlier at the start of the season than is the current practice to maximise CCS and therefore returns. If this could be successfully negotiated, it would be a win-win for the industry.

Conclusion

The economic analysis clearly shows that had the Loeskows not had the vision and commitment to make the required changes, they would not be in the cane farming business today. While the scale of this operation is considered larger than average, the principles demonstrated by the Loeskows can be readily embraced by the cane growing industry at large. New farming system practices of controlled traffic, minimum tillage and legume rotations along with good planning, timeliness of operations, and attention to detail along the way are not restricted to large scale operations. Indeed for the long-term survival of the industry, these principles and practices need to be applied to every farming venture.

REFERENCES

Cameron, T (2005). Farm Economic Analysis Tool, (FEAT), a decision tool released by FutureCane, Department Primary Industries & Fisheries.

Donnollan, T.E., Wilson, P.R., Zund, P.R. and Irvine, S.A. (1998). Soils and irrigated land suitability of the Bundaberg area. South East Queensland. Queensland Department of Natural Resources Bulletin DNRQ80142.

Garside, A.L., Bell, M.J., Berthelsen, J.E. and Halpin, N.V. (2002). Effect of fumigation, density, and row spacing on growth and yield of sugarcane in two diverse environments. Proc. Aust. Soc. Sugar Cane Technol., 24: 135-144.

Garside, A.L., Robotham, B.G., Chappell, W. and Berthelsen, J.E. (2005). Row spacing and tillage effects on the growth and yield of sugarcane. Proc. Aust. Soc. Sugar Cane Technol., 27: 133-143.

Isbell, R.F. (1996). The Australian soil classification. CSIRO Publishing, Collingwood, Victoria.,

Farming in a Low Income Environment

> John Agnew

A new workshop is gaining a lot of favour with growers because it demonstrates practical ways that even the most efficient farm enterprise can ratchet up its profits. Burn Ashburner (farm business manager at Mackay CANEGROWERS) and John Agnew (senior extension officer, BSES) report.

Unfavourable seasonal conditions, pests and disease have combined to cause dramatic reductions in productivity and profits. A return to a "normal" growing environment will definitely help, but this would be only part of the answer - we still face the prospect of a strengthening Australian dollar and low sugar prices. Currently sugar prices are low and may remain in the $240-$300 range.

BSES Limited has worked closely with CANEGROWERS to develop a workshop that can give you the tools to better cope with the present economic challenges. The *Farming in a Low Income Environment* workshop is about assisting participants to examine the performance of their sugar business relative to local industry cost and production benchmarks.

The workshop sessions are very friendly and very practical. They focus on ways everyday farmers can improve profits by reducing some short-term costs while increasing production. Very helpfully, the workshops demonstrate a direct connection between business performance and best practice farming practices.

The *Farming in a Low Income Environment* workshop is not about cutting costs despite production, which some people mistakenly believe is the best strategy when sugar price is low. Also, the principles that participants learn in this workshop still apply when the sugar price is favourable.

BSES understands that the vast majority of growers are already highly efficient in their operation.

BSES Limited understands there is nothing more frustrating for growers who run very streamlined farm operations than receiving the call to 'be more efficient.' Rather, these workshops are designed to assist even the most efficient farmers find that extra advantage.

The half-day workshops cover a lot of ground, and components include:

- changes that have the greatest effect on farm business profitability;
- benchmarking production, income and expenses;
- implementing best practice changes at farm level (nutrition, weed control, irrigation efficiency, variety management and harvesting);
- record keeping and financial tools; and
- strategy for the future.

Workshops were run at Mackay in August and September and 14 farming enterprises attended. Feedback from growers was positive, with all growers agreeing that there was scope to fine-tune their farm businesses and hopefully increase production and/or reduce some costs.

An important point they all saw

John Agnew with central district growers Carol Punzel of Mt Christian and Mary Anne Vassallo of Seaforth

demonstrated was that several small changes can make a large improvement in profitability. The workshops also let growers benchmark their farm practices against others; although benchmarking is only a tool to help the individual gauge performance compared to others. This was something that all participants found valuable.

Two trainers run each workshop (9am-3pm). The sessions are an easy-to-handle mix of presentation, discussion and hands-on. They include computer spreadsheet access for each participant. Participant numbers are limited to 10 farms, usually one or two persons per farm enterprise. Keeping group numbers low enables a good balance of support and discussion.

The workshop is *FarmBis* approved and costs $73 (including GST) for each eligible primary producer. This price includes morning tea, lunch, workshop notes and useful financial spreadsheets. It should be noted that without *FarmBis* subsidies, the workshop would cost $440 per participant.

Farming in a Low Income Environment workshops are being planned for your district soon. To book your place in a workshop, please ring your local BSES office.

NEWS

The good news on orange rust

The outbreak of orange rust disease in the central district in 2000 was one of our industry's worst epidemics - causing hundreds of millions of dollars damage. But today, things are looking a lot brighter.

Three years down the track, the orange rust is virtually non-existent. Orange rust dramatically reduces yields by causing the leaves of the infected cane plant to die and halting the plant's production of sugar. The central district, including Mackay, Proserpine, the Herbert and Plane Creek, was hard hit by the disease in 2000 largely because of the high percentage of orange rust susceptible variety, Q124, which was the district's most popular variety.

Principal research officer with BSES, Dr Robert Magarey, said that two factors have had a big impact on the disease's occurrence: varieties and weather.

"We've seen a massive shift to adoption of new varieties in the area, with Q124 now only making up about 30% of the crop in the central district. Many of the varieties now grown in the region are orange rust resistant," Dr Magarey said.

"To add to this, fungal disease likes moist conditions. So, one of the benefits of the prolonged dry patch that we have been experiencing has been a lower incidence and reduced severity of the disease."

In the future, growers can expect to see the release of more orange rust resistant varieties and more options in terms of controlling the disease, such as registration of fungicides. For more information, contact your nearest BSES extension officer.

Goodbye the 'Bureau'... Hello BSES Limited!

The last few months have been an exciting time for BSES and the Australian sugar industry. On 1 September, 2003, the assets and staff moved from the state government-owned Bureau to a new industry-owned entity. Eligible millers and growers have been sent documents giving them the opportunity to become initial member of BSES Limited.

The new organisation was officially launched and celebrated at a gathering in Mackay on October 28. The Minister for Primary Industries and Rural Communities, the Hon. Henry Palaszczuk, attended the launch at the Mackay Station.

Mr Palaszczuk emphasised that BSES Limited would carry on the tradition of Australia's, if not the world's, leading sugar research and development organisation, with more scope to expand to new horizons to improve the value of Australian sugarcane. BSES staff, growers, millers and other industry representatives on the day expressed strong support for the new set up.

For more information on incorporation or how to become an initial member of BSES, contact Peter Allsopp on 07 3331 3316 or Steve or Julie at the BSES Media Section on 3331 3309 or 3331 3339.


Orange rust

APPENDIX 7 - Agnew J. 2005. Using and looking after your hand-held refractometer. BSES Bulletin 7: 26-28.

Using and looking after your hand-held refractometer

> John Agnew

This article aims at assisting growers in the correct use of a hand-held refractometer as a tool for determining block harvest sequence. Growers who use the refractometer prior to each harvesting round have the ability to select blocks with potentially higher CCS, thereby maximizing whole-farm sugar yield.

The refractometer measures brix, or soluble solids (which includes sucrose and other dissolved substances), in juice. The assumption is that the higher the brix, the higher the sucrose and, hence, CCS. The refractometer is used as a relative guide between blocks and the brix readings can never be directly converted to actual CCS figures. Some reasons why it is difficult to convert field brix into CCS include:

- sampling error
- environmental factors
- crop stress, e.g. drought, frost, waterlogging
- physical damage of crop
- disease/pest damage
- harvesting process, e.g. tops/trash/dirt/staleness
- fibre content
- effect of gases and **in**soluble solids in suspension in juice sample
- temperature variation
- variety differences

Identifying the parts: refractometer and other sampling equipment

Figure 1: Parts of the refractometer.

Juice sampling equipment

A proper juice sampling device or dibbler (Figures 2 a. & b.) is necessary to streamline the process. The use of pliers to squeeze juice out of the stick is fairly slow, destructive and **not** recommended. When taking juice samples, pierce the rind with the dibbler, push into the stalk and slightly twist wrist a few times to get juice to flow into the collector.

Figure 2a: Juice sampler-dibbler (side view).

> ***Growers who use the refractometer prior to each harvesting round have the ability to select blocks with potentially higher CCS.***

Figure 2b: Juice sampler-dibbler (top view).

How does a refractometer work?

The speed of light in a vacuum slows as it passes through transparent material. The speed of light then depends on the wavelength of light and the concentration of the material it passes through. The change in speed when moving from one medium to another causes light to deviate (bend or refract) from its original path. This allows the estimation of total dissolved solids in a solution using the refractometer. The more concentrated the solution, the slower the speed and the greater the deviation.

Calibrating the Refractometer

Before you start taking brix readings, you must calibrate the refractometer. Start by opening the cover plate and make sure the prism is clean of juice, dust, etc. by rinsing with distilled water. Wipe with a soft cloth to dry the surface. Next place a few drops of distilled water on the prism surface, and close the cover plate so that the water spreads out into a thin film without any air bubbles or dry spots. Wait for 30 seconds, to enable the water to adjust to the ambient temperature of the refractometer before you attempt a reading.

Hold the refractometer in the direction of a natural light source and look into the eyepiece. You will see a circular field with graduations down the centre (Figure 3). You may have to focus the eyepiece to clearly see the graduations. This is done by turning the eyepiece clockwise or anticlockwise.

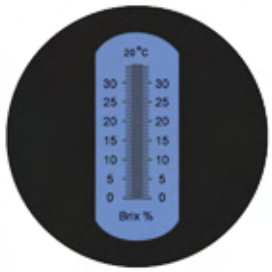


Figure 3: View through the refractometer without any sample present.

Turn the calibration screw until the boundary between the upper blue field and the lower white field meet exactly at ZERO on the scale (see Figure 4).

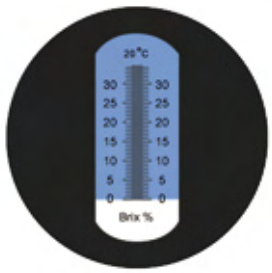


Figure 4: View through the refractometer once properly calibrated.

Using the Refractometer

Once the refractometer has been calibrated properly, you are ready to take readings of cane juice. Clean the instrument (both the cover plate and the top of the prism) using a soft, damp cloth. Make sure the prism and cover plate are dry. If water remains, it will dilute the juice sample. Place 2-3 drops of juice on top of the prism. Close the cover plate and take your reading as before. Figure 5 shows what you might see at this point.

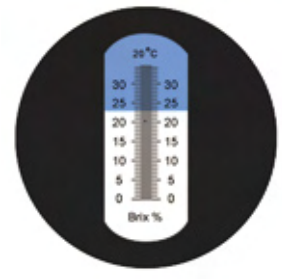


Figure 5: View through the refractometer with a juice sample brix reading of 23.

When looking through the refractometer eyepiece, be sure that you are using natural light to view the readings; you should **not** read a refractometer in the presence of fluorescent light.

Differences between the ambient temperature of the prism and the temperature of the sample will throw off the accuracy of your reading. Remember to allow the sample to rest on the prism assembly for **30 seconds** before taking a reading.

Sampling Technique

Don't fall into the trap of sampling cane on the edge or ends of the block, as these may not be representative. Also, accuracy improves as more sticks are sampled. Go to at least five locations spread across the block (and at least 10 m in from the edge/ends), and at each location sample juice from 10-20 sticks of cane. Take one brix reading from the juice sampled at each of the locations and then average the five readings to give an overall brix for the block. If one of the five brix readings varies by greater than 10% from the average, discard it from your calculation.

Take each juice sample from the **same** height on each cane stick, which can be about 'belly-button' height for example. The idea here is to be as consistent as possible. If cane is lodged, this makes things harder, but it is still possible to take the sample from approximately the same point on each stick.

Another sampling technique of value is to take three separate juice samples from bottom, middle and top of the stick. This helps determine how mature the block may be. The closer the three readings are to each other, the more mature the block.

*Practice good **farm hygiene** and ensure that the dibbler (juice sampling device) is cleaned & sterilised with methylated spirits/water mixture (70% metho) **between** blocks.*

Maintenance of Your Refractometer

The refractometer is an optical instrument. It requires careful handling and storage. Failure to do so can result in damage to the optical components and its basic structure. If the refractometer is dropped or subjected to an impact, it may not give correct readings and it should be checked for accuracy. Do not expose the refractometer to damp working conditions. Do not immerse the instrument in water. If the instrument becomes foggy, water has entered the body. Call a qualified service technician or contact your dealer to purchase a new refractometer. Do not leave the instrument in direct sunlight or in areas where temperature could get above 40 degrees Celsius (e.g. car dash board).

Do not measure abrasive or corrosive chemicals with this instrument, because they can damage the prism's coating. Clean the instrument using a soft, damp cloth when you have finished with it. Failure to clean the prism on a regular basis will lead to inaccurate results and damage to the prism's coating. Store the instrument in a dry, shaded area. With care, this instrument will provide years of reliable service.

For further information please contact your local BSES Extension Officer.

Call for nominations for election as a Grower Director at 25 October 2005 Annual General Meeting

Election of a Grower Director

The Constitution of BSES Limited provides that at the Annual General Meeting of the Company to be held on Tuesday 25 October 2005, one of the current Grower Directors will retire, and having retired is eligible for re-election. Grower Members may also nominate to the Company a person (or themselves) to stand for the election of one (1) Grower Director at the 25 October 2005 Annual General Meeting.

Duties of Directors

BSES Limited is a company limited by guarantee and incorporated under the Corporations Act 2001. A short summary of the duties of a company director at common law and under the Corporations Act may be obtained by Grower Members considering nominating by contacting the Company Secretary at the address set out below or by calling BSES on 07 3331 3333.

Who may nominate

Under the Constitution, to be eligible for election as a Grower Director a person must be a Grower Member or a director of a Grower Member at the time of their appointment as a Director. The Corporations Act also requires a person to give their written consent to act as a director of a company governed by the Corporations Act prior to being appointed as a director.

How to nominate

Grower Members wishing to nominate to stand for the election to be held at the 25 October 2005 Annual General Meeting must write to

The Company Secretary
BSES Limited
PO Box 86
Indooroopilly, QLD 4068

notifying BSES of their nomination, setting out their full name and address, and stating that if elected they consent to act as a Director of BSES Limited. Grower Members nominating may (optional) also include a short summary of not more than 100 words of their background and experience for distribution by the Company to Grower Members with the Notice of Meeting for the 25 October 2005 Annual General Meeting and advice of holding the election.

When must nominations be received by

Only nominations by Grower Members received by BSES at the above postal address by 5pm on Monday 19 September 2005 will be accepted.

APPENDIX 8 - Bonaventura P. 2004. The move to minimum till - how one grower did it. BSES Bulletin 1: 7-8.

Pat grows two rows 550 mm apart on 1.8 m centres

The move to minimum till – how one grower did it

> Palmina Bonaventura

Millaquin grower Pat McGibbon saw many advantages in changing from 1.5 m single rows to a 1.8 m dual-row cropping system. Extension officer Palmina Bonaventura explains the reasons Pat made the switch, what changes he made, and the advantages he now enjoys.

Pat McGibbon is a fourth generation Bundaberg/Isis canegrower that has been steadily converting his farm to a minimum tillage, 1.8 m dual-row farming system, and is delighted with the results - despite battling drought and orange rust disease during the transition period.

Pat, who farms 75 ha in Bundaberg's Millaquin district, had many reasons for moving away from a traditional 1.5 m row burnt cane system. In particular, he noticed harvest machinery was causing a great deal of compaction beside the cane stool. With row spacing and machinery axle widths incompatible, the harvester was also knocking down unharvested stalks.

To try and counter this knock-down, machinery was run off-centre but this only increased compaction in the cropping zone soil - and this placed limitations on the transition to a green cane trash blanket (GCTB) system, forcing Pat to continue burning and traditional cultivation to loosen his soils.

Pat farms mainly red kandosol (red forest) type soil and traditional cultivation causes low furrow irrigation efficiency as the loosened soil absorbs water too quickly. This in turn meant he had to keep his row lengths shorter, resulting in more machine turns per hectare and reduced harvester efficiency.

Why are 1.8 m rows better?

Pat saw many potential advantages in switching to a GCTB, minimum-till system on rows matched to machinery axle widths. Foremost was better water use: it made sense that more water would be absorbed by friable, uncompacted crop zones.

If water efficiency could be improved, then he might be able to use longer rows, which would reduce turns and consequently harvest costs (time and fuel). Pat also saw the green trash as a big aid to retaining water in the soils.

These potential advantages were a strong lure, and Pat steadily began the change, keeping some sections of his farm on 1.5 m rows so he could accurately compare the performance of the new system to the old.

Great hopes, great outcomes

Despite challenges of dry weather and the threat of orange rust disease in 2000, Pat steadily implemented the switch to a system where two rows were planted 550 mm apart on 1.8 m spaced rows.

The first and most rewarding benefit was found in a marked improvement in irrigation efficiency. Pat attributes this to the help he received from Rural Water Use Efficiency (RWUE) project officer, Maurie Haines.

Removal of trash from the less absorbent traffic zone (furrow) with a specially designed finger wheel rake resulted in a constant flow of water along the furrow. This meant that the amount of water entering the more absorbent crop zone was controlled by the time taken for water to flow to the end of the field, not the absorptive capacity of the soil.

Using a surface irrigation simulation model (Sirmod), application efficiency as high as 80% and requirement efficiency of 93% was recorded. As a result, Pat was able to increase his row lengths from an inefficient 200 m on 1.5 m beds to 400 m on 1.8 m beds - significantly reducing the number of vehicle turns. Now that is soil compaction working for you and delivering benefits.

More efficient use of rainfall is another benefit of 1.8 m row spacing on Pat's farm. Rainfall infiltration studies conducted by RWUE found that for 60 mm fall,

Pat's paddocks undergoing a RWUE rainfall infiltration test.

30% more rain entered the dual rows than the old 1.5 m system.

Pat uses a low horsepower tractor to remove trash from the furrows in a fast operation that tackles two beds (3.6 m) at a time. The rake can be used any time up to the "out of hand" stage.

Irrigation furrows are only installed at plant cane; because there is no cultivation of ratoon crops, the furrows remain in place for the entire crop cycle. Pat has just ploughed out a block of dual row after six ratoons!

Other advantages, new problems

With the new cropping system, Pat is able to fertilise two beds at a time, allowing the heavy 120 HP tractor to do 3.6 m in a pass, and is now only used for this one operation instead of many on the traditional system. Loose soil beside the stool allows a lot more flexibility in the timing of fertiliser application - coulters are used to bury the fertiliser beside the stool whenever it's needed, rather than waiting for rain or needed irrigation. A lighter 60 HP tractor is used for spraying, and this can cover four rows (7.2 m) in a pass, further reducing fuel costs.

Harvesting costs have been reduced by the use of longer rows, though some problems were initially encountered with stool damage at harvest. This was solved by raising the basecutter to cut just above the soil line. The stumps pose no problem to ratoon management because no cultivation occurs in ratoon crops! A lightweight detachable elevator extension allows the haulout to match the row spacing.

The big question: crop performance

As mentioned, Pat was savvy enough to keep some 1.5 m single rows so he could accurately evaluate the performance of the new 1.8 m dual-row system. To date, production from the new set-up is equal with the old layout. This means his crop income is the same, but his costs of production are greatly reduced.

Other advantages are obvious: reduced workload, better water efficiency and longer ratooning. Pat points out that, during the period of his transition to the new set-up, Bundaberg was seriously affected by drought, low water allocations and losses to orange rust disease.

As more productive commercial varieties are introduced and hopefully better seasons, Pat is convinced that the next step will be higher productivity.

For more information, contact Palmina Bonaventura on (07) 4132 5200 or 0408 062 370.

Above: The less absorbent soil in the vehicle track has allowed Pat to increase row lengths and irrigation efficiency.

Bottom: Trash is easily removed from the irrigation path with a finger wheel rake.

APPENDIX 9 - Bonaventura P and Matthews R. 2005. Burdekin zero-till planting trial.
BSES Bulletin 8: 14-15.

Burdekin zero-till planting trial

> Palmina Bonaventura and Ryan Matthews

Top: Pre–irrigation before sowing soybean. This assisted with weed germination.

Middle: Weed emergence after irrigation was easily controlled by spraying glyphosate.

Bottom: One month old weed–free soybean crop. Pre-emerged using Stomp.

After attending a Sugarcane Yield Decline Joint Venture (SYDJV) workshop in 2004, BSES Burdekin extension officers (aka 'The Terrific Trio') decided to set up their own trial to test the research outcomes that had been presented to them.

The trial compares proposed newer farming systems with the more traditional farming systems currently widely followed. 'The Burdekin farming system is unique and successful but any change in practice that would make it even more productive would be advantageous,' says Inkerman grower Mark Rossato.

Three row spacings were used in the trial-1.52 m single row, 1.83 m single row and 1.83 m dual row. Dr Alan Garside (BSES), who is the SYDJV program leader, says: 'There is no set recipe when it comes to row spacing. The sugarcane plant is capable of producing similar yields across a range of row spacings. Controlled traffic is the key to the new system and this doesn't work with 1.5 m row spacing. The main aim here is to demonstrate that moving to 1.83 m spacing will not cause a yield reduction, and to test whether different varieties respond differently to row spacing.

It is well known that compaction caused by heavy vehicles affects crop productivity. The effects of compaction will be closely monitored in the trial using a hand penetrometer. By matching the row spacing to the harvester and haulout wheel spacing (1.83 m), a controlled traffic system can be created.

'It will be interesting to monitor compaction of the different row spacings over the crop cycle and determine whether it can be related back to yield when we come to harvest', says Mark Rossato.

The use of rotational cropping to increase soil health was one of the major research areas of the SYDJV. The Burdekin trial has introduced soybean in the fallow as a rotational crop. Ryan Matthews, BSES extension officer, explained that soybean was chosen because of its outstanding ability to produce nitrogen and its tolerance of a fair amount of waterlogging.

The SYDJV also identified reduced tillage as an avenue to improve soil health. BSES extension officer Dale Chapple says: 'It was necessary to perform several tillage operations at the

commencement of the trial because we needed to remove the compaction layers created by previous farming systems'.

The trial has been zero-till since the beds were formed and will remain that way for the entire crop cycle (approx. five years).

The Burdekin trial is testing six different sugar varieties. It is hoped that the trial will identify which varieties excel in each different farming system (single row vs dual row). Selecting the right variety is expected to be an important factor in the future of new farming systems.

Above left: Extension Officer, Ryan Matthews, standing in the three month old soybean crop.

Above right: Extension Officer Danielle Skocaj measures the growth rate of the various varieties in the trial.

Operations to date:

1. Two offset discings to remove old cane stool;
2. Gypsum application 10 t/ha;
3. Two rippings to remove old compaction layers from previous cane crop;
4. Bed forming (half paddock at 1.52 m and half at 1.83 m rows);
5. One irrigation, for bed consolidation and weed growth;
6. Roundup PowerMax™ spray out of emerged weed seeds;
7. Sowing of soybeans;
8. Spraying of Stomp® 330EC (3 L/ha) and incorporated with irrigation after soybean germination;
9. Three more irrigations of soybean crop;
10. One spray of Blazer® for pigweed control. Irvin spray legs used to keep chemical below soybean canopy;
11. Soybeans sprayed out in March;
12. Irrigated 20 days before planting sugarcane;
13. Soybeans left five weeks before cane planted;
14. Cane planted into moisture on 21 April;
15. One application of SPRAY.SEED® 250 (1.5 L/ha) and Amicide® 625 (1 L/ha) on 10 May;
16. Irrigated 13 July;
17. Confidor® Guard at 1.4 L/ha applied on the 1 of August;
18. Muriate of Potash at 125kg/ha on the 11 August;
19. One application of Velpar K4® (1kg/ha), SPRAY.SEED® 250 (1.5L/ha) and Amicide® 625 (1L/ha);
20. Irrigated 23 September, 9 October and 27 October.

Mistakes made and lessons learnt in growing soybeans:

- Always check the germination percentage of the seed. (We used one batch with a low germination percentage and the result was very poor);
- Always make sure the planter is set up correctly and that it is sowing at the desired rate;
- Seed placement is crucial. Initially, we used an old Covington Planter which worked well, however sowing depth was set too shallow and this led to less than perfect germination;
- Pre-irrigation is worthwhile. It allows the weeds to germinate and then be managed with Glyphosate; provides a stabilised bed for planting; and allows for excellent soil-seed contact and even germination;
- Pre-emergent weed control is worth every penny; soybeans don't compete very well with other plants, particularly grasses;
- Desiccation of soybeans prior to planting can be a problem. A healthy, actively growing plant will die quite easily with Glyphosate but a stressed plant which has shut down due to moisture stress will not die easily. It proved worthwhile to water the soybeans before the herbicide application. Ensure that the boom has a 50 cm clearance above the top of the soybean canopy.

The trial is situated at BSES Burdekin Research Station in Brandon. Visitors are most welcome. For more information please contact BSES Burdekin on (07) 4782 5455.

APPENDIX 10 - Bonaventura P, McGregor D and Poggio M. 2004. Saving weed control dollars. BSES Bulletin 2: 12-17.

Saving Weed control Dollars

> Palmina Bonaventura, Duncan McGregor and Mark Poggio

Spray tractor

It's all in the timing

Weeds cost our sugar industry buckets of money. It's estimated that yield loss from weed competition plus the cost of control exceeds $70 million annually.

Herbicides are one of the most commonly-used tools in integrated weed management - in most cases, herbicides allow for quick, easy and cost-effective control of weeds. However, herbicides cost money, and a critical factor to getting good value for that investment is making sure that the timing of herbicide application is spot on. Poor timing of herbicide application can result in lost revenue from yield reductions, poor control or even crop damage. But there are a few common-sense steps you can take to ensure your herbicide chemicals pay for themselves.

What am I controlling?

You should always identify the weeds present in your field before choosing which herbicide to apply. Weed species can react differently to the various herbicides available. Getting the timing right for herbicide application can also vary depending on the weed type. For most effective control of annual weeds, spray during early growth stages. Delay spraying perennial weeds until the later stages of their growth. Very importantly, read the label; the herbicide's label lists the weeds that the product is registered to control.

Right time, right conditions

Most herbicides work best in rapidly growing plant tissue, so the most effective control comes from applications made in favourable environmental conditions and when weeds are young and vigorous. Favourable environmental conditions, like good soil moisture, are particularly important when using systemic herbicides. If the soil surrounding the root zone is dry the plant tends to 'shut down' in an attempt to survive the harsh conditions. If the plant 'shuts down', it will not readily absorb agricultural chemicals. The use of a contact herbicide such as paraquat would be the best weed control in dry conditions.

Choosing to spray when atmospheric conditions are ideal is sensible. Spraying during windy times will see expensive chemicals blown away instead of killing weeds. Neutral conditions best for spraying (wind speed no more than 10 km/h, temperature below 280°C) usually occur in the early morning or late evening when there is little air turbulence caused by atmospheric heating and cooling. A slight breeze away from sensitive areas can also be beneficial to increase droplet deposition and movement towards the target. Bear in mind that the best spraying conditions for different products can vary, so you should always refer to the herbicide's label before application. Using the correct nozzles will increase the efficiency of your spraying operation. More information about nozzles can be found further on in this article.

Crank handle effect
When the amount of herbicide(s) applied is too potent or toxic, the balance of growth regulators inside the cane plant is disrupted. The resultant faster growth is usually focused on one side of the plant, which forces the stalk to bend - appearing like a crank handle. Some cane varieties are more susceptible to this effect than others. The good news is that the plant will correct its growth over time; however, some yield loss is usually associated with crank handle effect.

Early control protects profits

Early control of weeds is critical in minimising yield loses and can deliver you significant savings. Trials conducted by BSES in plant cane showed that weeds left uncontrolled for just four weeks after spiking stage can result in yield losses up to 11%! Delaying weed control until eight and 12 weeks after spiking stage resulted in yield losses of 23% and 34%, respectively - that's big bucks! Table 1 outlines the potential losses from delayed weed control in plant cane. Results from BSES trials have indicated that late weed control (12 weeks from spiking) is still better than none at all and helps prevent further weed infestation from occurring. Bear in mind that late weed control on established weeds is more difficult and expensive.

Table 1 – Potential yield and monetary losses

Timing of weed control after crop emergence (plant care)	Yield (t/ha)	$/ha
Full control	100	2030
4 Week	89 (11%)	1807
8 Week	77 (23%)	1563
12 Week	66 (34%)	1340
No Control	40 (60%)	812
Assumptions – ccs 13.5	– sugar price = $230/tonne	

The early stages of cane growth are a critical period. Weed control during these stages not only minimises yield loss, but enables more effective control on smaller weeds.

Post-plant, pre-emergent herbicides and early application of knockdown herbicides provide effective, economical weed control. Due to the delicate state of young cane, care should be taken to select the correct herbicide and rate to avoid crop damage.

Weed-free fallows save money

Good growers consistently say the fallow period is the key to maintaining a clean farm. Maintaining a weed-free fallow before planting is imperative. This can be done through cultivation, cover crops or the use of herbicides. Preventing weed growth at this stage is the most cost-effective way to keep future populations of problem weeds under control. It will also reduce the amount of weed control required in the subsequent plant and ratoon crops.

Assess, plan, save

If you use the right herbicide at the right rate at the right time, you are a long way towards maximising your cane yield and profitability. But before using any chemical it is essential that you *first read the label*. The label is a legal document and contains valuable information on the product, including safety directions, application procedures, mixing and suitable spraying conditions.

Weeds are a continuing problem, but they can be brought under control cost-effectively if you do a bit of forward thinking. *Remember, the most expensive herbicide is the one that does not work!*

If you require more information about herbicide selection or weed management in cane crops, please consult your local BSES extension officer.

"Using the wrong nozzle is just like throwing good product - and money! - away."

Nozzle choice

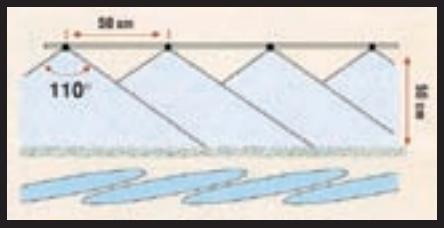
Herbicides are important chemicals on a sugarcane farm, but can be a considerable expense. Since you want every millilitre doing good and not drifting off, it's important to choose the right nozzle for the product and the prevailing conditions. Using the wrong nozzle is just like throwing good product - and money! - away.

Coloured nozzles make life easier

New nozzles are now colour coded to an international standard (ISO). This makes it easier to select the correct spray nozzle and to clearly identify and fix the problem of having nozzles with different output on the same boom. Nozzles of the same colour have the same output at the same operating pressure. Outer dimensions of flat fan nozzles have also been standardised, so a Hardi flat fan nozzle tip will fit into a TeeJet cap and vice versa. A boom can now have a Hardi nozzle alongside a TeeJet or Albuz nozzle and, providing they are the same colour, the output will be the same. Changing to a low drift (LD) or drift guard (DG) nozzle with the same colour will not affect boom output, provided the pressure and travelling speed are not altered.

The right nozzle for the job

Flat fan 11004 (Red) nozzles on boom sprays are ideal for application of pre-emergent herbicides; however, these nozzles are not suitable for applying glyphosate for ratoon sprayout. A set of flat fan nozzles costs approximately $80 for a standard five-row boom spray - about the same cost as spraying 2 ha of glyphosate for ratoon sprayout. So purchasing an extra set of yellow 11002 nozzles specifically for glyphosate application is a good investment.



Add caption [Spray tractor]

If your farm is on the coast where wind can undermine the effective use of yellow nozzles, LD or DG nozzles are recommended. Special venturi nozzles that produce a coarse spray are highly recommended for herbicides like trifluralin or 2,4-D.

The right filter for the nozzle

Nozzle filters have not yet been standardised - for example, a 50 mesh filter from Hardi is blue while the same filter for TeeJet is red. Use a 50 mesh filter with red nozzles and when using water-dispersible granular herbicides like diuron. Use an 80 to 100 mesh filter with yellow nozzles.

Worn nozzles

Old, worn out nozzles create uneven spray patterns that apply inconsistent amounts of chemical. This may result in herbicide failure, noticeable as early weed breakouts from pre-emergent applications, or as 'striping' with contact herbicides such as Paraquat. Although a Paraquat spray mixture is relatively cheap ($24/ha), if the application is a failure you may need to respray with a more expensive product like Asulox® ($150/ha) or with a cheaper herbicide that causes crop damage and loss of productivity. The economics are obvious: purchasing a new set of nozzles to replace old worn nozzles is cheaper than respraying!

Buy nozzles in sets - keep one unused to check nozzle wear

It is recommended to purchase nozzles in sets, but keep one nozzle unused. This spare is great for

Boom Spraying – Nozzle Guide					
Herbicide	Recommended Nozzle Type	Spray Quality (drop size)	Boom Output @ 6 km/hr		
			Pressure	L/min	L/ha
Glyphosate eg ROUNDUP® TOUCHDOWN®	Flat Fan 11002  For drift control use Hardi LD or TeeJet DG	Fine	1.5 bar 2 bar	0.57 0.65	113 130
Paraquat + Diuron or Atrazine or FLAME® or BALANCE® or STOMP® or Trifluralin	Flat fan 11004  Do not use low drift (LD) or drift guard (DG) nozzles	Medium	2 bar	1.3	260
STOMP® or Trifluralin also 2,4-D where drift control is required	AI 110015  Must operate at >3bar pressure Change nozzles to increase water volumes (AI 11003 = 270 L/ha) Venturi nozzles Air inclusion, Air induction and TurboDrop	Coarse	4 bar	0.68	136

checking nozzle wear, indicating when to replace the nozzles. Nozzles wear differently, depending on the frequency of spray operations and the type of herbicide passing through them - for instance, granular herbicides cause more wear than soluble liquids. Every year you should test nozzle wear by placing your spare, unused nozzle in the boom and compare its output to that of the other nozzles. When the variation is greater than 10-15%, it's time to replace all the nozzles.

Different manufacturers make nozzles from different quality materials, so their products are subject to different rates of wear. Generally speaking, you get what you pay for - the cheaper the nozzle, the quicker they wear out.

Spray quality (drop size) - now recommended on some labels

The label directions with some herbicides give specific recommendations for spray quality (eg very fine, fine, medium, coarse, very coarse) and water volume. Both the Flame® and Balance® labels request the use of a medium to coarse spray pattern with 200 - 250 L water/ha. Red nozzles at 2 bar (30 psi) pressure put out a medium spray quality and, when travelling at 6 km/hr, deliver 260 L/ha. Using a red nozzle for paraquat tank mixtures with either Flame® or Balance® strikes a balance between the fine/medium spray required for paraquat and the coarse spray for the pre-emergent, soil-applied herbicides.

For more news about nozzles, visit:

http://www.sprayingequipmentsupply.com/teejet/teejet-spray-products.html

www.mrnozzle.com.au/albuz

www.hardi.com.au/html/nozzle_guide.html

If you need more information about nozzle use, contact your nearest BSES extension officer.

Weed hooded sprayer

> *The hoods are essential for applying glyphosate when controlling weeds in established cane*

Hooded sprayers

You might recall a *Bulletin* news item from 2002 where Bundaberg grower Des Schulte explained how he both improved weed control and almost halved his chemical bill by using a hooded sprayer. Like many growers, Des found that a trash blanket reduced the performance of many residual herbicides. He found that hooded sprayers allowed him to use glyphosate effectively without damaging his cane.

Hooded sprayer application of glyphosate (eg Nufarm's Weedmaster® Duo) is now permitted by the Australian Pesticides and Veterinary Medicines Authority. Glyphosate is excellent for the control of perennial grass weeds including couch or guinea grass. In addition, Roundup® PowerMAX™ is expected to soon be permitted for use in hooded sprayers.

The hoods are essential for applying glyphosate when controlling weeds in established cane, because the product can harm or kill plants.

While glyphosate readily breaks down in the environment and therefore has no residual action, it is relatively inexpensive and does allow excellent control of perennial grass weeds. Glyphosate works best with low water volumes and a fine spray pattern - the hoods prevent drift.

Industry permission to spray glyphosate under hoods is thanks to hard work by BSES extension staff, Des Schulte and Nufarm.

Des' Redball hooded sprayers from the U.S. cost approximately $8,000, but his chemical savings over two seasons have now paid for the new equipment.

Above: demonstrating the sprayer at the Wallaville Canetalk group, Bingera

New ideas - ute boom spray

BSES has created a utility-mounted boom spray that is proving a very successful weed management tool. Developed in the southern region, the ute boom sprayer is used in herbicide strip trials, and has attracted a lot of interest at field days and shed meetings.

Convenient

The sprayer is easily installed on the back of a 4WD utility, making it ideal for cane paddocks and highway travel. Snap fittings allow quick nozzle changes, and the 4.5 m boom covers three conventional rows. It's easy to flush clean between herbicide treatments.

Accurate and flexible

Three Flojet pumps deliver commercial flow rates and pressure up to 4 bars, which allows the use of venturi nozzles. The rig is height-adjustable, allowing it to be used for other crops, and spray droppers can be used for band spraying. The only real downside is that it is only suitable for conventional 1.5 m row spacings and for spraying plants up to one metre high.

For more information, contact BSES Bundaberg on 07 4132 5200.

"The sprayer is easily installed on the back of a 4WD utility, making it ideal for cane paddocks and highway travel."

A row too far?

> David Calcino

High density planting (HDP) is a farming system that has achieved some excellent results in some Queensland canegrowing districts, but less convincing results in others. BSES Northern Regional Manager, David Calcino, explains how careful testing suggests this system might be better suited to irrigated canegrowing areas.

Two years ago, six suppliers to Mulgrave Mill in far north Queensland decided to test some promising research results on their farms by developing a new farming system.

Led by Tom and Gaynor Watters, they successfully applied for partial funding for the project from AFFA (Federal Government Department of Agriculture, Fisheries and Forestry Australia) under the *Farm Innovation Program.*

The new farming system trials incorporated the outcomes of three pieces of research:

- **high density planting** - cane yield increases of up to 50% had been recorded in trials in south Queensland;
- **controlled traffic** - reduced compaction can aid soil health and reduce cultivation costs;
- **break cropping** - the use of well-managed fallow legume crops between crop cycles had been shown to significantly increase cane yield, improve soil structure and greatly reduce the need for nitrogen inputs into the following cane crops.

The key element of the new system involves triple rows of cane 55 cm apart planted into permanent, raised beds on 2.3 m wide centres.

The rows and vehicle tracks remain the same from season to season; this means the cultivated planting zone remains uncompacted and friable, while the vehicle tracks are uncultivated.

However, this wider spacing meant major machinery modifications had to be made.

Major machinery modifications necessary

Tom employed a local identity, Eric Archibald, to develop the various pieces of machinery for the project.

A planter caters for three rows of cane planted 55 cm apart. It comprises three whole-stick chopper planters with presswheels that plant the three rows together.

Above: soya bean mounds - fallow legume crops increase yields

Left: modified harvester and trailer

A second implement was built to fill in the three rows.

The harvester provided the biggest challenge to Eric. A second-hand Austoft 7000 harvester was turned into a triple-row machine on a 2.3 m wheel spacing. A haul-out trailer was also modified to operate at the wide row spacing.

Trials planted on six farms

The Watters and the five other partners - Jim Hesp, Frank Poglio, John Porta, Kevin Sues and Mulgrave Mill - established their trials in the latter half of 2001. Each trial compared approximately 1 ha of high density planting with 1 ha of conventional planting (1.52 m rows).

At the time the trials commenced, conditions were abnormally dry. As a result, germinations in the recently raised beds at some of the trial sites were not ideal because irrigation water was not available. However, both systems were facing the same challenges so the comparison was very fair.

Interesting results

An immediately striking result was that the middle rows of the three-row high density plantings were generally inferior to the two outside rows. The centre row stalks appeared thinner and sometimes shorter than the outside stalks. The dry conditions may have caused the plants to compete for soil moisture, and hence the middle row was disadvantaged.

The plant crop on the six sites was harvested in 2002. Two trials were harvested on one of the sites.

What is interesting is that, in all seven trials, the cane planted conventionally outyielded the triple-row cane!

By looking at the trial results, it's plain to see that the conventional system of planting single rows of cane at 1.52 m performed better than the triple-row system in the plant crop.

The first ratoon crops were harvested in 2003. While we still have to collate the results of that harvest, it is obvious the conventional system again outperformed the high density system.

One row too many?

The trials will be harvested as second ratoons in 2004, and we shall see if they continue the trend set by the first two trial crops.

After a huge effort to implement this radically different farming system, what does Tom Watters think of this particular version of high density planting?

"It doesn't seem like close triple rows will work here in far north Queensland under these conditions," said Tom. "It might be more suited to fully irrigated areas of the industry where the best results in trials seem to have been achieved."

It is unlucky that these trials were established during one of the driest periods in the Mulgrave district on record, and that did not favour the high density system on beds. However, it is valuable research for growers seriously considering multiple rows, and seeing how it performs in a worst-case scenario.

Tom went on to explain that, despite the HDP aspect of the

Right: triple row planter construction

system having no advantage, he still firmly believes in a controlled traffic system. In 2003, he planted a further trial on his Gordonvale district farm. This trial compares the two treatments discussed above (conventional rows and triple rows at 55 cm on beds 2.3 m apart) with twin rows 80 cm apart on raised beds at 2.3 m interspaces.

Tom believes that the dual rows on low beds might be the answer to high density planting in the northern district. He believes a key to developing an alternative farming system utilising controlled traffic and legumes lies with the formation of the beds.

"The preformed beds should only be high enough to achieve the correct basecutter profile," explained Tom. "However, planting should not be too shallow and for sound germination, soil moisture needs to be adequate."

While any change of farming system may be expensive to implement, it is hoped the long-term benefits of reduced compaction, reduced fertiliser inputs, lower production costs and improved soil health will pay dividends. The trick is to develop a system that is suited to particular canegrowing areas.

Table 1 Results for high density triple rows versus conventional single row 2002 (plant cane)

Trial site 1 Q186$^{\Phi}$	**Treatment**	**Date cut**	**Cane yield (t/ha)**	**ccs**	**Sugar yield (t/ha)**
	Conventional	27.8.2002	104.7	15.41	16.1
	HDP	20.9.2002	87.1	14.59	12.7
Trial site 2 Q186$^{\Phi}$	**Treatment**	**Date cut**	**Cane yield (t/ha)**	**ccs**	**Sugar yield (t/ha)**
	Conventional	10.9.2002	98.6	14.91	14.7
	HDP	23.9.2002	89.6	15.15	13.6
Trial site 3 Q186$^{\Phi}$	**Treatment**	**Date cut**	**Cane yield (t/ha)**	**ccs**	**Sugar yield (t/ha)**
	Conventional	5.9.2002	99.7	15.37	15.3
	HDP	26.9.2002	72.8	15.78	11.5
Trial site 4 Q174$^{\Phi}$	**Treatment**	**Date cut**	**Cane yield (t/ha)**	**ccs**	**Sugar yield (t/ha)**
	Conventional	26.9.2002	102.2	15.79	16.14
	HDP	24.9.2002	87.5	15.84	13.86
Trial site 5 Q186$^{\Phi}$	**Treatment**	**Date cut**	**Cane yield (t/ha)**	**ccs**	**Sugar yield (t/ha)**
	Conventional	3.10.2002	125.0	14.71	18.4
	HDP	4.10.2002	96.1	14.71	14.1
Trial site 6 (a) Q113	**Treatment**	**Date cut**	**Cane yield (t/ha)**	**ccs**	**Sugar yield (t/ha)**
	Conventional	3.10.2002	96.5	14.41	13.9
	HDP	7.10.2002	81.4	12.86	11.3
Trial site 6 (b) Q201$^{\Phi}$	**Treatment**	**Date cut**	**Cane yield (t/ha)**	**ccs**	**Sugar yield (t/ha)**
	Conventional	3.10.2002	117.6	12.67	14.9
	HDP	7.10.2002	93.0	13.24	12.3

Average of all trials	**Treatment**	**Cane yield (t/ha)**	**ccs**	**Sugar yield (t/ha)**
	Conventional	106	14.75	15.64
	HDP	89	14.75	13.13

APPENDIX 12 - Callow B. 2005. Beating the weeds in sugarcane. BSES Bulletin 5: 8-9.

Beating the weeds in sugarcane

> Barry Callow

The battle against weeds continues in the Southern Region. In mid October 2004, unexpected rain across the Bundaberg/Isis region caught out many growers who were very busy with harvesting and planting operations.

This rain resulted in an outbreak of grass weeds and, as we all know, in a plant crop this can lead to potential losses of income of $250 to $500 per hectare. BSES data shows that controlling weeds once they have emerged can cost growers up to $150.00/ ha, instead of up to $65 per hectare if a pre-emergent herbicide is applied at the correct time and incorporated to the correct depth.

To assist in the battle, BSES extension officer Barry Callow has had the engineers at BSES Bundaberg build the 'Red Rocket', a single-row applicator for demonstration work in the region. This will allow Barry to apply appropriate products in plant and ratoon cane at the correct time for field walks involving the Canetalk and productivity group members. Growers can then determine which product will provide the best level of control on their farm. This will take into account variations in soil type, weed spectrum, irrigation and planting methods and other variables.

The sprayer will also be used in comparison demonstrations of low-drift air-inducted nozzles and the conventional nozzles still used by many growers. The Bundaberg/Isis area is generally a windy place, and every grower should be aware of the reduced drift options available if they haven't already changed over. The pace of change in application technology is rapid, and these demonstrations will improve grower understanding of the changes.

The 'Red Rocket' is light, inexpensive and can deliver 330 L water/ ha. It is powered by a battery that will give up to 1 hour of spraying time. The machine and the demonstrations aim to get the growers at meetings out of the sheds and into the field, where the interest level is usually greater. Stand by for further updates.

Left: Barry Callow and the 'Red Rocket'

"The 'Red Rocket' is light, inexpensive and can deliver 330 L water/ha. It is powered by a battery that will give up to 1 hour of spraying time."

WEB WATCH

www.bses.org.au
www.crcsugar.com
www.bom.gov.au

Left: Palmina Bonaventura is presenting at a Canetalk meeting on alternative legume choices growers may use in rotation with sugar cane.

Below Left: Diane Bush is one of our local Future Cane Industry Liaison Officers (ILO) and is explaining to growers what Future Cane is all about as a lot haven't yet been informed.

A 'best bet' block

> Barry Callow

One of the 2005 objectives of the Southern region FutureCane team was to establish best bet blocks in Bundaberg, Isis and Maryborough. In the Bundaberg area a 6.4 ha best bet block has been established on Warren Glass's farm, to commercially test the results of twelve years' research by the Sugarcane Yield Decline Joint Venture (SYDJV).

Results of this research led to recommendations for an improved farming system that incorporated three key components-controlled traffic, minimum till and legume rotation crops. Controlled traffic is all about matching cane row spacing to wheel spacing of farm machinery, especially heavy harvesters and haulouts to reduce compaction in the plant line.

Minimum till is about reducing ground workings to reduce input costs and to allow improvements in soil structure and soil biological health by preventing the damage from excessive cultivation. The third component, (legume rotation), aims to improve soil health by introducing legumes such as soybeans, which do not harbour cane pests and diseases during the fallow period. They fix atmospheric nitrogen and can be profitable in two ways-savings in nitrogen fertiliser and sale of harvested grain.

Above: Dual rows of cane planted in soybean stubble.

Left: Andrew Dougall (middle), DPI&F FutureCane agronomist and Barry Callow (right), BSES FutureCane Extension Officer discuss the Best Bet block with Warren Glass (left).

Warren Glass is investigating the economics and agronomics of changing to a dual row system. On the best bet block, dual rows will be planted on beds 600 mm apart at 1.9 m row spacings. Currently there are three rows of soybeans in the beds as standing stubble, and cane is being planted between these in spring. Part of the block will be planted using a BSES double disc opener as a direct drill operation and the remainder will be planted with a conventional Hodge billet planter which has been modified by Warren.

Samples taken from the soybeans enable scientists to determine the amount of fixed nitrogen. Soil samples were taken in the autumn and will be taken again prior to spring plant to observe how the soil nutrient status has changed over the winter fallow. Soil bulk density will be determined each year as a way of monitoring changes in soil compaction over time. The costs of each operation will be carefully documented by FutureCane economists and analysed with their impressive new spreadsheet, 'Farm Economic Analysis Tool' (FEAT for short). This will generate the gross margins, determined by detailing each operation and, more importantly, where cost-savings can be made.

The overall objective, as already stated, is to test the commercial reality of new farming systems and to demonstrate them to farmers at field days. We also plan to have commercial-scale demonstration sites on more farms in the area, but with fewer detailed measurements and less data collection.

> *The overall objective ... is to test the commercial reality of new farming systems and to demonstrate them to farmers at field days.*

APPENDIX 14 - Cox M and Wallis D. 2004. Choice quality - choosing and managing the best variety for your farm. BSES Bulletin 2: 3-5.

Choice Quality – choosing and managing the best variety for your farm business

> Mike Cox & David Wallis

How do you decide which varieties will prosper best on your farm? BSES Plant Improvement Leader Dr Mike Cox and Extension Officer David Wallis have compiled this easy guide that helps you make those critical decisions.

What variety should I plant?

This is probably the single most important management question a canegrower can ask - and the answer will determine the 'bottom line' of your canegrowing enterprise, not only this year, but for the next five or six!

Most growers have a pretty good feel for which canes will do well on their farm. But in these times where every single dollar and even the smallest increase in productivity counts, is 'feel' enough to base this vital decision on?

Choosing a variety that delivers just an extra five tonnes per hectare can return an extra $6,500 per year to a 100 ha farm (based on $230/t and 13 units ccs). So you can see that an inappropriate variety decision could prove very expensive over a five or six year period.

We've compiled this straightforward check-list of questions and actions to help you settle in your mind how to choose the varieties that will deliver the best dollar return to your farm.

Variety choice

***Ask**: Which of the varieties that are currently grown have performed well either on my farm, or elsewhere in my zone/district?*

Action: Check farm and district/mill area productivity records. If you've never done this, contact your BSES extension officer for assistance.

***Ask**: Which new varieties can I propagate on, or plant for the first time?*

Action: Carefully assess new varieties planted last year on either your farm or neighbours'. Keep a 'watching brief' on new varieties that are due to be released in your district, and ask your BSES extension officer about how suitable they might be to your farm's conditions.

Below: Mike Cox and Tony Linedale in a crop of Q205^{ph}

***Ask**: How do I assess whether a new variety will suit my farm or a particular soil type?*

Action: Conduct a simple variety strip trial on your soil, comparing the performance of the new variety to a variety that you know performs well. Do not plant large areas of unproven varieties on your farm. The earlier example shows how expensive a poor decision can be. Your local BSES extension officer can give you great tips for conducting an effective variety strip trial.

> *Perhaps the most important decision, management of your commercial cane is also critical to realising the best return from your investment.*

***Ask**: How many varieties do I currently grow on my farm, and what proportion of my farm's area is planted to my major variety?*

Action: Your farm's production should be based on at least four varieties, with no more than 50% of your farm planted with any one variety. This approach will help you accommodate different harvest times, soil types and conditions across your farm. Very importantly, investing in multiple varieties reduces your farm's vulnerability should a new disease or insect outbreak affect a variety. A rule of thumb: never plant more of any one variety than cannot be replaced over two years.

While choosing your varieties is perhaps the most important decision, management of your commercial cane is also critical to realising the best return from your investment. The points below also help you decide ways to squeeze the optimum dollar value from your chosen canes.

Variety Management

***Ask**: Is my plant source clean? Or do I need to purchase clean seed?*

Action: Never risk using ratoon cane as planting material. You should maintain a nucleus of clean seed as the source of your farm's main varieties. It is also very worthwhile to ask your local BSES extension officer or Cane Productivity Service officer to check your plant source for ratoon stunting disease (RSD). RSD can rob you of income, but it can be controlled, if not eradicated, through sound management practices; as the adage says: better to be safe than sorry.

***Ask**: Is the variety I intend to plant in a particular block different from the variety I previously planted in that block?*

Action: Do not plant any block with the same variety twice in succession. If you are in an area prone to Pachymetra root rot, check with your BSES extension officer how resistant to the disease the previous variety rated. Always follow varieties rated 'susceptible' or 'intermediate' with varieties resistant to Pachymetra.

***Ask**: Do I have any varieties on my farm that are resistant to sugarcane smut disease?*

Action: Where possible, the answer should be 'yes'! However, you can go broke growing so-called 'resistant' varieties if they don't suit your farm - remember the $6,500! Aim to have sufficient cane of at least two smut-resistant varieties. That way, if the unthinkable happens and smut does infect your district, you can change over to these two varieties immediately. See the table below for a list of varieties with good and intermediate resistance to smut in your district.

***Ask**: Is the block I am planting most likely to be cut very early or very late?*

Action: Match the harvest time to the maturity of selected varieties, bearing in mind conditions for the block in question - eg a well-drained block in a wet area.

***Ask**: Do I have a mix of varieties with optimal ccs for all harvest times?*

Action: Remember: each additional unit of ccs is worth between $2 and $3 per tonne of cane - which could add several hundred dollars profit for every hectare! So it pays to ensure that all the varieties you grow will deliver maximum ccs for early-, mid- and late-harvest. Brix your canes with a hand-held refractometer to fine-tune the timing of harvest for optimal ccs.

***Ask**: What is the crop age of each of my varieties at harvest?*

Action: Ensure each crop is at least eleven months, or preferably twelve months, at the time of harvest for maximum profitability.

Above: Growers inspecting a new variety in Isis CPPB plot

***Ask**: What irrigation management strategies best suit my different variety/ harvest time combinations?*

Action: Match the scheduling of your irrigation regime to the requirements of the plant type. For early-harvested varieties, stop irrigating earlier to allow sufficient drying down time. For late-harvested varieties, apply extra irrigation to maximise yield and keep the stool in good condition for ratooning.

***Ask**: Which fertiliser management strategies are best for my crops' different variety/harvest time combinations?*

Action: Soil and leaf analyses are great investments. They will help you determine optimum nutrient requirements, taking into account legume rotational crops and applications of mill mud. Apply recommended nitrogen rates and strongly consider reducing nitrogen rates with vigorous varieties - especially in the wet tropics. This will minimise lodging and any resulting drop in ccs. It is also wise to consider reduced nitrogen rates for early-harvested crops to avoid ccs depression.

Appropriate smut resistant and intermediate varieties for each region

Region	Resistant varieties[1]	Intermediate varieties[1]
Northern (coastal)	**Q199**$^{\Phi}$, **Q200**$^{\Phi}$, Q130, Q149	**Q135, Q172**$^{\Phi}$**, Q198**$^{\Phi}$, Q175$^{\Phi}$
Northern (Tableland)	**Q151**, **Q200**$^{\Phi}$	**Q96, Q135, Q172**$^{\Phi}$
Herbert	**Cassius**	**Q96, Q135**
Burdekin	**CP74-2005, Q133, Q171**$^{\Phi}$**, Q177**$^{\Phi}$**, Q208**$^{\Phi}$	**Q96**
Central	**Q151**	**Q96, Q135, Q190**$^{\Phi}$
Southern	**Q146, Q151**	**Q135, Q155, Q190**$^{\Phi}$
New South Wales	**BN73-3416, BN81-1394, Q151, Q212**$^{\Phi}$	**75C326, Arris, Q124, Q135, Q155, Q203**$^{\Phi}$**, Q213**$^{\Phi}$

[1] Varieties in bold are the Recommended Varieties for each region

Take the time to make the right choice

It is a tough time for Australian sugarcane producers right now, and which varieties you choose now will help determine the future of your farm business. If you have any questions about deciding the best commercial canes for your farm enterprise, contact your nearest BSES extension officer.

APPENDIX 15 - Garrad S. 2005. Best management practice for farms. BSES Bulletin 5: 6-7.

Best management practice for farms

> Steve Garrad

Doing the right thing, at the right time, in the right way for the right reason.

Best Management Practices (BMP) is a term to describe the combination of sound science with proven practical management to create recommendations that benefit the community, the environment and the grower.

These can arise from research programs but usually they are found where innovative growers are looking for improved efficiency and productivity while taking on board good environmental practices and sound resource management.

There is a growing international trend for the adoption of BMPs, EMS, QAs and alike in major markets, and it has been suggested that failure to adopt such practices may disadvantage agricultural industries in the future.

Growers may already be applying BM practices and these can be recognised as such and have their worth reinforced. Where practices are outside what is generally described as BMP, it does not necessarily mean that they are wrong.

In these cases, BMP can assist the grower to describe the context of the variation and add to the understanding of what BMP is in the sugar industry.

BMP is a great way to describe to others outside the farm about what you are doing and why. It opens doors for the community, consumers, government and non-government agencies to understand our farming system better. Growers need to continually monitor and adapt their management practices to improve production efficiencies, ensuring a sustainable future.

BMP is a form of industry self-imposed responsibility, which is far better than government imposed regulations. In particular, the regulatory authorities prefer to work with BMP on difficult issues such as access to particular chemicals, management of resources such as irrigation water, and quality compliance.

The application of BMP on a farm helps demonstrate 'due diligence' and duty of care. Like a good reputation, this standing proves its worth when talking with financial institutions, government agencies, funding bodies and community organisations.

If much of this sounds familiar to you then there is a good chance you have been to a COMPASS Workshop in the last few years. COMPASS aims to combine profitability and sustainability in the sugar industry by going into the detail of what may be BMP.

It is hard to find a better prompt to help growers think about a range of issues relating to cane growing, the environment and sustainability in any agricultural industry. However, COMPASS had to be able to be applied throughout the whole industry and there are many instances where the detail did not necessarily apply to all farms.

COMPASS is a self-assessment tool that gives growers the opportunity to identify where they are at and build-

on from there. BSES is working with CANEGROWERS to develop an on-line version of COMPASS, allowing growers to undertake a self-assessment at anytime, and as many times as desired. More on this on-line self-assessment tool in the next *Bulletin* issue.

Anything described as Best Management Practice has to keep the context of the farm operations in mind. This includes the natural resource base of the farm and the experience and skills of the manager and those people implementing the changes in the field.

BMP is in danger of becoming a hackneyed catch-phrase if you focus on the detail only to pick it apart. Instead, it may be worth concentrating on the frame of mind that you should have when approaching the principles that underlie BMP. These may be described as:

- Due Diligence
- Planning
- Commitment

It is expected that the promotion and adoption of BMPs will result in a more sustainable industry, and will enable the grower to manage impacts in a practical way at the farm level.

For further information on BMP please contact your nearest BSES Extension Officer.

APPENDIX 16 - Jeppesen M and Staier T. 2005. New farming systems: Central district growers taking up the challenge. BSES Bulletin 7: 18-21.

New farming systems: Central district growers taking up the challenge

> Mandy Jeppesen and Tim Staier

The amount of literature promoting the advantages of controlled traffic, legume fallows, and minimum tillage is ever-increasing. But how do these practices perform in a commercial farming situation? New Farming Systems (NFS) is a BSES-managed project, (partially funded by SRDC) that is aimed at increasing grower adoption of alternative farming systems in the Central district. The project funding has allowed the purchase of appropriate equipment. This has allowed growers to trial the new system on their farms, and enable them to make informed decisions on how NFS can be incorporated into their current operations. Two growers in the Mackay district have taken advantage of this opportunity to 'test-drive' some of the equipment with positive results.

Farqhuar Family, Habana and Seaforth

Alistair, Alan and Brian Farqhuar own and operate two farms in the Mackay district, with a total cane production of 20000-21000 tonnes. After years of stick planting large areas, the family were finding it difficult to keep up with the work, and decided to purchase a billet planter.

A dual-row billet planter with adjustable planting width was purchased from Bundaberg in 2001. Used previously for contract planting, the machine was too large to suit its new use, and required extensive modifications.

The Farqhuars were uncertain about the MF 6000 harvester's ability to handle the larger throughput of cane. Their initial plantings were on 1.8 metre centres with the dual rows planted 45 cm apart. It soon became clear that stooling caused the two rows to become one wide row, increasing competition, and the number of dead sticks to unsatisfactory levels. A second set of plantings used dual rows planted 65 cm apart, allow the rows to remain separate, and reducing the severity of the competition problem.

Image 1: Alan Farqhuar with modified harvester front.

Further modifications to the planter included the addition of:

- discs located behind the planting chute to bring soil back into the row;
- sweeps added in front of the press wheels to move dirt into the centre of the mound, and reduce the 'volcano' shape effect;
- double-disc openers on the planter to reduce dirt disturbance associated with the planter chutes.

The Farqhuar family believe that, even though growers are hesitant to convert to a controlled-traffic system, the use of double-disc-opener cane planters has benefits. In their operation, they were able to reduce time associated with working paddocks, and now have the ability to plant into moisture. Previously, any moisture had been lost due to preparing the paddock for planting. This has worked to their advantage, particularly on the heavy clay soils on their Habana farm.

> *A hand penetrometer is used to determine soil compaction, and the decision to rip paddocks is made based on these results.*

Image 2: Alan Farqhuar with penetrometer.

This year the Farqhuars borrowed the double-disc-opener cane planter from the NFS project to plant 25 hectares of dual row on their Habana farm. In contrast to other nearby farms, they were able to plant early into moisture. They now have a 3-4 month growth advantage compared to later planted blocks, and achieved an excellent strike in doing so.

Alistair, Alan and Brian were able to achieve the changeover to dual rows relatively cheaply by undertaking many of the modifications themselves.

Other changes have been implemented: they use a McLeod grubber to apply fertiliser and hill up in the one operation. In the first working, rubber flaps attached to the tynes start the hilling-up process by adding a small amount of soil onto the row. In a second pass, the fertiliser is applied and the rubber flaps add further soil to form the final bed. Hilling-up is undertaken earlier than most other growers, as time to canopy closure in the duals occurs more rapidly.

Modifications to the harvester enable it to harvest the wider 1.8 metre rows (image 1). The elevator extension was home-made (image 3), with the only direct cost being $240 for a length of chain. The angle of the bin flap and elevator was altered to reduce the amount of trash being directed into bins. The machine also has single spirals, which had their length reduced, and the angle altered to allow the correct shoe width. Originally it had a shredder topper, which was unable to handle the extra cane being fed into the machine. This was replaced with a topper.

The choice of row width was dictated by the cost of changeover and the reduction in row length per hectare. Overall, the 1.8 metre dual-row system was the least expensive option, as much of the existing machinery was already that width. By going to a 1.8 metre dual row system from the conventional 1.5 metre system, the Farqhuars have reduced the row length per hectare from 6,666 metres to 5,555 metres. If they had gone to 2 metre centres, there would have only been 5,000 metres of cane row and compensation would have had to be much greater to maintain the same yields.

The use of pre-emergent herbicides negates the need for further row cultivations after planting. This controls weeds up until canopy closure, which occurs quicker than in the conventional 1.5 metre system.

The conversion to a controlled-traffic system is part of the overall farm strategy to reduce costs and improve productivity. A hand penetrometer is used to determine soil compaction, and the decision to rip paddocks is based on these results (image 2).

The Farqhuars also decided to harvest their own cane following many years of using contractors. This allowed them to reduce stool damage from turning at the end of rows, and reduce compaction by not harvesting in adverse weather conditions.

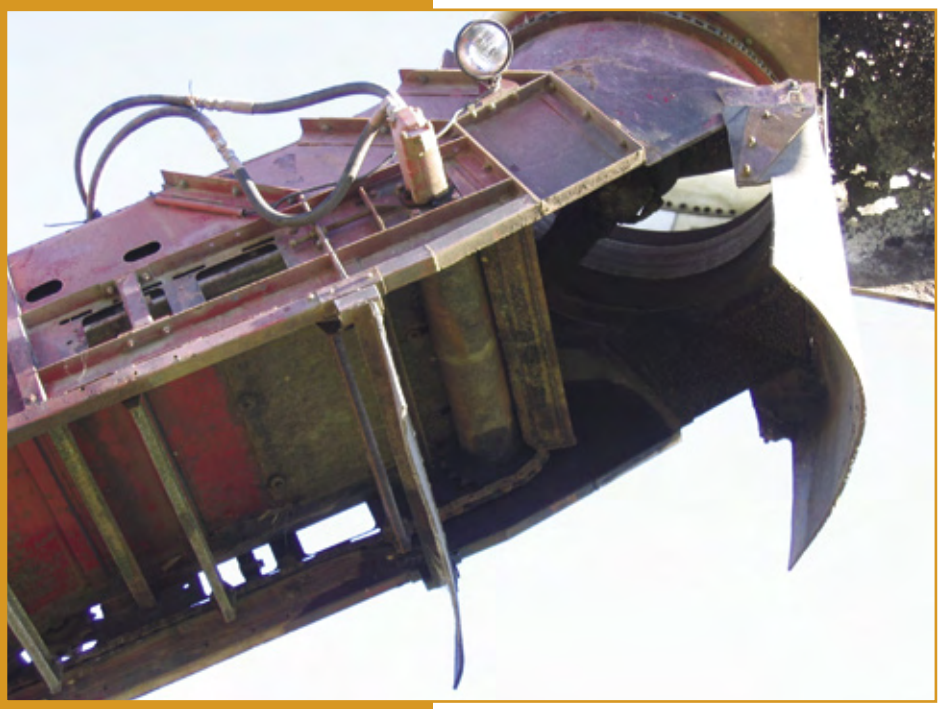


Image 3: Farqhuar's elevator extension.

Image 4: Colin and Colin Vassallo's with modified double-disc-opener billet planter.

Both farms are trash blanketed. They also use centre busting of the interspace with coulters and rippers to increase water infiltration and make better use of effective rainfall.

"The soil is the goose that lays the golden eggs," Alan Farqhuar comments, "Lose that and you lose your business".

Vassallo Family, Septimus

Only this season did Colin, Georgina and Colin Vassallo start the conversion to a controlled-traffic, minimum-tillage system on their 200 hectare farm in Septimus.

By using the NFS direct-drill soybean planter, they established 20 hectares of soybean in their fallow in 2005. The soybeans were sprayed out, and the residue was cut and placed on top of the mound (image 6). None of the soybeans have been harvested for grain. The Vassallos are eager to plant soybeans into fallow every year, after seeing the improvements to soil structure.

The family are converting to 1.83 metre rows, with duals 50 cm apart. A Hodge double-disc-opener planter was purchased and modified to suit (image 4). Initially, duals were planted 42 cm apart, but the planter experienced problems with clogging soil, the spacing was widened to combat this. The discs have also been widened to allow for a higher planting rate. Blockages have been alleviated with these modifications.

The choice of row spacing was determined by the cost of conversion, and harvesting machinery centres. They also wanted to reduce hours in the paddock, cover ground quicker, and become more fuel efficient.

Vassallos will use a bedformer to form mounds prior to planting. To reduce costs, Colin made this over 3 weeks from an old grubber frame and old Hodge mouldboards. The program for planting is to mark out the rows, rip only the bed area

using zonal tillage, and mound up the rows. Ripping is undertaken only on the bed area with a three-legged ripper. Wings have been added to the middle tyne to lift and shatter the hardpan. The beds will be left to settle over the wet season, and reformed if necessary prior to planting.

32 hectares have been planted under 1.83 metre dual rows this year (image 5). The Vassallos are pleased that the strike has been as good as, if not better than, the Poplin planter used in the past. The NFS double-disc-opener cane planter was used to plant new clean seed cane, and to establish a trial to determine which varieties do best in the dual-row system. They plan on planting another 32 hectares of fallow to dual rows in 2006.

The Vassallos plan to improve their existing machinery in the conversion to a controlled-traffic system. They want to widen the shoes on the harvester from 1.5 metres to 1.83 metres, and investigate GPS guidance systems in tractors for hilling-up and planting, and eventually in the harvester. GPS guidance is seen as an integral part of the new farming system, further reducing driver error and compaction.

A high-clearance spray tractor has been modified to allow spraying on row spacings between 1.5 and 2 metres by altering the hydraulics. So far, three tractors have been converted to the 1.83 metre wheel spacing.

After reading the literature and listening to accounts of his peers, Colin Vassallo decided to join the growing number of growers changing to controlled-traffic systems."Over time, the concepts of the new farming system made sense, especially the cost-cutting," said Colin.

Image 5: Colin Vassallo's dual row plant cane.

Image 6: Colin Vassallo's soybean crop.

Effective Weed Control

> Mark Poggio

Herbert BSES extension officer Mark Poggio explains some tricks of the trade and common pitfalls of herbicide application for weed control.

Keeping crops relatively weed-free remains a primary component of good cane farming practice. To get the best value and performance out of your chemicals, it is essential to maintain effective spraying principles. Achieving only a partial result - or worse, a complete failure - from your herbicide application is expensive and time consuming, and in some cases may cause greater difficulties in weed management.

Cases of genuine failure by a herbicide to control a weed for which it is registered are rare. Environmental conditions, weed growth and application method are the main factors that contribute to herbicide failure. Unfortunately, it is often very difficult to determine the cause of herbicide failure because problems usually only become apparent some time after the spray was applied.

To achieve an effective result, it is important you know as much as possible about the product you are applying. Before using *any* chemical, it is essential that you first read the label. The label is a legal document and contains valuable information about the product, including safety directions, application procedures, mixing and suitable spraying conditions. All recommendations appearing on the label - including general instructions, compatibility and restraints for use - should be followed if you want to achieve the desired result.

To avoid a costly herbicide failure, some common errors and their causes are listed below.

Environmental Conditions

Choosing to spray when conditions are ideal will often go a long way toward providing effective control of weeds with minimal wastage of herbicide. Neutral conditions are often the most ideal period to apply herbicides. These usually occur in the early morning or late evening when there is little air turbulence caused by atmospheric heating and cooling. A slight breeze away from sensitive areas can also be beneficial, to increase droplet deposition and movement towards the target. Ideal spraying conditions for different products vary, so you should always refer to the label before application.

Spraying during hot, dry conditions - Hot, dry conditions speed up drying of droplets on the leaf, reducing the time for the weed plant to absorb the herbicide. Pre-emergent product sprayed on hot, dry soil is often lost through volatilization. Again, check the label to determine the most appropriate spraying conditions for the product.

Humidity - High humidity greatly improves the absorption of most herbicides by the plant. Spray droplets dry slowly under highly humid conditions, allowing more time for chemicals to enter the leaf - resulting in more effective control.

Temperature - Temperature influences the rate of herbicide absorption, the rate of chemical movement within the plant, and the plant's growth rate. Cool conditions following herbicide

Mark Poggio discusses reduced tillage operations with Herbert growers

Reduced tillage in plant crops can be achieved with the tactical use of herbicides

> *Record keeping doesn't take long, and it is a very useful reference on what you did right – and can help you isolate causes of problems if things go wrong.*

application will often produce poor results. High temperatures can lead to the loss of volatile herbicides to the atmosphere through evaporation of the spray solution before it is absorbed into the leaf. Volatile herbicides include 2,4–D ester.

Dew and rainfall - Heavy dews and rainfall may be detrimental to the uptake of contact and systemic herbicides by causing the applied spray droplets to roll off the leaves. The length of 'rainfast period' varies with the herbicide selected - again, read the label.

Weed growth

Weed species can react differently to various herbicides. You should always identify the weeds present in your field before choosing which herbicide to apply. The product label outlines the weeds that the herbicide is registered to control in the 'directions for use' section.

Plant age and growth rate - Most herbicides are more active in rapidly growing plant tissue, so the most effective control comes from applications made in favorable environmental conditions and when weeds are young and vigorous. Systemic herbicides (e.g. glyphosate, Asulox, Ametryn) are most effective when the weeds are actively growing. Soil moisture is an important factor controlling plant growth. If the soil surrounding the root zone is dry the plant 'shuts down' in an attempt to survive the harsh conditions. So, during dry conditions, the plant will not readily absorb doses of agricultural chemical. The use of a contact herbicide like paraquat would be the best alternative for weed control in dry conditions.

Annual and perennial - The pattern of water and nutrient movement within the plant varies between annual and perennial weeds. Annual weeds should be sprayed during early growth stages to obtain the best results. Delay spraying perennial weeds until the later stages of their growth when translocation is mainly into the root system.

BSES Limited Deputy Chair Grant Maclean (L) and CEO Eoin Wallis (R) promote the importance of maintaining native vegetation

NEWS

Planting for the future

BSES Limited Deputy Chair, Grant Maclean, and CEO, Eoin Wallis, were two of many distinguished guests who planted 100 Crows Ash trees on BSES land at Bundaberg for a special tree planting day in late September.

The planting day was part of an ongoing revegetation project that has received support from BSES, Bundaberg Landcare, Envirofund and Bundaberg City Council.

After the tree planting, Eoin Wallis highlighted ways in which the sugar industry is embracing environmental sustainability, and encouraged landholders to maintain native vegetation on land unsuitable for agriculture.

Above: Higher recommended rates had to be used here to control large grass

Below: Hymenachne invading a Tully cane field

Herbicide application

Choosing the right herbicide is only half the battle. The chemical has to be applied in the right dose, at the right time and in the right way if it is to be effective - that means ensuring your spray gear is set up properly. If the herbicide you apply fails to work properly, you should immediately check on the spray equipment and your application methods. The correct droplet size and distribution will provide a high level of coverage of the target, resulting in effective weed control and minimal product wastage.

Incorrect calibration - You should calibrate your spray equipment regularly to prevent underdosing or overdosing of a product, and to ensure that the nozzles are providing a uniform spray across the boom. It is also important to check that the water rate applied is correct for the product being used.

Inadequate agitation - If there is insufficient agitation of the spray tank, the product can settle and this results in either overdosing or underdosing. As a general rule, a minimum of 5 L/min agitation is required per 100 L of water.

Failure to use wetting agent - The addition of a non-ionic wetting agent is important to improve the ability of a spray mixture to spread on the leaf surface. Always use a wetting agent in post-emergent herbicides unless otherwise specified on the label.

Spraying with high pressure - Using excessive spray pressure can cause the droplets to bounce off the target, resulting in poor weed control and possible drift. Generally, use 200 kPa for tapered fan jets and 120 kPa for flood jets.

Water quality - The quality of water available on farms is often highly variable and water from some sources can cause important application problems. The use of hard or dirty water can cause chemical tie-up or breakdown. The product's label will specify if water quality will affect its efficacy.

Pre-emergents and high organic matter soils - Chemical tie-up can occur in areas of high organic matter (such as from mill mud or ash applications) where the chemical is adsorbed by the organic matter.

Spraying plants covered in dust - Avoid spraying if a fine film of dust covers plant foliage - the dust will prevent the chemical reaching the plant tissue. Tie-up on dust of some post-emergent products, such as paraquat, can result in poor or patchy weed control.

Monitoring and records

Read the product label and follow the suggestions in this article, and you should get the spray result you're after. Record keeping is also an essential part of pesticide application. Record keeping doesn't take long, and it is a very useful reference on what you did right - and can help you isolate causes of problems if things go wrong. Spray records should include details on the calibration, application procedures, location and environmental conditions. To check that a successful spray job occurred, monitor the field after application and record the results.

If you have any questions about how to achieve the best result and value from your herbicides, contact your nearest BSES or Mark Poggio on telephone 0427 771 845.

Towards better, safer pest and weed management

> Mark Poggio

BSES Limited actively undertakes both field and laboratory research components of pesticide and herbicide registration applications for use in sugarcane crops. BSES also assists agribusiness companies to provide accurate data on products through various efficacy, phytotoxicity and residue trials. These trials are a critical source of quality data essential for registration of chemicals for control of pests and weeds within the sugar industry. They must pass the rigorous testing of the Australian Pesticides and Veterinary Medicines Authority (APVMA) – formerly known as the National Registration Authority (NRA).

Phytotoxicity trials

In most cases, herbicides allow for quick and easy control of weeds and are usually the most cost-effective method. However, the use of chemicals can be taken for granted, and in some cases may cause a detrimental effect on cane growth by either incorrect use of the herbicide or its use on a susceptible variety. Cane varieties have different degrees of tolerance to particular herbicides and care needs to be taken to select the correct herbicide and application rate to avoid crop damage during the different stages of growth.

To assess the effect of a particular herbicide on a variety, BSES undertakes phytotoxicity field trials or pot trials with various chemical treatments and varieties. In some cases BSES may also conduct phytotoxicity trials for commercial herbicide companies before a product is released into the market. Crop safety trials or phytotoxicity trials are established to specifically assess if the product causes any effect on crop yield or other measures of productivity. This enables BSES to advise on which varieties may be susceptible to a particular chemical.

Before applying herbicides, it is important to consider these factors:

- Evaluate variety **susceptibility** (refer to variety guide or consult your local extension officer);
- Use the **lower end of recommended rates** on susceptible varieties;
- Assess **crop growth stage** (actively growing cane may be more susceptible);
- Assess **soil type** (residual herbicides are more active in lighter soils at lower rates and potential damage is greater from herbicides leaching into the crop root zone);
- **Minimise drift** onto non target areas (use a directed spray where possible);
- **Select a product** that has minimal potential for causing crop damage;
- Take care with **aerial application** (avoid high rates of 2,4-D amine on susceptible varieties);

- **Timing** (early control of weeds will reduce the need for high rates of chemical).

Maintaining a weed-free fallow before planting, either through herbicide application, cultivation or planting of a cover crop, is critical in reducing the number of weed seeds present in the soil. This will also reduce the need for using herbicides later in the crop growth stages.

Efficacy trials

Field efficacy trials determine the usefulness of a product on a particular range of weed species, under various environmental conditions. Efficacy testing provides vital information about how the product performs under various conditions, including differing environmental conditions, soil types, application methods and rates, on different varieties and when tank-mixed with other products.

The data and information from these trials must be provided to the APVMA before a company can make any broad claims for use on the product label.

Residue trials

The APVMA requires results from field residue studies to determine the quantity of an agrichemical (or its metabolites) remaining on or in a crop when the proposed method of application is tested on a crop. The data collected from the residue trials are used in conjunction with other information to ensure that the Maximum Residue Limit (MRL) is not exceeded when the pesticide is used according to label recommendations.

The MRL is the maximum amount of residue of a pesticide legally permitted in or on the food or a feed commodity at a specified stage in harvesting, storage, transport, marketing or processing up to the point of consumption. Residue studies are an essential part of the product registration process and provide vital information for determining the safe use of a chemical when managing a particular pest population.

The process generally undertaken for registering a chemical for agricultural use in Australia is complex and expensive. Field trials are only one aspect of product registration and in addition there is an extensive amount of toxicological and environmental data collected to ensure a product is safe and effective before release into the general marketplace.

Development of a successful farm chemical from the initial product discovery phase to the commercial market release may require somewhere between 6 and 12 years of detailed study. Aside from the issues of time and cost, ultimately the quality of the field and laboratory analytical data will be critical to the success of registration applications.

Above: A ChemCert trainer talks to growers about chemical safety

"Chemical training is becoming an essential part of running a highly regarded agricultural business. The effective use of chemicals requires...knowledge and skill."

Above: Use of a directed spray in can to minimise drift

Above: Growers learning about risk management during a ChemCert course

ChemCert training

Chemical training is becoming an essential part of running a highly regarded agricultural business. Australia's reputation for safe, high-quality food and natural fibre is a fundamental part of our livelihood and relies on growers collectively taking a responsible attitude towards pesticide use and safety. The effective use of chemicals requires a substantial amount of knowledge and skill. Incorrect use of chemicals can be costly in terms of hazards to human and livestock health, effects on the environment and poor management of weeds.

It is also essential to keep up-to-date with the latest changes to regulation, application and personal protection technology and the various methods of pest management available. ChemCert is a practical chemical training course that can be undertaken by growers, managers and employees of a farming enterprise. It is a nationally recognised course endorsed by the National Farmers Federation and many other industry organisations. ChemCert training provides valuable information on:

- Personal protective equipment;
- Hazards and farm chemicals;
- Transport storage and handling;
- Risk management in the rural workplace;
- Legislative requirements;
- Relationship between NOEL, ADI, MRL, WHP and ESI;*
- Calibrating spray equipment;
- Record requirements;
- Managing the environment when applying chemicals;
- The label and Material Safety Data Sheets;
- Mix, fill and spray in the field;
- Effective use of spraying principles;
- Integrated pest management.

**NOEL: No Observed Effect Level; ADI: Acceptable Daily Intake (for humans); WHP: Withholding Period; MRL: Maximum Residue Limit; ESI: (Export Slaughter Interval)*

ChemCert accreditation remains valid for five years; indefinite accreditation is not offered because products and application methods are always changing and improving.

BSES now offers ChemCert training to growers throughout Queensland according to demand. If you are interested in attending a ChemCert accreditation course or would like to find out more information, please contact your nearest BSES ChemCert trainer:

Mark Poggio	07 4776 2500
Derrick Finlayson	07 4068 1488
Robert Sluggett	07 4956 2576

Farming systems update – Herbert

> Greg Shannon & Mark Poggio

The term "Farming Systems" can mean many things to many people. In the Herbert the term has come to mean a wide range of farming practices designed to meet several distinct outcomes, namely:

a) improvement in soil health

b) minimisation of cost of production

c) provision of environmental benefits.

The achievement of these outcomes makes the goal of maintaining sustainable agriculture more readily attainable, and in times of increased cost of production (eg fertiliser, fuel), any efforts to keep costs down are worthwhile.

There is no set recipe or strict guidelines that growers should use, rather they adopt a combination of options which suit their soils and climate, and which aid in effective time management. Some of the main components of a new farming system include reduced tillage, controlled traffic and crop rotations (eg. legumes).

Trials for adaptation of technology to achieve the above outcomes are not a recent development, and Herbert growers, like any primary producers, will adopt new techniques, technologies and ideas as the benefits are tested and proven. The adoption of green cane trash blanket (GCTB) in the 1980s is a glowing example of this willingness to adapt. In present times the adoption of new processes and changes to farming systems is looming as the next big challenge for growers. As far back as 1985, Herbert grower Roy Pace, began work on reducing cultivation and preserving "traffic and growing zones". BSES Limited staff, as part of general extension, and also the SYDJV have been involved in many trials and demonstrations which seek to test the benefits of changing the conventional farming system.

One of the most exciting developments is the use of pre-formed mounds, generally established in November/December and later planted with a legume crop grown over the wet season. At planting time a double-disc-opener cane planter is used to plant the crop.

Recently, the BSES Herbert staff established a farming system trial to demonstrate the benefits of the new system. The trial is situated near the BSES Herbert station and compares dual row at 1.8 m on pre-formed mounds and single row at 1.6 m on pre-formed mounds (both planted with a double-disc-opener planter) against conventionally planted cane at 1.56 m. All treatments were planted with a legume crop during fallow and later sprayed out in April. A further component of this demonstration trial is weed competition, where weed populations will be monitored to determine if there is a reduction in weed germination under the new farming system compared to conventional cultivation practices. Temperature probes have also been placed in each treatment to monitor soil temperature during the initial stages of the trial. This demonstration trial is part of a continuing farming system program established by BSES Herbert staff in recent years.

This demonstration trial will be used as a valuable extension tool for farm walks and will provide further trial data on yield, CCS and characteristics of the new farming system. In addition, double-disc-opener cane planters are now available at BSES Herbert for growers wishing to trial the new planting system. Please contact your local extension officer for more information on 07 4776 2500.

Northern growers point the way to sustainable, more profitable farm systems

> David Wallis

Research findings by BSES and the Sugar Yield Decline Joint Venture (SYDJV) have identified many practical ways for even very efficient farm operations to improve productivity and maintain long-term sustainability, with little outlay. One of the most important is improved fallow management practices - these include soybeans as a break crop and the adoption of controlled traffic zones. The Sugar Research and Development Corporation (SRDC) has funded a best management practice project to assist growers to realise the benefits of this research. BSES extension officer, David Wallis, reports on four real farm enterprises that have made small changes which have made big impacts.


Ken & Heather

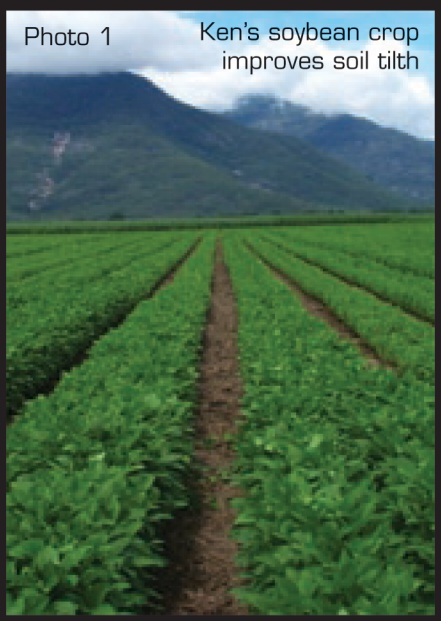


Photo 1 Ken's soybean crop improves soil tilth

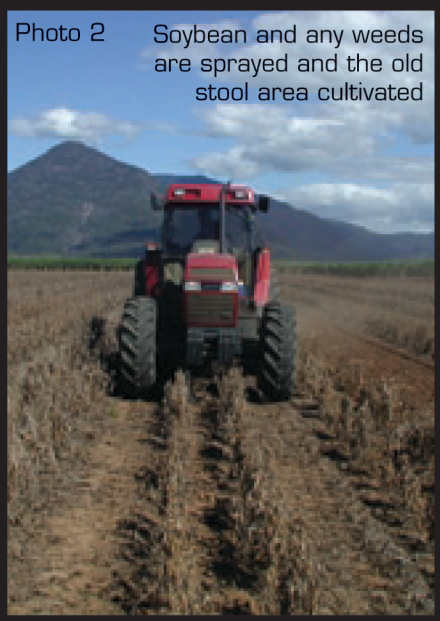


Photo 2 Soybean and any weeds are sprayed and the old stool area cultivated

Farm 1 - a custom tiller and soybean fallows make planting cheaper and quicker

Heather Johnson and Ken Clarke have successfully employed strategies to reduce costs and save time. Heather is a Mulgrave grower who has employed Ken for the past 25 years to manage her 100 hectare farm.

Over the last two seasons, Ken has developed a new farming system that has proved relatively easy and inexpensive to implement, and really does save time and money.

Ken's system works like this: a zonal tillage operation is carried out at the end of the season, when the previous stools are destroyed in a block to be fallowed.

To achieve this, the centre blades of the rotary hoe are removed and two stools at a time are destroyed. In the untouched inter-space, the remaining trash (the block is cut green) provides nutrients, erosion protection and weed suppression. From this point, the inter-space becomes a controlled traffic zone.

Ken then plants two rows of soybeans into the old stool area (*Photo 1*). Soybeans are sown using a HBM legume planter mounted on a tool bar, which directs seed behind a simple tine arrangement.

Grass control is achieved using an initial spray of a pre-emergent herbicide compatible with soybeans. Any volunteer cane in

Ken has built an implement to cut away dead soybean stubble, rip, throw the soil back and press

Photo 3

> *This is a good example of how sustainable and environmentally acceptable practices can be adopted to improve profitability.*

the soybean crop can be controlled by a grass-selective herbicide, such as Fusilade®.

Grass and vine are controlled in the inter-row while they are small plants using low rates of paraquat applied with a home-made hooded sprayer.

Once the soybeans have matured, everything (including any weeds) is sprayed and a strategic cultivation of the old stool area commences (*Photo 2*).

Ken has noticed that after a soybean crop the soil tilth improves and much less cultivation is required to prepare for planting compared with traditional methods.

Ken prepares the planting zone by performing a couple of passes with an implement he has developed over the past two years. This consists of a coulter with two small discs on either side to cut away the dead rows of soybean stubble.

Following directly behind the discs are three ripper legs in a triangular formation for deep cultivation of the old stool area. On the back of the implement are two gangs of ratooning discs, which throw soil back into the centre of the row. A hydraulically adjustable roller follows, which presses the cultivated strip. This also acts as a ground wheel to adjust the depth of cultivation (*Photo 3*).

These implement passes produce a slight mound to plant into. Ken has mounted a tine either side of the roller to leave a mark in the inter-space to guide the driver during planting (*Photo 4*).

On light soils, one or two passes are sufficient. On heavier clay soils, an extra cultivation or two is sometimes required. Ken remarks that this system not only saves time, but requires considerably less diesel than a conventional land preparation program. Ken now has time to contract out his cultivator, which brings welcome, extra income back to the farm.

By developing this innovative yet practical farm system, Ken has been able to achieve an excellent result. This is a good example of how sustainable and environmentally acceptable practices can be adopted to improve profitability.

Footnote: For many years Heather's late husband, Les, was a strong supporter of the BSES variety selection program - support which Heather continues to provide. Recently, Heather and Ken were recognised at the Mulgrave 2002 Productivity Awards for their outstanding contributions to the local industry.

Photo 4

One or two passes with Ken's cultivating implement is often enough on light soils

Farm 2 - a trash rake design that saves money and neighbourly goodwill

Due to increasing urban sprawl, many growers find their farming operations are coming under scrutiny by thousands of new neighbours moving into rural areas. In north Queensland, smoke from trash fires has become a major community issue resulting in many complaints to talk back radio and local newspapers.

Ken Hardwick and his son Doug farm 296 ha in Mulgrave, one-third of which is very close to the expanding township of Edmonton (15 km south of Cairns).

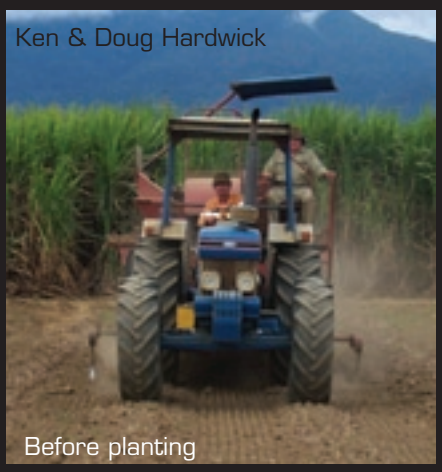
Their innovative approach to replanting without burning trash has led them to developing a front-mounted finger rake (*Photo 5*).

Known as the *Hardwick Eco Rake*, the implement rakes trash from the stool into the inter-space while a rear-mounted ripper/rotary hoe performs a zonal tillage operation. To achieve this, the centre blades of the rotary hoe are removed and two stools at a time are destroyed. From this point, the inter-space becomes a controlled traffic zone.

Strictly speaking, driving on the stool while cultivating is a compromise between the principles of controlled traffic and the need to save time and money. The number of passes required to achieve suitable planting tilth depends on conditions and soil type (*Photo 5*).

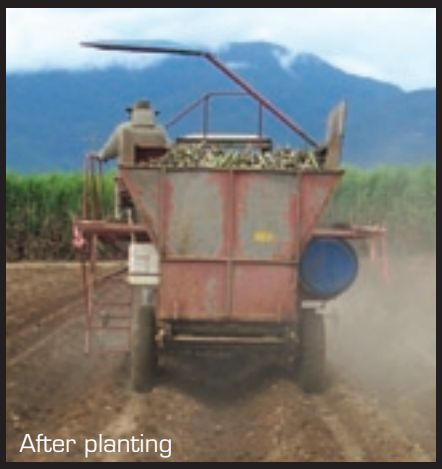
The trash remains in the inter-space where it is buried by the soil drilled out during the planting operation. Ken has modified the press wheel on the planter by attaching wings, which form the drill during the planting operation.

This modification (*Photo 6*) covers the trash, leaves the drill in a shape ready for spraying and saves Ken an extra pass later.



Ken & Doug Hardwick

Before planting



After planting

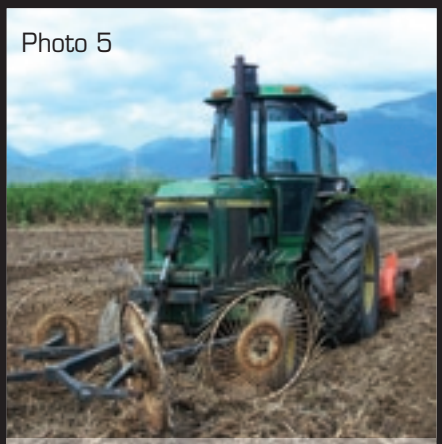


Photo 5

The Eco Rake moves trash to the interspace while a rotary hoe destroys two stools at a time

The trash in the inter-space is buried by soil during the planting operation

Photo 6

Once the trash is covered, it begins to decompose very quickly and presents few problems by the time hilling-up operations commence.

In fact, by this time the buried trash has decomposed into valuable nutrient-rich compost that would have otherwise been lost if the trash had been burnt. Weed control is achieved through the normal combination of herbicides and cutaway operations.

Ken boasts that the shortest period taken from harvest to plant is two hours. Ken also points out that the inter-space may be cultivated if necessary simply by driving in the inter-space, raking trash onto the stool and working the inter-space behind.

Some growers in very wet districts who may need to repair damaged inter-spaces could find this operation useful when it is not possible to burn trash.

Although their trash-conserving system gives Ken and Doug greater flexibility at replanting time, both agree that burning trash in a responsible and considerate manner remains a necessary management tool, particularly if major drainage and earth works are required or if row spacing is being changed.

The Hardwicks are so happy with their rake they have patented their idea. They are more than happy to sell the units, which can be fitted to all makes of tractor. Ken remarks that the cost is quickly recovered through significant savings in fuel and time.

Ken and Doug have proved to be innovative growers who have developed a system that has improved their profitability without compromising their good relations with neighbouring town folk.

Farm 3 - soybeans can not only improve soil, but save it!

The practice of spraying-out your old cane crop greatly reduces potential soil erosion from fallow land. Despite some media reports regarding damage to inshore reefs, some growers are significantly reducing the risk of erosion by direct drilling soybeans into a sprayed-out block.

As well as providing erosion protection, a good cover crop gives the soil a break from the cycle of pests and diseases, and can provide most or all of the nitrogen requirement for the subsequent plant crop. Direct seeding involves planting seed in a narrow slit opened by coulters through the trash (block is cut green) into the old stool area. This technique also saves time and fuel compared to conventional legume fallows.

Photo 7 shows how a relatively cheap modification by Mourilyan canegrower, Joseph Marano, has enabled him to achieve many of these benefits. Joseph mounted a legume planter on a disused fertiliser frame. After the cane was sprayed out, soybeans were directed behind coulters through the trash blanket either side of the stool.

Joseph achieved an excellent result. After the soybean crop has matured, a strategic tillage operation is conducted prior to planting, where further fuel and time savings are achieved.

Tom Watters from Mulgrave has made similar modifications that have also achieved successful results (*Photo 9*).

Photo 10 (next page) shows young soybeans emerging through the trash after the ratoon cane has been destroyed using herbicide. This technique is particularly useful on sloping ground where growers are sensibly reluctant to cultivate their paddocks prior to the wet season.

It was quite inexpensive for Joseph Marano to mount a legume planter on a disused fertiliser frame

Photo 7

Joseph's modifications helped achieve an excellent soybean crop

Photo 8

Tom Watters has made similar modifications to his machine, and has also received very good results

Photo 9

The increasing adoption of using soybeans as a fallow crop demonstrates sugarcane growers' genuine desire to conduct environmentally responsible management while improving productivity and profitability.

Tom Watters

Farm 4 - clever machinery modifications and soybean fallow combine to make dual-row planting work even better

A husband and wife team from Murray Upper near Tully has implemented the findings of current research into their farming system with great results.

Kathy and George Henry are growers relatively new to the sugar industry. In 1996, George was managing the local Grow Force branch when he and his wife Kathy purchased a new block of predominantly light forest soil.

After the initial headaches that come with starting from scratch, the Henrys implemented a farming system that enabled them to be independent and more efficient than conventional farm systems.

This is how their system works: after the plough-out round, the block to be fallowed is cultivated so that mounds (at a spacing of 1.8 m) can be formed prior to the wet season. The farm is light-textured forest soil, so this is usually the only cultivation made before planting starts in the following year. In some heavier clay blocks an extra cultivation prior to planting is required to ensure good soil tilth.

Three rows of soybeans are planted directly into the mound. When the soybean crop has matured the following year, weeds are controlled using herbicide.

At this point, George and Kathy form the planting team, cutting plants with a Toft 6500 and dual-row billet planting about 30 ha. The harvester produces an excellent billet because the rollers have been rubber-coated and all blades are kept sharp to produce a clean cut.

George plants directly into the mound through the soybean stubble. To do this, George has made several modifications to his planter. George has mounted coulters at a slight angle to open the drill just in front of each of the planter chutes. He has also removed the wings on the planter and lined the chutes with Teflon® to reduce soil build-up (*Photo 11*).

These simple modifications result in a minimum amount of soil being displaced by the planting operation. This means little soil movement is required later on, when normal row profile operations are being performed. Photo 15 shows soybean stubble prior to and after planting.

To assist in the maintenance of the mound profile, a pair of small discs is mounted either side of the chutes to return displaced soil to the mound. Another innovative idea George has adopted was mounting disused fertiliser augers close to the press wheels to reduce soil build-up in moist conditions. George says they were simple to make and achieve the desired result. The press wheel frames are weighted with lead blocks to apply the correct pressure to the setts (*Photo 13*).

Weeds in the plant cane are controlled using a directed knock-down herbicide combined with

Photo 10 Young soybeans emerging through the trash

George & Kathy Henry

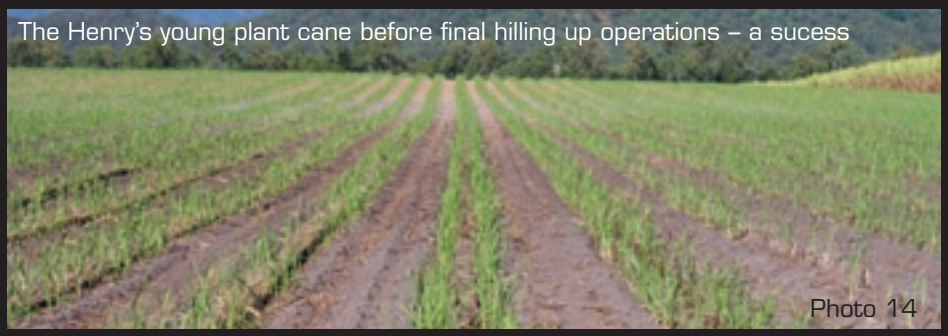
Photo 11

Soybean stubble prior to and after planting

Photo 12

Photo 13

Among George's modifications and disused fertiliser augers to keep the press wheels clean of the most soil



The Henry's young plant cane before final hilling up operations – a sucess

Photo 14

> *"Another innovative idea...was mounting disused fertiliser augers close to the press wheels to reduce soil build-up in moist conditions."*

a single pass of a set of boards that produce the final hill. At this point, all that remains to be done is top dressing and applying pre-emergent herbicide at the out of hand stage.

Fertiliser is applied subsurface, three rows at a time through coulters between each of the dual-rows. The same box is used in ratoons through a trash blanket.

Photo 14 shows young plant cane prior to final hilling up and top dress operations. Soybean stubble is evident; this will break down and supply valuable nitrogen to the plant crop.

George and Kathy have found that by planting in this way they can usually plant much earlier in the year because they don't lose time or valuable moisture due to unnecessary, expensive and time-consuming cultivations.

The Henrys believe that controlled trafficways, dual rows and the adoption of soybeans into their farming system has saved them considerable time and expense, and assisted them to remain sustainable into the future.

For more information about these achievable and affordable improvements, contact David Wallis on mobile 0407 968 572.

APPENDIX 21 - Klok JA and Di Bella LP. 2004. Findings from the harvester survey conducted in the Herbert region in 2003. BSES Project Report PR04003.

BSES Limited

FINDINGS FROM THE HARVESTER SURVEY CONDUCTED IN THE HERBERT REGION IN 2003

by

JA KLOK and LP DI BELLA

PR04003

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SUMMARY

This report presents the findings from a harvester operators' survey, conducted in the Herbert region in 2003. The survey comprised introductory questions regarding the group details, questions regarding machinery used, and questions on those parts of the milling and farming sectors that impact on harvesting and on future directions. 40 operators were surveyed.

Harvesting groups were mainly contractors (11) or grower contractors (27), with two single grower groups. The average tonnage cut last season was 44695 t (median 44500 t), with the largest being 84000 t and the smallest 20000 t. All groups surveyed used one harvester only. Harvesters used were generally 5-10 years old; haul units were 9 years old for tippers and 13 years old for movers.

Operators would like to see research on multiple-row harvesting (Two-in-One, double-row harvesting). The second most common response was in the cleaning of the machine. A list of other priorities was compiled.

1.0 INTRODUCTION

This report presents the findings from a harvester operators' survey, conducted in the Herbert region in 2003. The survey was carried out as an activity of the Harvesting R&D team and will be used as part of the milestone requirements for the SRDC-BSES funded project BSS260 'Enhanced delivery of PROSPER to achieve adoption of Best Management Practice [BMP] in the Queensland sugar industry'. That project aims to increase the profitability of growers, harvester operators and millers by increasing the adoption of BMP.

The survey was developed by the local harvesting research and development team, which has members from BSES, CSR Sugar, HCPSL, CANEGROWERS, QMCHA and local harvester operators. The survey was modelled on a similar survey in the Proserpine district.

The aims of the survey were to assess the local harvesting sector and compare current practices to BMP harvesting, to identify milling and farming practices that impact on harvesting, and to assess local research directions.

2.0 SURVEY DESIGN

The survey comprised three main sections. Firstly, there were introductory questions regarding the group details. The second section asked a series of questions regarding the main harvester that the group operates. The questions ran through the machine, taking details on the current set up of the machine and any modifications. The sections of the harvester include: topper, fronts, roller train, primary extractor, basecutter, chopper, elevator and instruments. The second section also collected information on the haulout equipment that the group uses and the time each piece of equipment is used. The final section was a series of questions on those parts of the milling and farming sectors that impact on harvesting and also on future directions.

The survey was delivered in a one-on-one basis, with BSES extension staff visiting harvester operators and going through the survey. Biometricians recommended a population of 30-40% be surveyed for meaningful results, with representative numbers from each geographical location. The Herbert region was divided into five geographical areas and harvester operators selected randomly within each area.

Questions were structured to facilitate the collection of data and asked in an open manner. For example, 'are you satisfied with …?'. The survey was optional, allowing the operator to refrain from answering questions if they felt uncomfortable.

Difficulties with questions relating to the value of equipment were experienced during interviews, as many operators were not aware of the value of their machinery, or because the value varies due to the economic climate. The responses to these questions are, therefore, less accurate and reflect operators' own estimates.

3.0 SURVEY SAMPLE

Survey samples were obtained from 40 operators out of a total of 103. The Herbert region was divided into geographical locations of Abergowrie, Ingham Line, Stone River, Macknade and Victoria, and the operators sorted into the regions. 22% of the total population of operators were in each of the Abergowrie, Ingham Line, Macknade and Victoria regions, with the remaining 12% from Stone River. To sample a total of 40 operators, we randomly selected 9 from Abergowrie, Ingham Line and Macknade, 10 from Victoria, and the remaining 3 from Stone River.

Interviewers obtained information regarding the location of operators on survey days from the Operations Centre at Victoria Mill. Information provided gave the siding location and UHF channel. Interviewers introduced themselves and gave a brief background of the survey and why we were gathering the information. It was explained that the survey was random and voluntary. There were no refusals.

Survey data were analysed using Microsoft Access®.

4.0 SURVEY RESULTS

4.1 Group details

Harvesting groups were mainly contractors (11) or grower contractors (27), with two single grower groups. The average tonnage cut last season was 44695 t (median 44500 t), with the largest being 84000 t and the smallest 20000 t. All groups surveyed used one harvester only.

4.2 Harvester details

The main make of harvester was Toft, with 65% of surveyed machines being made by Toft. Cameco made up the remaining 35% of the fleet. Over 82% of the fleet was made in the years 1994 to 1998, with the most common years being 1995 and 1997 for both makes of harvester. The Toft harvesters had an average of 7590 engine hours, with the Cameco machines having 6830 engine hours. These figures reflect the age of the machines.

The market value of Toft harvesters ranged from $180000 to $30000; the range for Cameco harvesters was similar at $180000 to $70000. A large range of external factors affects the value of the machines.

Of the 40 machines surveyed, 10 had the roller train optimised. Three of these had been done by Matt James (BSES), one machine came optimised (2003 Cameco), and six had been done locally.

Average fan speed for the 2002 season was 1100 rpm, with a range of 800-1500 rpm. Average fan speed for the 2003 season was also 1100 rpm, with the same range. Four machines increased their fan speeds from 2002 to 2003 and five machines reduced their fan speeds from 2002 to 2003. The common reason for these changes was the change in the

crop size; operators of machines operating in the low yielding areas of the district decreased fan speed and those in high-yieiding areas increased fan speed.

4.3 Haulout details

The 40 groups had a total of 114 haulout units. All groups used at least two haulouts, and a third was used 27% of the time (range from 100-5%). The most common haulout unit was an elevator tipper towed by a tractor. There were 107 tractors, 4 powerhauls and 3 trucks used for hauling. Attached to these were 88 elevator tippers, 22 roll-on-roll off units and 4 side tippers. The average value of movers was $35000 and the average value of the tipper units was $40000.

The average age of haul units was 9 years (1994) for tippers and 13 years for movers (1990). The range of years of manufacture was similar for both types of equipment, 1973 to 2002.

4.4 Issues in the harvesting and transport area

There was a series of eight questions asking if the operator was satisfied with the harvesting and transport area. These were 'yes/no' questions with a space for comments. Each question's response is broken down into the harvest areas. Responses are summarised in Table 1.

Table 1 Summary of responses to questions regarding issues in the harvesting and transport areas. Numbers represent the number of operators (out of 40) NOT satisfied

Question	Abergowrie	Ingham Line	Macknade	Stone River	Victoria	Total
Timing	8	5	6	2	7	28
Shunting	5	4	6	0	6	21
Access	2	3	2	1	1	9
Location	2	1	2	2	4	11
Capacity	8	3	8	1	6	26
Overflow	4	2	5	2	5	18
Overflow access	2	1	3	1	4	11
Communication	2	0	3	1	2	8

Timing of bin deliveries
The most common response was that deliveries are too late and inconsistent.

Shunting procedures
The most common comment was that there was a lack of consistency in procedures and an industry protocol needs to be drawn up for all loco drivers.

Siding access
Responses included slope of siding, width and large shared sidings.

Siding location
Similar issues to access.

Siding capacity
The most common response was that sidings were too small.

Overflow bin arrangements
This did not apply to all operators; where this did apply, questions were raised about the extra cost to harvesters and who should compensate for this.

Access to overflow
The most common response was that there should not have to be overflow arrangements if siding capacity was increased. Similar issues to siding access.

Communications
The most common response was that there seemed to be no consistent answers from the traffic office. Another common comment was that things were getting better.

4.5 Issues in the farming area

This section was a series of seven questions related to farming and how this affected the harvesting operation. These were 'yes/no' questions with a space for comments. Each questions response is broken down into different farming areas. Responses are summarised in Table 2.

Table 2 Summary of responses to questions regarding issues in the farming area. Numbers represent the number of operators (out of 40) NOT satisfied with farming issues

Question	Abergowrie	Ingham Line	Macknade	Stone River	Victoria	Total
Row profiles	4	2	4	1	4	15
Row width	1	3	2	0	4	10
Row length	4	2	6	1	4	17
Headlands	5	4	7	1	6	23
Rock removal	4	7	7	1	6	22
Cross drains	4	2	6	2	6	20
Layout	1	2	6	0	2	6

Row profile
Problems for harvesting are uneven row profiles, lack of filling in and inconsistency between growers and blocks.

Row width
The main problem is consistency.

Row length
Short rows are a problem, especially point rows.

Headland width
Most operators would like to see wider headlands and smoother headlands.

Rock removal
There were a number without rock problems, but those with rocks find that they have to increase their basecutter height to avoid rocks – this then becomes a problem when attempting to avoid leaving stubble after harvesting.

Cross drains
Those operators with cross drains would like to see them wider and flatter.

Layout
The most common response was that growers could join some blocks together, or change the direction of some blocks to join them together. The farm layout must suit harvesting.

4.6 Future research directions

The main direction of research that operators would like to see was multiple-row harvesting (Two-in-One, double-row harvesting). 20 of the 40 operators responded with this answer. The most respondents came from the Ingham Line area (7).

The second most common response was in the cleaning of the machine. Seven operators would like to see research in this area, mainly from the Ingham Line area (3).

The following is a list of topics where operators wanted to see research. The number in brackets is the number of operators who noted this answer.

Abergowrie
Two-in-One (3)
Rubber tracks
Row lengths
Geographic harvesting
Cleaning
Basecutter height sensor
Elevator capacity
Economics of double-row harvesting
Carrying capacity of harvester

Ingham Line
Two-in-One (7)
Cleaning (3)
Varieties
Trash placement of Two-in-One
Chopper system
Vortex fan

Macknade
Two-in-One (4)
BSES fronts (2)
Optimisation
Feeding
Row profile
Cost of cutting per tonne
Basecutter height sensor
Hourly rates for harvesting
Group size
Cleaning
Billet length
Match farm to harvesting
Other method of chopping (laser?)

Stone River
Two-in-One (2)
Cleaning (2)
Extractor loss

Victoria
Two-in-One, harvest more than one row at a time (4)
Costs (2)
BSES fronts (2)
Engine capacity (2)
Varieties
Increased efficiency
Value adding to cane
Increase trash breakdown

5.0 CONCLUSIONS

This information will be useful as baseline information for the Herbert River sugar industry to establish ‘best management practices’ and to assess industry position.

A subsequent survey should be undertaken in a few years to assess change and adoption of new technologies. The two surveys could be compared to assess adoption and implementation of ‘best management practices’ for the harvesting sector in the Herbert River District.