BSES Limited

FINAL REPORT – SRDC PROJECT BSS264

ADOPTION OF AN OPTIMAL SEASON LENGTH FOR INCREASED INDUSTRY PROFITABILITY

by

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SD08001

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CONTENTS

SUMMARY

The project aimed to maximise commercial cane sugar (CCS), sugar yields (TSPH) and industry profitability in the Herbert region by exploiting regional variation in CCS, soil moisture and trafficability. There is significant potential to increase total sugar production, and individual grower and district CCS through better management of harvesting scheduling.

A collaborative partnership developed among BSES Limited, CANEGROWERS Herbert River, QMCHA, CSR Sugar, and other research and extension organisations to investigate opportunities to improve monetary returns from the harvested crop. A consultative group was established to guide the research and implementation of the outcomes of the project; this group contained representatives from BSES, CANEGROWERS Herbert River, QMCHA, CSR Sugar, HCPSL and CSIRO Sustainable Ecosystems.

The project developed information packages and tools to assist with the decision-making process on when to harvest particular blocks on farms, optimum season start and finish times for different areas, and opportunities manage cane to maximise CCS, particularly for early harvest.

The project delivered the following outcomes:

- Provision of data for the Herbert on the CCS and yield consequences of different harvesting times;
- Variety by agronomic management combinations for cane harvested to maximize whole-of-industry profitability;
- Variety by ratooning performance for both early and late harvest;
- CCS profiles for different variety by management by harvest time combinations;
- Commercial registration of a crop ripener (MODDUS®) for the Australian sugar industry;
- Risk-management plans for each Herbert subregion, combining seasonal climate forecasts, CCS profiles, soil trafficability and ratooning data, transport infrastructure and crop size;
- An integrated model that provides an indication of probability of wet field conditions disrupting harvesting;
- An economic model incorporating different season start and finish times that produces cost-benefit analyses for all sectors of the sugar-industry value chain and local community;
- Opportunities to provide a supply of fuel for cogeneration, if investment in cogeneration infrastructure occurs.

The project has failed to make significant alterations to season length, because at present it is difficult to engage the growing sector in seeking any significant extension of the harvest season. The rationale behind this issue is the perceived risk and lack of financial benefits to obtain increased monetary returns from the crop harvested under current cane-pricing arrangements. Surveys conducted throughout the project highlighted that growers would consider season length extension only if there were opportunities to increase monetary returns from value-adding opportunities. In the future, consideration on how to

engage grower involvement will be essential when seeking opportunities to increase season length and value-adding opportunities.

When the project commenced, CSR were investigating the profitability of a cogeneration plant at Victoria Mill, which would require a continuous supply of cane over a longer season length. The CSR Board have decided not to proceed with this project, but it might be reconsidered under different economic conditions.

A significant outcome from the project is the strong support in the Herbert for the development of harvesting and processing plans to seek to maximise CCS across the region. This will be achieved through grouping of farms together in harvesting groups to exploit climatic and soil variations across the district, within existing season lengths. This concept is now part of SRDC project CGH002 Enhancing Efficiency and Integration from Field to Factory in the Herbert.

The opportunity of getting industry stakeholders to discuss, work together and develop management strategies for future directions and needs for the industry has been a significant outcome of this project. The project has provided industry stakeholders an opportunity to understand better supply-chain issues and to seek to investigate further opportunities to increase monetary returns.

1.0 BACKGROUND

The project aimed to maximise CCS, sugar yields and industry profitability in the Herbert region by exploiting regional variation in CCS, soil moisture and trafficability. There is significant potential to increase total sugar production, and individual grower and district CCS through better management of harvesting scheduling.

The project sought to provide information and tools to assist decision-making on when to harvest particular blocks on farms, optimum season start and finish times for different areas, and how to manage cane to maximise CCS, particularly for early harvest.

At the commencement of the project, CSR was investigating the profitability of a cogeneration plant at Victoria Mill. This would require a continuous supply of cane over a longer season length to ensure its viability.

2.0 OBJECTIVES

The project sought to increase Herbert industry profitability by 5% by optimising the season length and exploiting geographical variations in CCS and climatic conditions.

The project consisted of seven components:

- Develop management strategies for early harvested cane;
- Assess ratooning ability of varieties under early and late harvesting;
- Promote the adoption of optimal season length by developing an economic model able to assess optimal season start and finish times, cane payment options and cost-benefit analyses for all industry sectors;
- Develop an integrated model incorporating seasonal climate data, climate forecasts and soil data to assess soil moisture and trafficability;
- Optimise harvest schedules to improve industry profitability, across the value chain;
- Establish a consultative group to develop a regional action and implementation plan for an extended harvesting season;
- Facilitate whole-of-system change using participatory research approach to achieve adoption of these plans and their support across the value chain.

A consultative group was established to guide the research and implementation of the outcomes of the project. The group consisted of representatives from BSES, CANEGROWERS Herbert River, QMCHA, CSR Sugar, HCPSL, and CSIRO Sustainable Ecosystems. Other industry stakeholders and service providers (such as Syngenta Crop Protection) were involved with the project through various activities planned throughout the project.

Linkages were established with the following projects:

- CGH002 - Enhancing efficiency and integration from field to factory in the Herbert;
- CSE005 - Integrating and optimising farm-to-mill decisions to maximise industry profitability;
- HGP007 - Siding roster optimisation in the Herbert.

Models were developed by the following parties:

- Economic model - CANEGROWERS Herbert River and CSR Sugar;
- Harvest scheduling and transport capacity planning- CANEGROWERS Herbert River, CSR Sugar, CSIRO Sustainable Ecosystems;
- Integrated climate-forecasting and rain-risk model - CSIRO Sustainable Ecosystems;
- SugarMax model - CSIRO Sustainable Ecosystems, with assistance from BSES and HCPSL;
- Cane-ripener (MODDUS®) use model – Syngenta Crop protection and BSES.

Field experimentation was conducted by BSES.

The project had two components that required field experimentation and research:

- Developing management strategies for early harvested cane, such as selection of high-early CCS varieties, crop age, nutrient management and use of chemical ripeners;
- Assessing the ratooning ability of different varieties under both early and late harvesting.

A combination of small plot and strip trials was conducted to investigate the interactions among varieties and crop age, fertilizer management and chemical ripeners. Trials were established to investigate variety by time of harvest and possible interactions. The data obtained were combined with existing data sets to construct models for assessing optimal season lengths. The field data built on previous work conducted by CRC Sugar (sub-programs 3.1and 3.2) and by Yvette Everingham in the climate-forecasting project.

Information from the project was extended to the industry through electronic media, publications, meetings and workshops (Appendices give copies of publications and a report from the workshop conducted).

3.0 DATA REVIEW

3.1 Historical productivity data

We reviewed historical data to investigate sub-district and productivity zones for variations in CCS, cane yield and sugar yield across the region. The review also provided a better understanding of CCS trends across the region over a number of different harvest seasons. Figure 1 shows the productivity zones within the Herbert region that were used to analyse the historical trends.

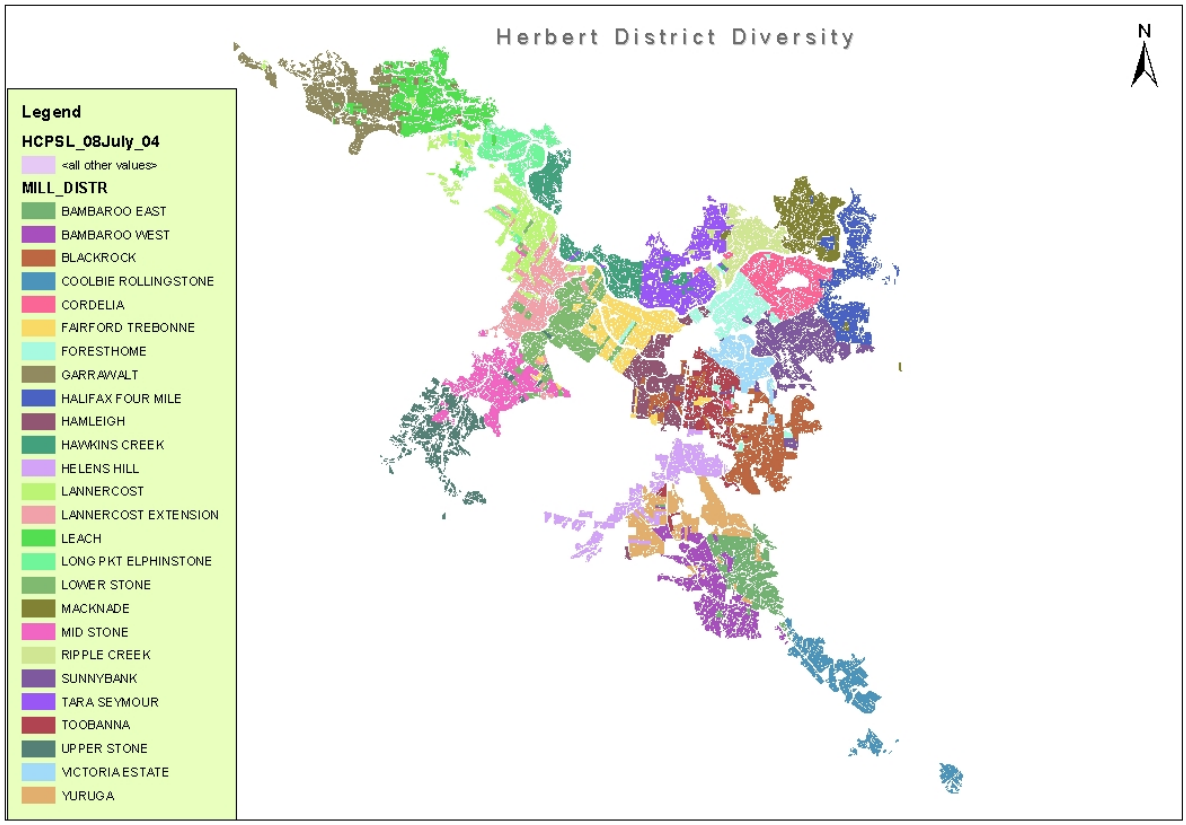


Figure 1 Productivity zones within the Herbert region. (map supplied by HCPSL)

The data indicated that there were significant variations in CCS across the region and throughout the harvest season (Figures 2-3) to consider alternative harvesting and crop management. The areas south and west are usually lower rainfall areas and have higher CCS levels when compared to the rest of the district. To maximise CCS, sugar yields and industry profitability by exploiting regional variation in CCS, soil moisture and trafficability is critical.

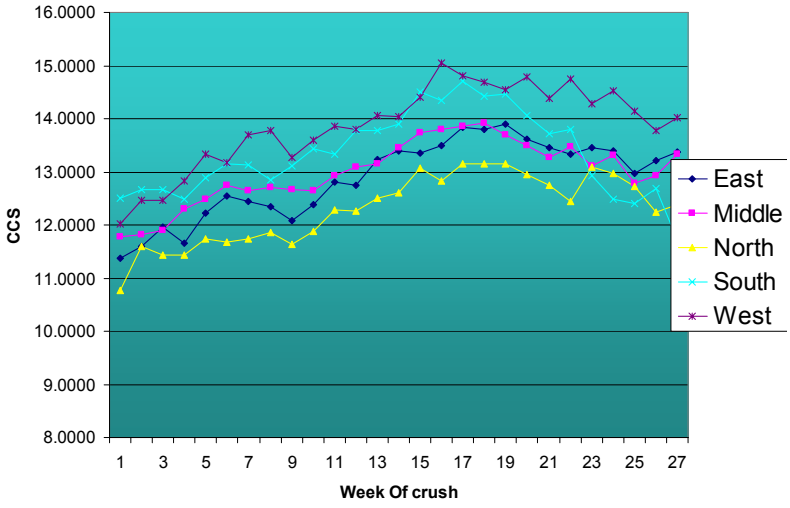


Figure 2 District weekly CCS levels for 2005 (data supplied by HCPSL)

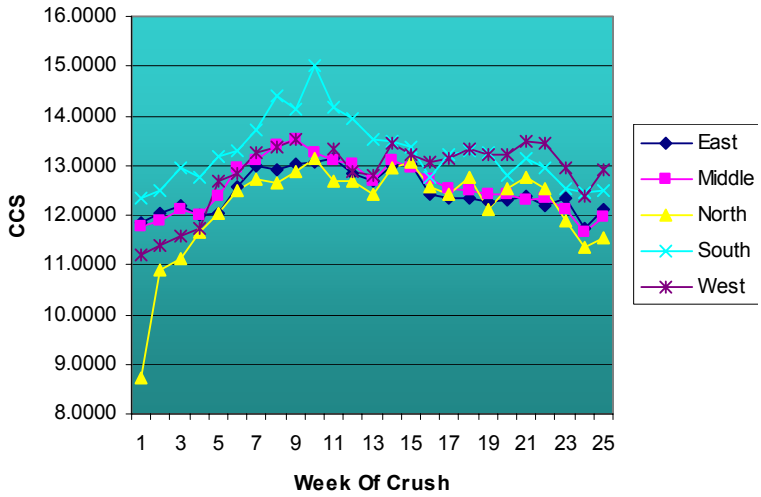


Figure 3 District weekly CCS levels for 2006 (data supplied by HCPSL)

Further analysis of historical data for individual productivity zones was undertaken to investigate sub-district differences for CCS, cane yield and sugar yield. There were significant differences across subdistricts. Figures 4 and 5 highlight the significant differences between Bambaroo West (located in the southern area) and Garrawalt (in the northern area) for 2003- 2003 for first-fourth-ratoon crops. Such differences were typically found in comparisons of other subdistricts.

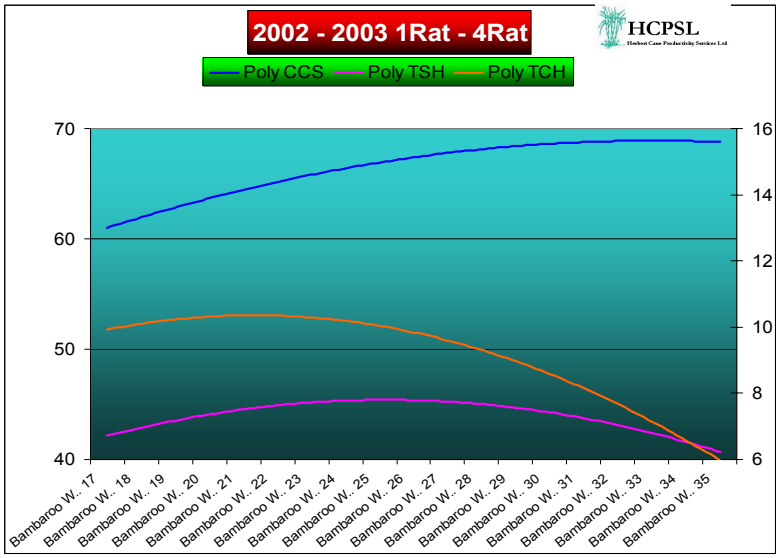


Figure 4 **2002-2003 first-fourth ratoon CCS, cane yield (TCH) and sugar yield (TSH) levels for Bambaroo West for mill standard weeks (data supplied by HCPSL)**

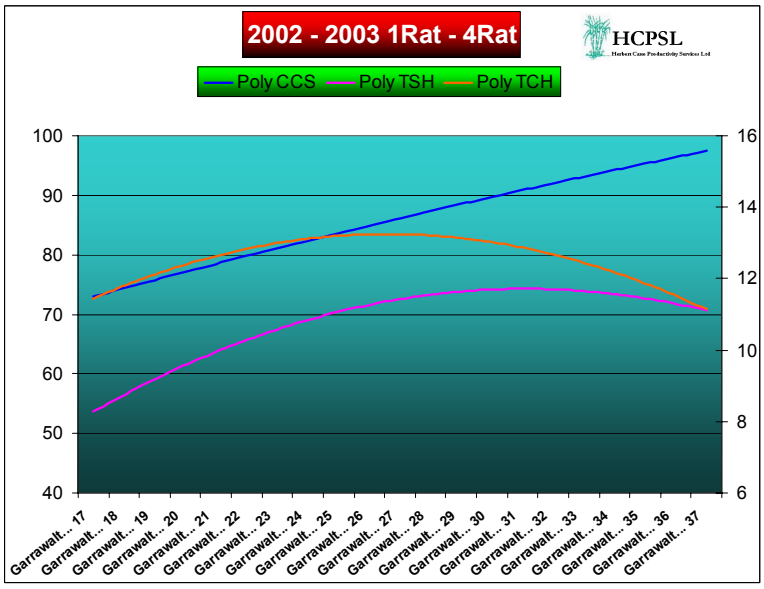


Figure 5 **2002-2003 first-fourth ratoon CCS, cane yield (TCH) and sugar yield (TSH) levels for Garrawalt for mill standard weeks (data supplied by HCPSL)**

Due to significant climatic, cane yield and sugar yield differences across the Herbert, the industry working-group requested modelling work to be undertaken by CSIRO Sustainable Ecosystems to look at opportunities to further exploit these differences.

3.2 Pre-season CCS data

At the commencement of the project, there was very little information available on early CCS trends for periods outside the normal harvest window. This information is important to understand the rates of CCS rise early in the harvest season for modelling purposes, and if the season length was to be extended forward.

To obtain relevant information on early CCS trends, it was decided to establish a series of monitoring sites based on harvesting group throughout the district. Growers within seven harvesting groups (Figure 6) were selected as CCS-monitoring sites for the purpose of this activity.

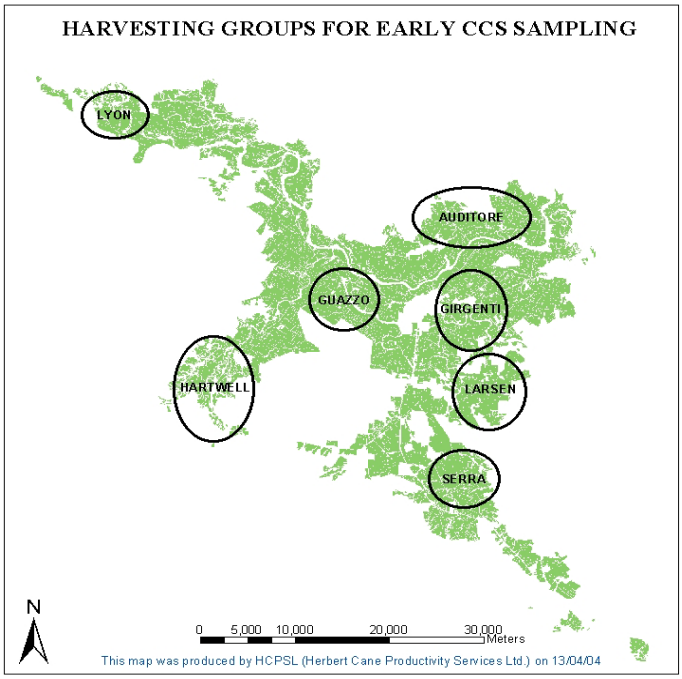


Figure 6 Location of harvesting groups acting as monitoring sites

Growers in each of these groups were asked to nominate a block that they planned to harvest in the first 6 weeks of the season. The growers agreed to assist with early CCS monitoring by taking their own CCS samples. Each grower was provided with a set of sampling instructions, to ensure that all samples were taken in the same way. Growers delivered the samples to a central location for collection and processing by BSES.

The samples were taken on 10-12 May and 6-7 June for each year (2004-06). The second sampling coincided with the early start of the cane-harvesting season in the Herbert. Because the program was run over 3 years, different climatic and rainfall variations occurred. More than 120 CCS samples were collected at each sampling time.

This activity was well supported by growers, and participation levels were very high for each harvesting group. Each year, all participating growers received a report on their individual CCS, had their CCS compared with other members of the harvesting group,

and their CCS compared to the other sampling groups. The growers involved in the trials commented that the sampling allowed them to identify high-early-CCS varieties and high-CCS blocks, and made them reconsider early harvest-management techniques within their own farms and in some cases within their own harvesting group.

The trial results showed an average increase in CCS of 0.35 units (with an average CCS range of 0.34-0.43 units over the 3 years) per week from May-June. There was no significant difference amongst groups in the average CCS increase per week. However, there was a significant difference in the average CCS levels among harvesting groups. The Lyon harvesting group had the lowest average CCS, reflecting the historical data trends for the region.

3.3 Rainfall probability and risk

Research conducted by Muchow and Wood (1996) indicated that knowledge of the probability of wet weather disrupting mechanical harvesting operations can assist in decision-making on scheduling the harvest of sugarcane. Based on these research findings, the working team engaged CSIRO Sustainable Ecosystems staff to undertake research on rainfall risk and probability.

The RAINRISK database software was applied to assess the probability of wet weather leading up to (and during) an early season start across the major areas of the Herbert region. RAINRISK firstly needed to be updated with the latest historical rainfall data for 13 weather station locations in Herbert region. The analysis was focused on six major areas in the Herbert region - Halifax, Upper Stone, Mutarnee, Long Pocket/Abergowrie, Ingham, Bambaroo. This allowed modelling of the risk of rainfall for an early season start (or a late-season finish) using historical data to calculate 60%, 70% and 80% cumulative probabilities for May-July (Figure 7) and October-December (Figure 8). They show that the Mutarnee and Bambaroo areas are not only suited to an early start (compared to the rest of the district), but that they should finish earlier than the rest of the district. Upper Stone is also suited to an earlier start, but has a low wet-weather risk of finishing late.

The second major analysis on rainfall risk is associated with the CCS trends. The impacts of El Nino versus La Nina years on the CCS trends throughout the harvest season were assessed. A hypothesis would be that an early start in a wet year would reduce the impacts of a large CCS drop-off in the second half of the harvest season. An earlier start in a dry year would increase the duration of low CCS in the beginning of the year and reduce the duration of high CCS at the end of the year. The analysis for El Nino versus La Nina was conducted using 17 years of data 1990-2006.

For all El Nina years, the harvest season ended with a rising or plateau CCS (Figure 9), whereas the wet years were different (particularly 1998). This effect is much less visually pronounced compared to the Tully region. There were several “unknown” (neither La Nina nor El Nino) years, which tended to have slight drop-offs in CCS towards the end of the harvest season. The results show that the phase of the SOI is an important criterion, along with rainfall risk, for determining the start time of a harvest season.

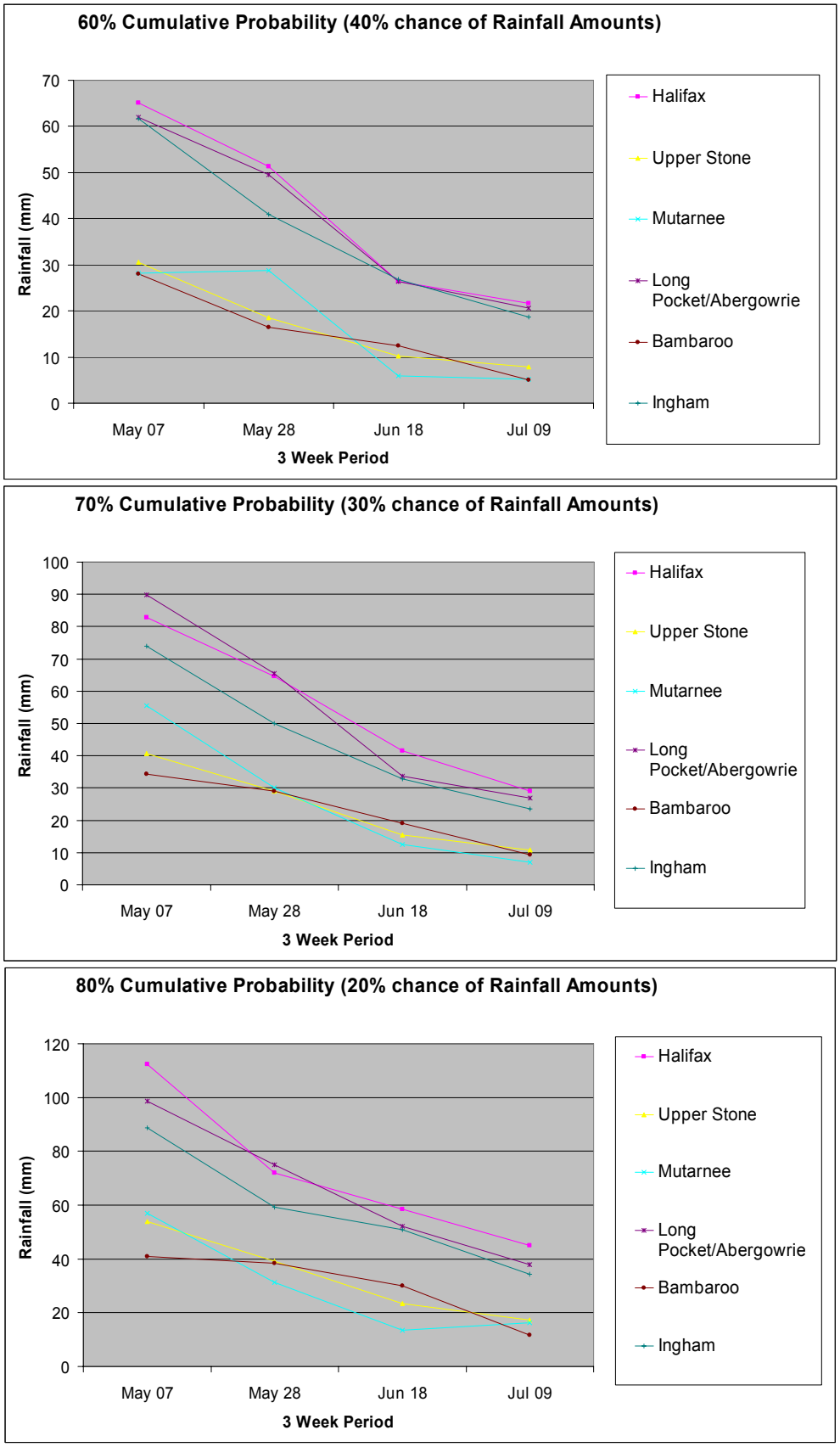


Figure 7 **60, 70 and 80% cumulative probability of rainfall early in the harvesting season**

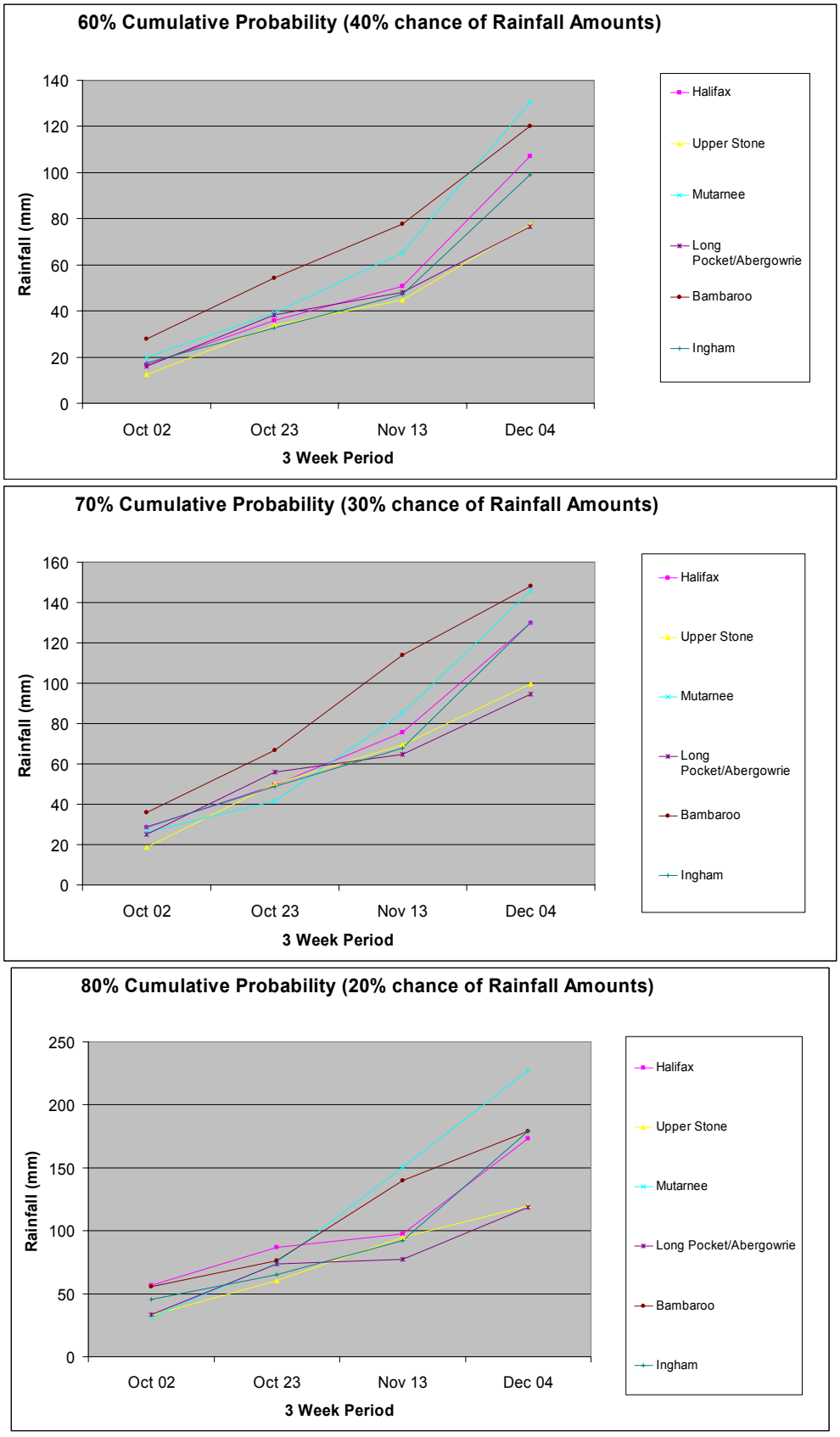


Figure 8 **60, 70 and 80% cumulative probability of rainfall late in the harvesting season**

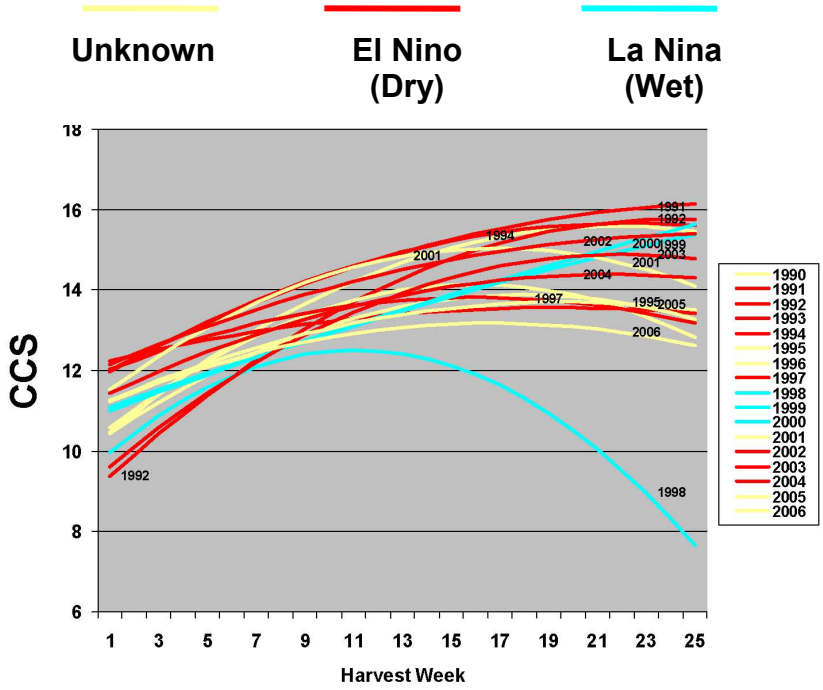


Figure 9 Mill CCS trends during El Nino and La Nina years

4.0 OPTIMISATION MODELLING

4.1 Harvest-schedule optimisation - SugarMax

For a given harvest season start date, or staggered start dates for various areas within the Herbert, harvest schedule optimisation offers an opportunity to best-manage the harvest dates of the different farms and varieties involved. As a result, the harvest-scheduling model SugarMax was adapted to the Herbert. In the first instance, SugarMax was adapted using the 2002-2004 historical block productivity data. It was used to optimise schedules exploiting geographical differences in CCS, which will highlight areas of the Herbert more suited to starting early and areas more suited to finishing later. Figure 10 shows the areas that should be predominately harvested at different stages of the harvest season. The legend (1-6) represents the six time periods of a harvest season. For a harvest season-length scenario, the results behind Figure 10 indicate farms more suited to starting earlier from a CCS perspective. These results can be transformed into dollar benefits for the growers and can be used as an additional incentive to encourage participation in the staggered season start time across the mills in the Herbert (noting that Victoria has two milling trains).

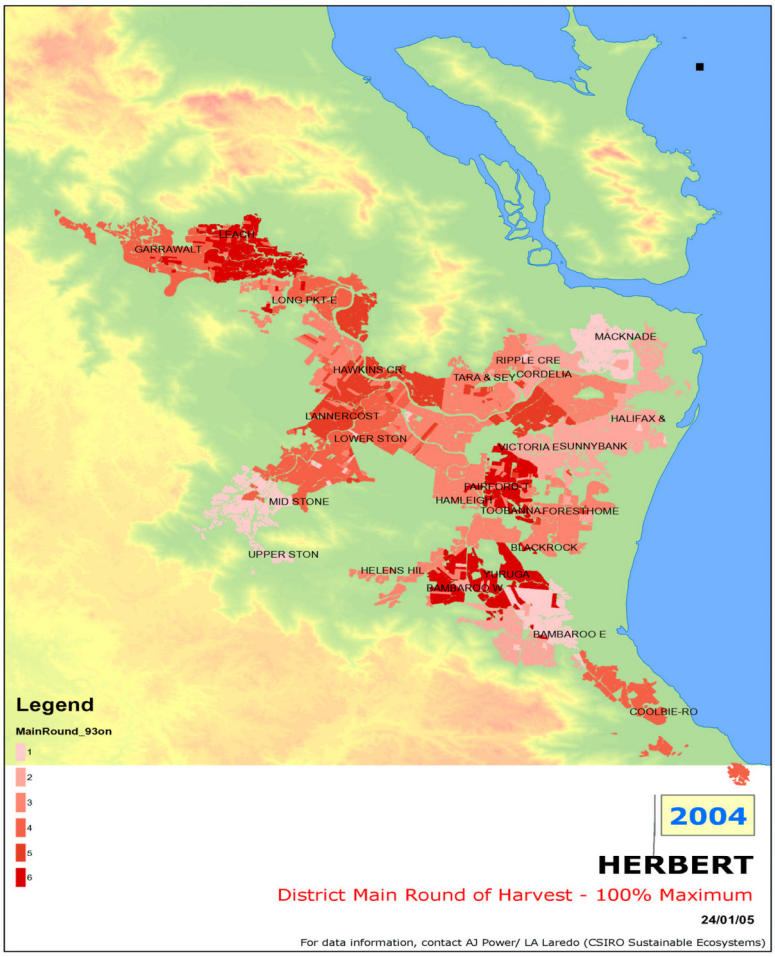


Figure 10 Times period most suited for harvesting the cane land; darker colours are closer to the end of the harvest season

SugarMax can also be taken a step further to provide schedules and assistance at a grower and harvesting group. Table 1 show the various applications of SugarMax to optimise under different harvest-season start-time options.

Table 1 Applications of SugarMax

Farms within Groups	Management groups – share profits across farms
Varieties within Farms	Best time to harvest mix of varieties on-farm
Varieties within Districts	District variety harvesting guidelines
Soil-types within Districts	Wet/dry soil types - harvesting trafficability
Classes within Farms	Ratoon follow-on year effects model (Burdekin)
Districts within Region	Early-start districts – early-start varieties

A description of the first SugarMax application of Table 1 is contained in Figure 11 using a hypothetical five-farm example.

Current Harvesting Practice – Equity for each Farm

- Farms currently harvest across the season using Equity
- Equity = harvest same % tonnes from each Farm for each harvesting Round

Round	1	2	3	4	5	6
Farm A	10%	20%	20%	20%	20%	10%
Farm B	10%	20%	20%	20%	20%	10%
Farm C	10%	20%	20%	20%	20%	10%
Farm D	10%	20%	20%	20%	20%	10%
Farm E	10%	20%	20%	20%	20%	10%

SugarMax - Harvesting with Equity over whole Harvesting Group

- Maintain Equity for the whole Harvesting Group
- Re-organise % tonnes taken from each Farm in Group for each Round
- Schedule harvesting to take advantage of CCS (and TCH) trends for Farms

Round	1	2	3	4	5	6
Farm A	5%	5%	10%	20%	30%	30%
Farm B		30%	30%	30%	10%	
Farm C	50%	30%	20%			
Farm D				40%	30%	30%
Farm E	10%	35%	25%		15%	10%
Group	10%	20%	20%	20%	20%	10%

Figure 11 Example of SugarMax for scheduling farms within harvesting groups

The second application of SugarMax involves optimally scheduling different varieties on the farm using the district level CCS trends by variety. CCS trends of eight major varieties are shown in Figure 12 - Q158 is a late-maturing CCS variety and Q186(ϕ) is a more early maturing variety. This effect is somewhat captured in the optimal harvest schedule in Figure 13, which is an example of a harvest schedule produced by SugarMax for farm 2663. Different optimal variety schedules can be produced under each of the season start and staggered-start options.

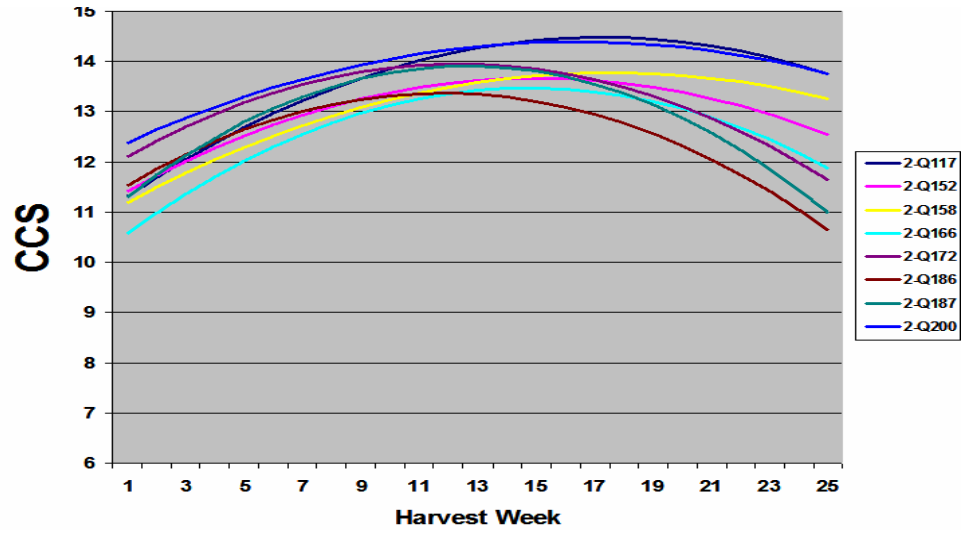


Figure 12 CCS trends of eight major varieties in the Herbert

SugarMax

Harvest PLAN Season: 2007 Rounds: 4 Season Length: 22 weeks

FARM: 2663

	Block:	DistrictVariety:	Class:	Tonnes	Area:	Age(m)	Harvested?	Harvest Date	Harvest Tonne	Harvest CCS	Comments
ROUND: 1	01A	2-Q200	3R	237	3	13					
	03F	2-Q200	PL	153	2	11					
	04B	2-Q200	PL	654	8	11					
	04F	2-Q186	4R	727	10	10					
	06A	2-Q186	4R	580	8	11					
	06B	2-Q200	2R	372	5	12					
	10A	2-Q200	3R	77	1	11					
			Total:	2,800							
ROUND: 2	11A	2-Q158	R7R	221	3	9					
	04D	2-Q166	2R	75	1	10					
	12A	2-Q172	3R	219	3	10					
	04A	2-Q152	R5R	369	5	10					
	09D	2-Q186	2R	85	1	8					
	12B	2-Q117	1R	37	0	11					
	10B	2-Q186	4R	222	3	8					
	07D	2-Q186	5R	140	2	11					
	06F	2-Q186	PL	116	1	12					
	03C	2-Q186	R4R	138	2	8					
	04E	2-Q187	2R	70	1	12					
	09C	2-Q186	R4R	74	1	8					
	09B	2-Q187	R4R	94	1	8					

FARM	DistrictVariety	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Total Tonnes
	Round Totals	3,008 28%	4,082 38%	2,041 19%	1,611 15%			10,742
2663	2-Q117		37 (100%)					37
	2-Q152	41 (11%)	328 (89%)		0 (0%)			369
	2-Q158		221 (81%)		51 (19%)			272
	2-Q166		75 (100%)					75
	2-Q172		219 (70%)	94 (30%)				313
	2-Q186	1,307 (51%)	1,255 (49%)					2,562
	2-Q187		1,210 (85%)		205 (15%)			1,415
	2-Q200	1,660 (29%)	738 (13%)	1,947 (34%)	1,355 (24%)			5,700
	Round Totals	3,008 28%	4,082 38%	2,041 19%	1,611 15%			10,742

Figure 13 Application of SugarMax for the scheduling of different varieties on a farm

Prestwidge et al. (2008) (Appendix 10) gives additional information on the harvest-management tools developed during this project.

SugarMax is being further adapted for the Herbert Region and plans are underway for it to be maintained locally. SugarMax will continue to be made available for season-length analysis in the Herbert, particularly through resources in project CGH002. SugarMax is increasingly (slowly) being adopted in the Herbert, particularly as a strategic-planning tool. It is currently being used to help growers better manage migration across different soil types and assist with regrouping. It is important that this adoption be maintained so that SugarMax will be more readily adopted for future season-length issues. SugarMax is very data intensive and the database and statistical trends need to be updated annually to accommodate district variety changes and long-term climate trends. This should be done through BSES Ingham or HCPSL.

Further work needs to be done to integrate SOI phases into SugarMax and season start-time analysis, so that best-bet scenarios can be produced, based on seasonal climate forecasts.

4.2 Cane-supply and transport-optimisation modelling

The adaptation of the cane-supply and transport-logistics models to the Herbert is now complete and ready to handle season-length options. The specific models adapted for this project are the Transport Capacity Planning model, SugarMax, and the Harvester and Siding Rostering model suites. These models combined handle the tactical supply-chain logistics at the harvesting and transport interface for a given start time. Whilst these models were primarily developed and adapted to the Herbert through other SRDC and industry projects (e.g. CSE005, HGP007), they have been adapted in BSS264 to handle different season length options, including different season start times for harvesting groups and Victoria versus Macknade.

These season-length issues impact on harvesting and transport logistics, particularly early and late in the harvest season. The technical capability is now available to develop and cost-out logistics plans for the season length scenarios, as well as determine potential bottlenecks and capacity limitations. An example is if the drier districts of the Herbert start harvesting early, there is a need to develop a logistics plan that handles this in the most effective manner. Modelling tools are needed, since the mill planners and harvesters are not experienced in this type of set-up and need modelling tools to explore options.

For the season-length options, the individual modelling tools are linked to provide an interactive system (Figure 14).

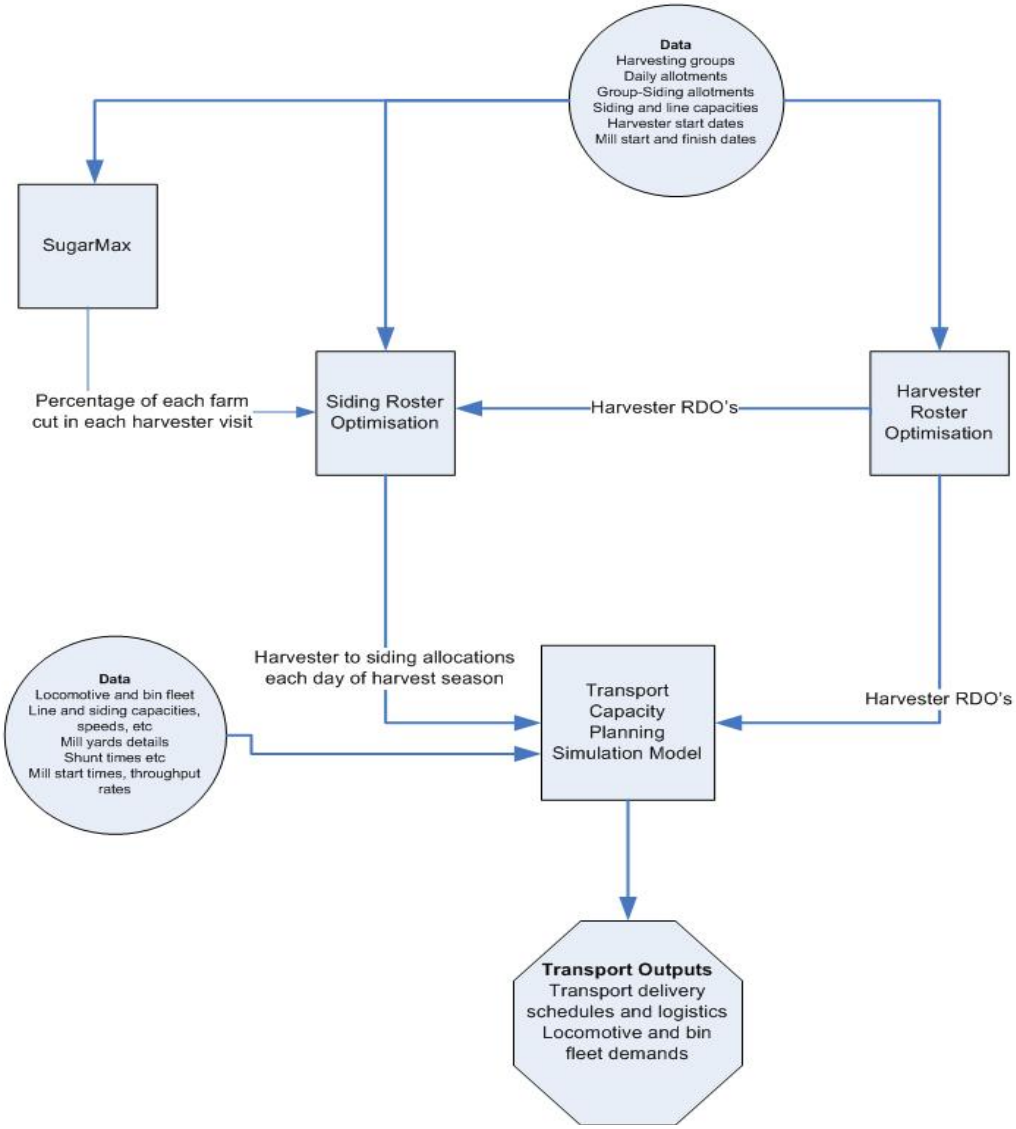


Figure 14 Linkage of Transport and Harvesting Logistics models for determining season-length options

5.0 FIELD RESEARCH ACTIVITIES

5.1 Crop-ripener research

MODDUS® is a new management tool from Syngenta Crop Protection that has the potential to improve the profitability of the Australian sugar industry by enhancing sugar content and providing greater harvesting flexibility. The product has been assessed through the research component of the BSS264 project and results are given in Di Bella et al. (2004, 2007) and Rixon et al. (2007).

Syngenta Crop Protection lodged with the APVMA (Australian Pesticides and Veterinary Medicines Association) for the full registration of MODDUS® and received product registration in June 2007. Four years of extensive research and more than 100 trials in Australia (with a considerable number of the trials conducted through the BSS264 project) have shown that MODDUS® can consistently increase CCS. The degree of response of the sugarcane crop to MODDUS® can vary. This variation is seen between varieties, fields, farms, regions and seasons. Research directed at understanding this variation has shown that there are many interdependent agronomic factors involved.

To better understand these interdependent factors, and to ascertain the harvesting season flexibility and the general benefit of the technology to the industry, a large-scale pilot program was established in the Herbert region. A "Permit to allow research use and supply" was sought by Herbert River CANEGROWERS and granted by the APVMA (PER 8955) for this purpose. The permit also allowed growers outside the Herbert region, in the Tully, Burdekin and Central regions, to participate in the MODDUS® pilot program.

Unique risk-sharing arrangement - Response to MODDUS® depends upon a wide range of agronomic variables. To address this, Syngenta developed a novel risk-sharing arrangement that aimed to maximise the potential benefits to all levels of the industry (Dorahy et al. 2007). Syngenta received from sugarcane growers a portion of the value of the incremental increase in sugar production in return for the provision of MODDUS®. If there was no economic response to MODDUS®, the grower's expense was limited to application costs only. The innovative program was conducted by Syngenta in partnership with CANEGROWERS Herbert River, BSES, HCPSL, CSR Sugar and Mackay Sugar.

Grower accreditation and field nomination - Growers were required to complete an accreditation program. On completion of this, they nominated fields for possible inclusion in the pilot program. Accreditation was completed to attempt to minimise chances of the small or insignificant responses to MODDUS®. Nominated fields were inspected by BSES and HCPSL officers and assessed for their suitability for application. Growers were notified which fields were accepted into the pilot program. In the Herbert, all trial fields were logged on the GIS database, and on the maps provided to harvesting contractors.

Benchmark program - BSES and HCPSL officers selected 20 of the nominated fields for use as 'benchmark' fields. These fields selected were representative of the subregions and varietal balance of the region. The performance of these fields were carefully monitored

by Syngenta and BSES officers and used to determine the average sugar-level response, and thus the cost of MODDUS® to participating growers. Half of each benchmark field was treated with MODDUS®. The other half remained untreated. The fields were harvested normally, with cane from treated and untreated areas consigned separately.

Application of MODDUS® - MODDUS was applied by helicopter to ensure accurate and uniform application to selected fields. Syngenta provided MODDUS® to accredited aerial operators for application in a timely manner before the start of the harvest season. Growers were responsible for the cost of aerial application.

Harvest and calculation of charges - Accredited growers harvested their crop 6-12 weeks after application, in accordance with the approval permit label. The average difference in sugar levels between MODDUS®-treated and untreated cane in the benchmark fields forms the basis of the calculation of the amount that the grower was charged. This benchmark information was collected and determined by BSES and HCPSL officers, who then notified the growers of the difference and the cost of MODDUS using a sliding-scale price structure.

Product stewardship - Syngenta provides stewardship and support to all of its products. MODDUS® has an excellent topological and environmental profile, Syngenta is aware of the community perception implications of a clear visual increase in the amount of aerial application. As a result, there is a product stewardship component to the grower accreditation called the "Good Neighbour Program". Most crop-protection products used in the Australian sugar industry are applied using ground equipment. By comparison, MODDUS® was applied by helicopter during the Herbert River Region Pilot Program.

The increased aerial activity has the potential to raise community awareness and/or concerns about the safety of pesticides that are being applied. People who are not involved with crop protection products on a day-to-day basis often do not fully understand why these products are used or how they work. In these instances, misconceptions may quickly arise about the perceived risks to human and environmental safety.

The sugar industry can learn from the experience of other agricultural industries in managing community concerns about the aerial application of crop protection products. This collective experience has shown that best defence against misinformation, misconceptions and mistrust is to clearly and proactively provide accurate information to neighbours and the community.

Growers were encouraged to study their farm maps and note where the nearest houses, roads and communities were located. They were encouraged to place phone calls or visits to their neighbours (even if they are sugarcane growers) to explain that they will be using a helicopter to apply a crop protection product. If neighbours or the public had any concerns, they were encouraged to phone Syngenta Crop Protection and/or the aerial operator immediately by phone or UHF.

The pilot program - The pilot program assisted with the understanding the industry benefits and the interdependent factors involved in gaining a reliable result from MODDUS®. This information will be especially important in developing management strategies that will allow a possible extension of the harvest season and increase the

financial viability in the Herbert River region. The results from the Herbert river region will assist in developing a MODDUS® program for the entire sugarcane industry in Australia (Di Bella et al. 2007).

A working group consisting of CANEGROWERS, BSES, HCPSL and Syngenta (a sub-set from the BSS264 industry working group) was formed to assist with the co-ordination, planning and logistics of the Herbert pilot program. CANEGROWERS Herbert River were successful in obtaining a SIIF grant under the State Government Sugar Assistance Program to assist growers meet the application costs associated with the application of MODDUS® in the pilot program.

Promotion and advertising occurred in the Herbert River Express, through productivity forums, through the BSES and CANEGROWERS email systems and an interview on ABC radio. Herbert Cane Productivity Services (HCPSL), BSES and Syngenta staff inspected all blocks for their suitability into the program the week prior to the proposed application date.

Forty-six farming businesses participated in the 2006 Herbert program, with 469.67 ha treated with MODDUS®. Twenty-two varieties were nominated by growers. The blocks were recorded on the HCPSL GIS database. MODDUS® was applied during 10-12 May 2006 for the early harvested cane and on 20 October for the late-harvested cane.

Field monitoring of the 20 benchmark blocks saw samples taken on 17 May 2006 to assess juice purity, stalk maturity and flowering. Further assessments were undertaken approximately 35 days after application and at harvest. Average monetary returns are given in Table 2.

Table 2 Average monetary returns for MODDUS® application in 2006 early harvest trials

Average CCS increase	Average cane yield (t/ha)	Average sugar yield increase (t/ha)	Average increase in gross value* ($/ha)
0.70	78	0.55	$209

*Calculations based on the estimated sugar price = $380/t sugar

APVMA approved the commercial registration of MODDUS® in June 2007. Pilot programs occurred in the Tully, Herbert, Burdekin, Proserpine, Mackay and Plane Creek Mill areas in 2007 and the Far Northern and Southern regions will be included in the pilot program in 2008.

The industry delegation, as apart of the SRDC Travelling and Learning Project BSS281, reviewed crop ripener use and research in Southern Africa (Di Bella and Wood 2005). Lawrence Di Bella also reviewed MODDUS® research and commercial use in Brazil during the SRDC Travelling and Learning Project CSR39 (Kerkwyk et al. 2006). Some of the findings assisted in the development of crop-ripener management strategies for the Australian sugar industry.

5.2 Crop-nutrition research

Four trials were established through the district (Figure 15) to assess nitrogen response in early harvested cane. The BSES recommended rate was applied and a lower rate was applied at all sites. The trials were two- or three-replicate trials. The Steine and Morley trials were conducted over 1 year and the Minato and Russo trials were conducted over 3 years. However, only 1 year's data was received for the Russo trial because the harvesting operator failed to notify BSES/ HCPSL staff when the trial was harvested.

The soil types of each trial are:

- Morley sit e- Sandy clay;
- Russo site - Clay;
- Steine site - Fine sandy loam;
- Minato site - Grey sand.

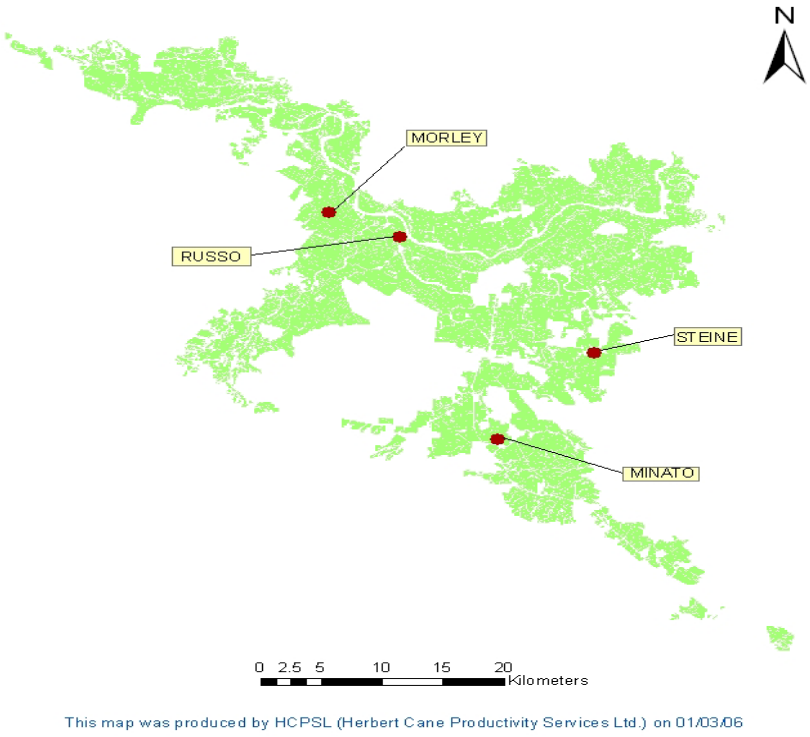


Figure 15 Location of nitrogen rate by early harvest trials

Leaf samples were taken in all trials to assess the nutrient status of each treatment. All treatments were above the satisfactory levels for the nutrients assessed.

Statistically there was no significant difference for any trial for CCS, cane yield and gross $/ha (Tables 3-6). There is no evidence from the trials that lower nitrogen rates increase the CCS of early harvested cane. Greater reductions in N rates are required to test this hypothesis.

Further research is required to assess nitrogen 'run down' over time because it may be a potential issue. The Minato trial indicates a decreasing trend in cane yield in the third ratoon after 3 consecutive years of lower nitrogen applications.

These trials have been useful as an extension tool and have been inspected by growers through the local productivity forum groups. A number of growers have been encouraged by the results obtained from the trials and are adopting the recommendation to reduce their nitrogen rates for early harvested cane.

Table 3 Results of the Minato early harvested nitrogen-rate trial over the 3-year period

Nitrogen rate (kgN/ha)	CCS			Cane yield (t/ha)			$/ha minus N fertiliser cost		
	1 R	2 R	3 R	1 R	2 R	3 R	1 R	2 R	3 R
100	14.00	12.25	14.8	78	90	62	1260	1954	1109
150	13.95	12.4	14.1	79	86	71	1227	1841	1118

Variety: Q157

Assumptions used for 1st ratoon crop:
Sugar price- $270/tonne
Harvesting and levies- $6.80
Nitrogen value- $1.24/kg of nutrient
Date harvested- 23/6/05

Assumptions used for 2nd ratoon:
Sugar price- $400/tonne
Harvesting and levies- $7.00
Nitrogen value- $1.24/kg of nutrient
Date harvested- 29/6/06

Assumptions used for 3rd ratoon:
Sugar price- $285/tonne
Harvesting and levies- $6.80
Date harvested- 24/7/07

Table 4 Results of the Morley early harvested nitrogen-rate trial

Nitrogen rate (kgN/ha)	CCS	Cane yield (t/ha)	Gross income $/ha	$/ha minus nitrogen fertiliser costs
98	11.4	103	1203	1082
156	11.4	103	1205	1010

Assumptions used:
Sugar price- $270/tonne
Harvesting and levies- $6.80
Nitrogen value- $1.24/kg of nutrient
Date harvested- 27/6/05

Table 5 Results of the Steine early harvested nitrogen-rate trial

Nitrogen rate (kgN/ha)	CCS	Cane yield (t/ha)	Gross income $/ha	$/ha minus nitrogen fertiliser costs
115	12.8	75.9	1151	1007
153	12.9	74.7	1151	961

Assumptions used:
Sugar price- $270/tonne
Harvesting and levies- $6.80
Nitrogen value- $1.24/kg of nutrient
Date harvested- 25/6/05

Table 6 Results of the Russo early harvested nitrogen-rate trial

Fertiliser blend	CCS	Cane yield (t/ha)	Gross income $/ha	$/ha minus nitrogen fertiliser costs
GF501 (lower nitrogen rate)	14.3	112	2107	1815
GF560 (higher nitrogen rate)	13.76	121	2110	1751

Assumptions used:
Sugar price- $270/tonne
Harvesting and levies- $6.80
Fertiliser cost:
GF501- $563.20
GF560- $558.80
Nutrients for each fertiliser blend:
GF501- 122 kgN/ha, 21 kgP/ha, 86 kgK/ha, 12 kgS/ha
GF560- 163 kgN/ha, 18 kgP/ha, 96 kgK/ha, 23 kgS/ha
Date harvested- 27/7/06

5.3 Soil-trafficability research

This research aimed to develop a technique whereby soil types could be categorised according to the soil's capability to be trafficked under different soil-moisture regimes.

Five different soil types (representing the five major soil groups found in the Herbert region) were collected for the study (Figure 16). The project attempted to use techniques used by the Main Roads and Hinchinbrook Shire Council to assess soil trafficability of cane fields.

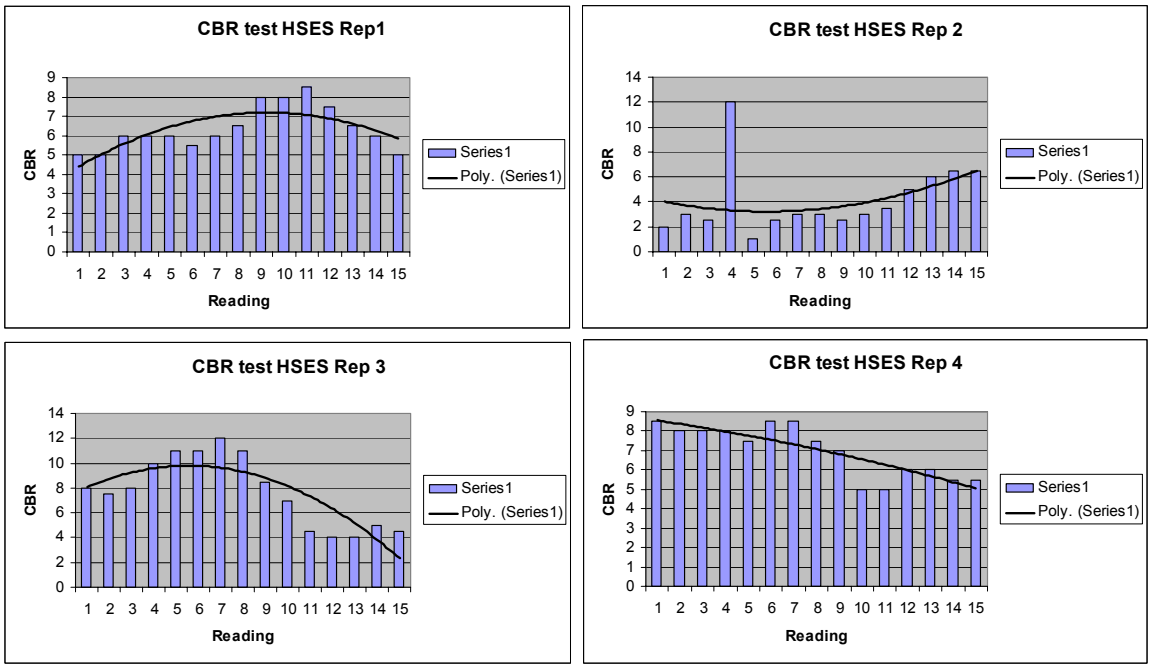
Figure 16 Soil-sampling team collecting samples (left) and preparing and drying soil samples (right)

Figure 17 clearly shows that there were no clear relationships between replicates for tests undertaken on soil from BSES Ingham; this was typical for all sites assessed.

It was not possible to make conclusions from these results regarding trafficability across the range of soil types. Trafficability is related to topography and block drainage, soil texture, structure, existence of a compacted layer, moisture content, trash cover, crop

development, crop class and many other factors. It was not possible within the scope of the project to develop a simple trafficability index for different soils; further research is required in this area.

Figure 17 Replicate results of CBR tests on soil from BSES Ingham



5.4 Controlled-traffic research

A demonstration trial was established at BSES Ingham to demonstrate the benefits of controlled traffic systems to allow for improved in-field trafficability early in the harvest season. This trial proved to be a useful extension tool.

The trial consisted of three treatments: 1.6 m single-row conventionally planted, 1.63 m pre-formed single-row double-disc-opener planted, and 1.85 m pre-formed dual-row double-disc-opener planted. The variety was Q174$^{(\dagger)}$. The trial consisted of two replicates.

The results of the trial are given in Table 7 and are presented with an economic evaluation in Poggio et al. (2006) (Appendix 9). In both plant and first ratoon, the crops were harvested early and under wet harvest conditions and growers were shown the effects of controlled traffic in-field through a series of grower meetings.

Table 7 Results from the controlled-traffic trial

Treatment	Cane yield (t/ha)		CCS		Sugar yield (t/ha)	
	Plant	1 R	Plant	1 R	Plant	1 R
1.63m single row - conventional	66	71	15.4	14.8	10.12	10.54
1.63m single row- DD planted	74	79	14.9	14.4	11.04	11.39
1.85m dual row- DD planted	82	74	14.5	14.1	11.95	10.48

5.5 Variety-by-time-of-harvest research

A number of field trials were conducted during the duration of the project. The results of these trials were reported in Di Bella et al. (2008) (Appendix 8).

6.0 PILOT EARLY SEASON START

The team decided that a simple, short-term goal was required in order to get the concept off the ground. Planning, therefore, commenced to start Victoria Mill 1 week earlier than normal in the 2004 season (on 7 June 2004) and to draw the early cane supply from the traditionally drier, higher-CCS areas of Ingham Line and Upper Stone. It was decided that CANEGROWERS would initially call for expressions of interest in supplying cane early to Victoria Mill and that a circular would be sent to each grower.

The team later changed its name to 'The Early Start Options Team' and focussed on raising awareness of the team's activities in preparing for 'the early start trial' in 2004. Presentations were given at all CANEGROWERS Mill Suppliers' Branch meetings and at three industry meetings held around the district in March 2004.

The concept of an Early Start Trial was developed to:

- Gauge industry support for an extended season length;
- Gauge industry support for the commencement of harvesting earlier in some parts of the district in order to optimise district CCS and yield potential;
- Evaluate cane supply and transport capability to access cane from the early harvested areas;
- Demonstrate that it is possible to supply cane earlier than normal with acceptable CCS;
- Demonstrate that there are ratooning benefits, particularly for the drier Ingham Line area, in harvesting cane earlier.

Initial expressions of interest in starting early were strong, with 18 of 19 harvesting groups in the Ingham Line area, 6 groups from Stone River and 2 from the Blackrock area interested. However, some growers in the Stone River area did express concerns over competing with the Ingham Line area for CCS.

The plan for the early start trial gradually took shape with the Herbert RIB providing guidance where necessary. For example, the RIB decided that:

- Certain areas would start early even if the overall season start date was delayed because of a poorer than expected crop;
- One milling train at Victoria would be used with a minimum volume of around 70,000 t cane to be processed in the first week;
- The main incentive should be to finish early if you supplied early.

Firm commitments to harvest cane for the early start trial were sought following the shed meetings in March 2004. 25 groups committed, of which 15 were in the Ingham Line area, four in Blackrock, five in Stone River and one at Danger Camp. Meetings were held with various groups and growers to answer their questions and to allay any concerns. Eventually, 29 groups committed to participate in the early trial. A traffic plan was constructed that had groups from Ingham Line and Blackrock harvesting for the first four days of the trial and Stone River groups then supplying cane from day 5 onwards. At this stage, one milling train at Victoria was scheduled to start on 7 June, the second milling train on 15 June, and Macknade Mill on 15 June.

In late April following heavy rainfall, rumours began to circulate regarding a delay to the start of the season. These rumours were further fuelled by further heavy rain in mid May. The heaviest falls were received in the Macknade area. Consequently, it was agreed to delay the start of Macknade by 1 week to 21 June. However, no change was made to the start dates for the two milling trains at Victoria.

The early season start commenced on schedule on 7 June. However, cane supply was much lower than expected during the first 2 days, with a number of harvesting groups unable to cut because of harvesters not being ready, harvester breakdowns or wet field conditions. Some groups agreed to cut above quota, but these arrangements were unable to make up for the shortfall in supply. The lack of a full cane supply led to stop/start crushing operations at the mill and caused bagasse stocks to rapidly become depleted. Other groups in Stone River that were due to commence on day 5 were not prepared to start harvesting earlier. It was, therefore, reluctantly decided on day 3 that the early start trial would have to be abandoned. Only 20,000 t of cane with an average CCS of 11.4 was supplied to the mill during the first week, from 45 different farms.

There were many reflections on the early start trial:

- The trial was successful demonstrating what is possible;
- Useful variety data emerged with Q119, Q138 and Q162 not having high early CCS, whereas Q174$^{\Phi}$ and Q200$^{\Phi}$ performed well;
- There were many rumours and much scaremongering – for example, trains were unable to operate, mill had severe breakdowns, etc;
- The major difficulty was in securing cane supply - there were some mill breakdowns, but generally the mill performed well for a first week;
- Much time at the mill was lost waiting for cane - the fuel situation became critical;
- Stone River suppliers were approached but were unable or unwilling to start;
- The delay to Macknade Mill starting gave some suppliers the impression that the 7 June start was 2 weeks early - this arose from a rumour that Macknade suppliers did not have to supply cane until Macknade Mill started crushing on 21 June;

- A fair amount of harvesting machinery was not ready to start - this arose from difficulties in sourcing parts, with some having to wait for many months before the parts arrived;
- Part of the problem was the Ingham rumour machine - given the concerns over low CCS when supplying cane early, two of the most destructive rumours were that Macknade growers would not have to cut in week 2, and that many rakes of cane were testing below 7.0 CCS;
- There is clearly a need to educate growers more, on how to manage cane for early harvest;
- The team felt particularly sorry for groups who started early, supplied extra cane and then were stopped - they put on their crews, were all set to continue harvesting and did nothing wrong;
- It was agreed that follow-up action was required for all those groups that had undertaken to supply cane early and then did not cut. In order to find out the reasons for non supply - follow-up action was conducted by CANEGROWERS;
- It was agreed that groups that started harvesting on day 1 should be given the advantage of finishing 1 week early - groups that started on day 2 should be allowed to finish 6 days early - groups that cut lots of extra bins should be allowed to finish an extra day early;
- It was agreed that a letter should be sent to all early start participants thanking them for their effort and outlining arrangements for when they would finish the season;
- It was agreed that in the future we should make the commitments to supply cane early by growers and harvesting groups more binding, possibly by individual contracts;
- The incentives for early supply need to be clearly understood - had there been more incentives, then maybe more growers would have been willing to supply.

A major outcome from the after-action review following the early start trial was to conduct a grower survey to obtain growers' views on early season harvesting and extended season length.

7.0 PROJECT EVALUATION

7.1 2004 baseline survey

A baseline evaluation in the form of a survey was developed to assess industry participants' views and opinions pertaining to harvest season length, crop-management issues associated with an extended season length (and the 2004 early harvest trial), industry infrastructure utilisation, community impacts, development of alternative income streams, industry viability, and cash flows.

The survey was developed by the industry working group overseeing and reviewing the project and the associated programs. Prior to undertaking the survey, the Herbert Regional Industry Board was consulted and subsequently modified and endorsed the contents and intent of the survey.

The survey is reported in Appendix 6.

7.2 2006 maximising profitability in the Herbert Sugar Industry workshop

A survey of industry opinions was also undertaken at the 2006 Maximising Profitability in the Herbert Sugar Industry workshop. This is reported in Appendix 7.

7.3 2007 project-completion survey

A project-completion survey was conducted as apart of the project. The survey was sent by electronic email or mailed to industry participants. Thirty replies were received for the survey. Results of the survey are as follows:

- What sector of the sugar industry do you represent?
  □ Growing - 44%
  □ Milling – 24%
  □ Harvesting -10%
  □ R,D & E -22%
- How critical is season length in relation to ensuring industry viability?
  □ Very important – 98%
  □ Important – 3%
  □ Not so important -0%
  □ No importance at all- 0%

- List the opportunities an optimised season length offer to the Herbert region
  1. Better ratoons (CM)
  2. Better chance to remove crop (HM)
  3. All-year-round crop management (CM)
  4. Economics (MR)
  5. Opportunities to adopt best practices (CM)
  6. More time for fallow management (CM)
  7. Maximise tonnes (CO)
  8. Maximise CCS (CO)
  9. Better returns (MR)
  10. Improved machinery utilisation and man power (CU)
  11. Increased profit and viability (MR)
  12. Optimise sugar make (CO)
  13. Improved harvesting efficiencies (HM)
  14. Improved use of mill infrastructure (CU)
  15. Value adding opportunities (VA)
  16. Improved monetary return for harvested crop (MR)
  17. Improved crop in the following year (CO)
  18. Improved capital utilisation (CU)
  19. Better opportunities for recreational activities (Other)
  20. Reduction in farm costs (CM)
  21. Opportunities for break crops (CM)
  22. Improved harvest scheduling on wet soils (HM)

23. Opportunities to apply crop ripeners (CM)
24. Opportunities to exploit geographical variations to improve CCS (HM)
25. Start harvest season early, less chance of late harvest finish (CM)
26. Greater opportunity to plan for crop age and harvest time optimisation (CM)
27. Potential to lead to cane payment based upon sugar yield and sugar quality (MR)
28. Appropriate capital, operating and maintenance investment (CU)
29. Risk management of crop harvest if adverse conditions likely (HM)
30. Higher cane yields (less drying out of cane) (CO)
31. Greater ability to handle large crops (HM)
32. Reduced likelihood of standover (HM)
33. Optimised season length in conjunction with shorter sub-district season length could increase CCS
34. Optimised season length in conjunction with shorter sub-district season length could increase profits
35. Optimised season length in conjunction with shorter sub-district season length could increase ratooning length

Groupings of comments:

- Harvest management- HM
- Value adding- VA
- Crop management- CM
- Capital utilisation- CU
- Crop optimisation- CO
- Monetary return- MR
- Other

- What impact does the following farm management practices have in relation to optimising a season length:

(a) Variety management

High	87%	Medium	13%	Low

(b) Crop age

High	50%	Medium	50%	Low

(c) Use of crop ripeners

High	46%	Medium	40%	Low	14%

(d) Harvest scheduling tools

High	57%	Medium	25%	Low	18%

(e) Harvest management

High	74%	Medium	22%	Low	4%

(f) Management of crop nutrition

High	76%	Medium	15%	Low	9%

(g) Other – Comments received:

  - Variety x soil type.
  - Zero tillage and controlled traffic.
  - Harvester guidance (reduced compaction).
  - If harvesting to CCS around the district (according to soil types) I believe it would lower the impact of environmental and farm management practices.

- What opportunities does season length optimisation offer to the industry and community?

☐ Nothing to list - 0%

□ List opportunities in order of priority - 100%

1. Lower potential for poor performance in late cut ratoons
2. Less damage from early wet season and flooding
3. Value adding opportunities
4. Increased monetary returns
5. Fallow cropping opportunities for extra income on farm
6. More effective pest and disease management
7. More opportunities for community stakeholders (aerial operators)
8. Increased sugar make
9. Better use of resources
10. More money in the community
11. Better use of capital
12. More cane next year
13. Cost reductions
14. Longer ratoons
15. Better organisation
16. Shorter season length for each sub district
17. Possibility of increase utilisation of equipment

- Should some parts of the district start harvesting before other parts of the district?

□ Yes (specify reason) - 100%

Totally different CCS levels between drier and wet areas
Drier areas should start earlier
Account for rainfall differences
Harvest high CCS areas
It is a cost not too.
Optimise sugar production
Drier areas should start earlier
Frees up mill capacity
Increase monetary returns
Start earlier, finish early
If it facilitates earlier finishes
Harvest drier areas with higher CCS at optimum time for ratooning
Our wide geographical spread gives some intrinsic differences that can be utilised
Industrial stability, longevity
Increased returns to the industry stakeholders that flow back into the local economy
Minimise capital required for harvesting and milling
Our current approach to harvesting does not recognise the various geographical and soil types of this district

□ No - 0% No replies in this section.

- Should harvesting groups starting early be allowed to finish early?

□ Yes- 100%

- Could there be some incentive to break away from conventional of fixed farms to a group, to maximise early harvest potential, with payback at the end of the season
- Harvesters should be assigned to the district not to the grower

□ No- 0%

- Would you consider using crop ripeners on your farm?
  □ Yes 80%
  □ No 15%

- Would you consider different harvesting arrangements within your harvesting group if there were opportunities to increase monetary returns?
  □ Yes-70%
  - Drier farms should be harvested first
  - Weather conditions should be considered
  - Harvest to optimise returns and minimise rainfall risk

  □ No- 0%
  □ Not a grower -30%

- If there were opportunities to increase monetary returns due to value added by-products (in the future), would you consider a different season length scenario?
  □ Yes -97%
  □ No -0%
  □ Unsure- 3%
    - Would like to see the value adding option first

- Should alternative harvesting arrangements be investigated to ensure that all the Herbert crop is harvested in an optimum time?
  □ Yes (please specify) - 79%
  - Harvest based upon maturity
  - We are all in it together
  - Optimise sugar make
  - Harvest scheduling across region and start drier area earlier
  - Encouragement for harvester groups that are prepared to start early and that harvest through rain periods
  - I believe an investigation to be a waste of time as there is already enough evidence contained within the information already available

  □ No - 21%

- When should we commence harvesting each year (weather permitting)?
  □ 3rd week of May – 14%
  □ 4th week of May – 8%
  □1st week of June – 68%
  □2nd week of June – 10%
  □3rd week of June – 0%
  □4th week of June – 0%
  □1st week of July – 0%

- What impact has the SRDC Season Optimisation Project has had on the decision making process in the Herbert?
  □ Significant impact – 28%

□ Some impact -3 0%.
- MODDUS very successful component of the project.

□ Little impact - 20%
□ No impact - 5%
□ Unsure – 17%

- What issue has the SRDC project failed in achieving, if any:
  □ Nothing to list – 40%
  □ List issues: - 60%
    - The industry does not appear to be aligned or excited about the enormous possibilities
    - How to implement starting the season early
    - See an early start implemented
    - Staggered start and finish
    - Trafficability research
    - "I think little has changed ; we are still in the old mould"
    - "I don't know if it's SRDC Season Optimisation Project failure or the Herbert industry stakeholders' failure to have successfully implemented the Project"
    - All projects achieve an answer but they fail to achieve the outcome they desired. Weather the outcome is a positive or a negative; they fail in its ability for a path of adoption by the intended community.

- Would you like to make any further comments in relation to the SRDC Season Optimisation Project or in relation to season length.
  - Groups of growers (including industry leaders) appear to be reluctant to take risk and try new opportunities.
  - More economic analysis required of value adding opportunities.
  - One of the most successful projects I've been involved with. It has demonstrated that the industry can work together collaboratively value-chain projects.

7.4 Comparisons among the 2004 baseline evaluation survey, 2006 maximising profitability in the Herbert Sugar Industry workshop and 2007 project completion survey

During the period of the project, industry has been surveyed on three occasions:
- The 2004 baseline evaluation survey reported in Di Bella (2004) (Appendix 6).
- The 2006 Maximising Profitability in the Herbert Sugar Industry workshop survey reported in Di Bella (2006) (Appendix 7).
- The 2007 Project-completion survey (Section 7.3).

Some questions were asked in each survey to assess changes in industry option and to gauge progress. Table 8 collates and highlights the differences in response among the three surveys.

Table 8 Responses to questions asked in the three surveys

Question	2004 Baseline evaluation survey	2006 Maximising profitability survey	2007 Project-completion survey
Should some areas start earlier than other areas?	66% replied yes.	81% replied yes.	100% replied yes.
Should those areas that start early finish early?	74% replied yes.	81% replied yes.	100% replied yes.
Would you consider using crop ripeners?	35% replied yes.	62% replied yes.	80% replied yes.
Would you consider different harvesting arrangements to ensure that all the Herbert crop is harvested at an optimum time?	This question was not asked.	53% replied yes.	79% replied yes.

The data in Table 8 highlight a significant shift in option that could be attributed to an increased awareness of the issue due to the project and other influences.

When surveyed about starting dates of the harvest (comparing the 2006 Maximising Profitability survey and the 2007 Project-completion survey), there has been a considerable shift in option to starting the harvest season to the first week of June as a opposed to mid June.

The surveys have indicated significant changes in option in some areas and highlighted areas that require further development or consideration. The surveys have been a useful tool to assess project performance and assist in the development of management strategies associated with season-length management.

8.0 OUTPUTS

The project has been very successful in getting industry stakeholders and service providers together to work on the project, discuss and investigate strategies for harvest management. The success of this project can be gauged by the establishment of the new project CGH002 Enhancing Efficiency and Integration from Field to Factory in the Herbert.

The project has been successful in highlighting the opportunities to increase season length in the early part of the harvest window and the disadvantages of increasing season length at the end of the harvest season.

The greatest success of the project was the increase of industry awareness of season length issues; provoke thought and discussion throughout the Herbert region. The impacts of the project are yet to be realised, but survey results from the project highlight shifts in industry perceptions and views.

This project was unsuccessful in achieving an extension to the harvest season length. However, it has collated useful information if the situation was to change. The milling and harvesting sector currently have achieved very little in relation to improved capital utilisation since the inception of this project. Significant opportunities for improved capital utilisation by the harvesting and milling sectors could be achieved through an increase in season length.

The long-term impact of the project is yet to be understood. However in the short term, the project has provided technical information for the industry to base decisions upon, challenged current paradigms, increased industry awareness of issues pertaining to season length, developed modelling tools (such as SugarMax and Rainfall Risk) for industry use and has stimulated discussion.

The project has been successful in establishing crop-management strategies to manage different harvest schedules such as the registration of MODDUS® as a crop ripener and variety-by-time-of-harvest scheduling.

In summary, the project has provided:

- Data for the Herbert on the CCS and yield consequences of different harvesting times;
- Variety by agronomic management combinations for cane harvested to maximize whole-of-industry profitability;
- Variety by ratooning performance for both early and late harvest;
- CCS profiles for different variety by management by harvest time combinations;
- Commercial registration of a crop ripener (MODDUS®) for the Australian sugar industry;
- Risk-management plans for each Herbert subregion, combining seasonal climate forecasts, CCS profiles, soil trafficability and ratooning data, transport infrastructure and crop size;
- An integrated model that provides an indication of probability of wet field conditions disrupting harvesting;
- An economic model incorporating different season start and finish times that produces cost-benefit analyses for all sectors of the sugar-industry value chain and local community;
- Opportunities to provide a supply of fuel for cogeneration, if investment in cogeneration infrastructure occurs.

9.0 OUTCOMES

The issue of season length management is a complex and contentious issue for the Herbert industry and will continue to do so into the future. It appears that one of the barriers to

adoption by the growing sector is that, under current payment arrangements and absence of value-adding opportunities to increase monetary return, there is a lack of enthusiasm to increase the length of the harvest season. It appears that the growing and milling sectors see opportunities to increase season length if, and when, value-adding opportunities arise. It is apparent that grower involvement will be essential to ensure successful implementation of value adding opportunities in the future.

Since the project's inception the growing and harvesting sectors are embracing opportunities to manage harvesting differently within the current harvest-season length in an attempt to manage rainfall risk situations and maximise CCS opportunities within a harvesting-group situation. The research indicates that there are still more significant opportunities to increase CCS and monetary returns through managing the crop harvest differently.

A significant outcome from the project is the strong support in the Herbert for the development of harvesting and processing plans to seek to maximise CCS across the region. This will be achieved through grouping of farms together in harvesting groups to exploit climatic and soil variations across the district, within existing season lengths. This concept is now part of SRDC project CGH002 Enhancing Efficiency and Integration from Field to Factory in the Herbert.

10.0 INTELLECTUAL PROPERTY

The intellectual rights and property of MODDUS® remain the property of Syngenta Crop Protection.

The financial models developed by CSR Sugar staff will remain confidential and the property of CSR Sugar.

11.0 PUBLICATIONS

Major publications arising from the project are listed below.

Anon. 2004. Harvesting cane early in the season. *BSES Information Sheet* IS04002. (Appendix 1).

Anon. 2006. Syngenta Crop Protection Pty Ltd MODDUS® Murmurs Issue 1. (Appendix 2).

Anon. 2006. Syngenta Crop Protection Pty Ltd MODDUS® Murmurs Issue 2. (Appendix 3).

Anon. 2006. Syngenta Crop Protection Pty Ltd MODDUS® Pilot trial, 2006. (Appendix 4).

Anon. 2007. Syngenta Crop Protection Pty Ltd MODDUS® Murmurs Issue 3. (Appendix 5).

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Di Bella LP, Rixon C, Armytage P, Davies B, Dorahy K, Wood AW and Sheedy P. 2007. The 2006 Herbert MODDUS® pilot program. *Proc. Aust. Soc. Sugar Cane Technol.* 29: 368-376.

Di Bella LP, Shannon G, Poggio MJ and Wood A. 2004. Final report - evaluation of MODDUS® (trinexapac-ethyl) as a sugarcane ripener in the Herbert River district, Australia. *BSES Consultancy Report* CO04023.

Di Bella LP, Stringer J, Wood AW, Royle A and Holzberger G. 2008.What impact does time of harvest have on sugarcane crops in the Herbert River district. *Proc. Aust. Soc. Sugar Cane Technol.* 30: in press. (Appendix 8).

Dorahy K, Aubert A, Rixon C, Davies B, Armytage P, Di Bella LP and Butler G. 2007. A risk sharing model as a way of delivering productivity gains for the Australian sugar industry. *Proc. Aust. Soc. Sugar Cane Technol.* 29: 377-384.

Poggio M, Shannon G, Di Bella LP, Holzberger G and Park G. 2006. Herbert farming systems trial report. Internal QDPI&F report. (Appendix 9).

Prestwidge D, Stainley T, Di Bella LP and Higgins A. 2008. Harvest planning for growers. *Proc. Aust. Soc. Sugar Cane Technol.* 30: in press. (Appendix 10).

Rixon C, Di Bella LP, Kingston G, Dorahy K, Davies B and Wood AW. 2007. MODDUS®- a sugar enhancer. *Proc. Aust. Soc. Sugar Cane Technol.* 29:318-327.

Wood AW, Di Bella LP, Pace RM and Schroeder BL. 2005. Optimising season length to increase industry profitability in the Herbert River District, Queensland, Australia. *Proc. S. Afr. Sugar Technol. Ass.* 76:443-446. (Appendix 11).

In addition, the project has featured in numerous newspaper articles and at a series of information meetings.

12.0 RECOMMENDATIONS

Further research is required in the following areas:

- Understanding the complexities of soil traffic ability under various soil type and soil moisture regimes.
- Financial implications across the value chain associated with the introduction of value-added by-products.
- Further development of the SugarMax model to provide the model with a user-friendly interface. Training of technical staff within the region on the use of the model is also recommended.

13.0 ACKNOWLEDGEMENTS

Thanks to:

- SRDC, QDPI&F and BSES for funding the project and SRDC for funding the associated Travel and Learning Project.
- The Herbert Season Optimisation Team industry working team, who supported and reviewed the research conducted.
- The BSES staff and fieldworkers (especially Graeme Holzberger, Greg Shannon, Vince Blanco, Ross Raciti, Minka Ibanez and Fulvio Gori) for planting, harvesting and sampling of the trials.
- Syngenta for their support and interest in the project and commercial registration of MODDUS®.
- HCPSL for allowing time for Lawrence Di Bella to complete and write up the project after his resignation from BSES.

14.0 REFERENCES

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Di Bella LP. 2006. Findings from the 2006 'Maximising profitability in the Herbert Sugar Industry Workshop'. Project BSS264 Adoption of an optimal season length for increased profitability. *BSES Project Report* PR06001.

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Di Bella LP, Shannon G, Poggio MJ and Wood A. 2004. Final report - evaluation of MODDUS® (trinexapac-ethyl) as a sugarcane ripener in the Herbert River district, Australia. *BSES Consultancy Report* CO04023.

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Muchow RC and Wood AW. 1996. Rainfall risk and scheduling the harvest of sugarcane. In: Sugarcane: Research Towards Efficient and Sustainable Production. Wilson JR, Hogarth DM, Campbell JA and Garside AL (Eds). CSIRO Div. of Tropical Crops and Pastures, Brisbane. pp.26-27.

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Prestwidge D, Stainley T, Di Bella LP and Higgins A. 2008. Harvest planning for growers. *Proc. Aust. Soc. Sugar Cane Technol.* 30: in press.

Rixon C, Di Bella LP, Kingston G, Dorahy K, Davies B and Wood AW. 2007. MODDUS®- a sugar enhancer. *Proc. Aust. Soc. Sugar Cane Technol.* 29:318-327.

APPENDIX 1 – Anon. (2004)

BSES information sheet

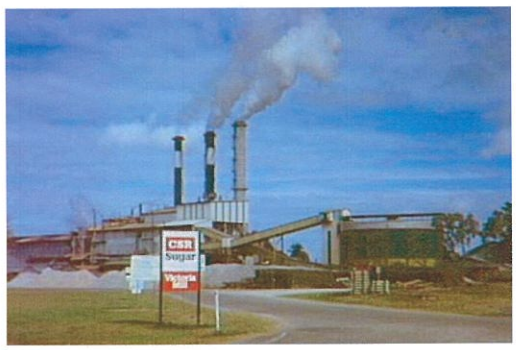
IS04002

Harvesting Cane Early In The Season

The following issues should be considered when managing cane blocks to be harvested early in the season:

- Plant an adequate area of cane on your farm to harvest early CCS potential varieties.
- Select cane blocks that are suitable for early harvest. Conditions maybe wet early in the season, so select blocks that have a good surface drainage and free draining soils. Improve surface field drainage by laser levelling.

- Harvest crops that were planted or ratooned early the previous year. Crops for early harvest should be close as possible to 12 months of age or older in order to maximise both CCS and yields.
- Consider using a refractometer to assess blocks for CCS potential, prior to harvest.
- Crop ripeners have been found to be cost effective to improve CCS of early harvested cane, in some situations. The local BSES Extension Officer can provide advice on crop ripeners.
- Harvest varieties which mature early and have high early CCS. The local BSES Extension Officer provides advice on which varieties to plant. It is suggested that you conduct some strip trials to find out which varieties are best for early harvest on your farm.
- Harvest blocks that normally have higher CCS. Some soils tend to produce crops with higher CCS than others.
- In-field compaction and stool damage will limit ratoon yield potential. Consider implementing a controlled traffic system or consider increasing row spacing, so that blocks can be harvested in moist conditions without damaging the stool.
- Blocks and sidings need to be accessible with all-weather haulout tracks. Improve haulout tracks to make them more trafficable.
- Fertilise cane for early harvest differently. Apply fertiliser early in the previous year and do not apply too much nitrogen. It may be better to apply less nitrogen on cane for early harvest, so that the crop uses up the fertiliser early and begins to mature.



- Plan at least one year in advance for early harvest. Identify the right block, have the right variety growing in it and manage it for early harvest.

For further information or assistance to develop farm management strategies for early harvested cane contact BSES Herbert Extension Staff on 4776 2500.

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APPENDIX 2 – Anon. (2006)

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MODDUS®

Issue 1 - August 2006 brought to you by Syngenta

Moddus Murmurs

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Welcome to our first update on the MODDUS pilot project, brought to you by Syngenta. To date results are looking promising and we will continue to update you as harvesting progresses.

OVERVIEW

We would like to take this opportunity to thank everybody involved in the Herbert, Burdekin, Tully and Mackay pilot programs, including those accredited growers who may not have put fields in but have shown interest.

We would particularly like to thank our pilot program partners, Canegrowers, BSES, HCPSL, CSR, Mackay Sugar and MAPS, who have been key to implementing the pilot in the field.

SIIF FUNDING

Last year it was suggested that MODDUS would be an innovative tool likely to attract industry funding support. With Syngenta's encouragement, Canegrowers applied for a SIIF (Sugar Industry Innovation Fund) grant from the Queensland government. The application was developed by Canegrowers Association, with the assistance of the Sugar Resource Officer for the Tully / Herbert region and Syngenta.

We recently received notification that this application was successful, having been approved by both the Deputy Premier, Treasurer and Minister for State Development, Trade and Innovation Hon Anna Bligh, and the Minister for Primary Industries and Fisheries, Hon Tim Mulherin. This SIIF funding means that 50% of the cost of the product and application for the growers involved in each of the Herbert, Burdekin, Tully and Mackay region pilot programs will be paid for by the government.

The success of the application is due to the potential benefits of MODDUS, as well as the interest in the innovative risk sharing process that we are evaluating. This support from the Queensland state government reinforces the importance of MODDUS to the Australian Sugar Industry.

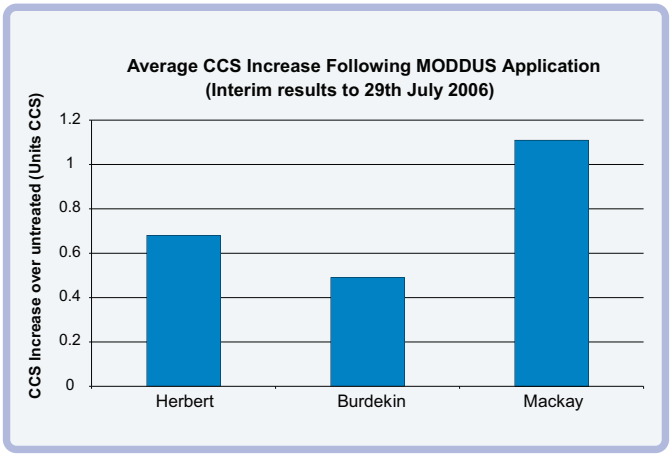
An invoice note explaining payment procedures is enclosed for all pilot participants. This incorporates aerial application costs, as well as MODDUS product costs and the government's SIIF Funding subsidy.

RESULTS TO DATE

At this stage, the analysis of available data indicates we are getting some good additional sugar for growers with MODDUS application, and we are also learning a great deal more about the technology and how it can fit best into the Australian Sugar Industry.

As at the 29th July, 2006, approximately 90 of the 108 MODDUS treated blocks in the Herbert, 10 of the 19 treated blocks in the Burdekin and 21 of the 26 treated blocks in Mackay, have been partly or fully cut. Most are indicating a strong response to MODDUS.

The graph below shows the average CCS increase following MODDUS application for the Herbert, Burdekin and Mackay Regions.



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Moddus Murmurs: Issue 1, Aug 06

Update on the Moddus Pilot Project

MODDUS®

Please note that these are interim results, which do not include the full data set as some blocks are only partly cut due to the wet season.

Individual results have been as high as 1.7 units through to zero. This variation in response is not entirely unexpected, as environmental factors are known to impact on MODDUS results. The results generated by the 2006 Pilot Program will give us a better understanding of the factors at play.

OBSERVATIONS

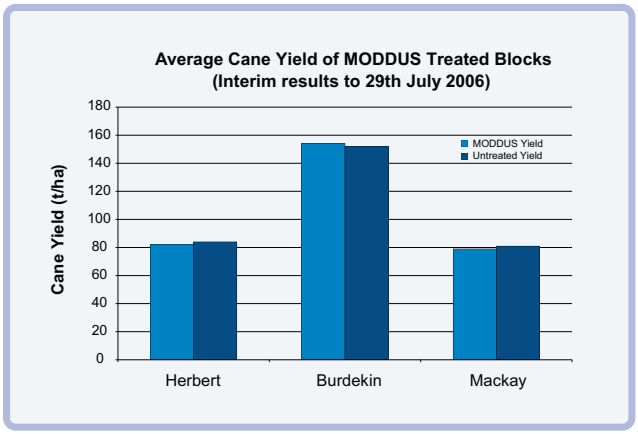
Based on the results so far, we estimate this small pilot program will generate an average improvement in value of $2-$4 per tonne for MODDUS treated blocks this year.

An early trend, as suspected, is that the more heavily flowered blocks are showing a significant visual shortening (or even aborting) of the flower and stem, but giving small or insignificant responses.

Visual effects in the crop

We have noted some visual differences in crops, besides flowering effects. In crops that have been providing a strong response, we have observed a normal growing point shortening between 5 to 10 cm. Often these crops have been providing the bigger responses of 1 unit CCS and above. This shortening of the growing point has not resulted in any significant loss of cane yield.

The graph below shows the average cane yield for MODDUS treated and untreated strips in the blocks harvested to date.



MODDUS is affecting the growth but not the number of nodes at the growing point of the plant. Consequently the leaves that have been produced during the time from application to now are also notably shorter. This is giving the canopy a more open look, and has been noted by many harvester operators. In crops that are heavily infected with Orange rust, this effect is more obvious.

Ratoons

The ratoons from the earliest harvested crops are now well advanced and the MODDUS effects are quite clear in some blocks. As we have seen in previous research, the crops that have given the bigger responses are showing the greater effects in the ratoon.

The MODDUS treated ratoons have shorter shoots, but many more of them. Since the MODDUS pilot fields are now mapped we can follow the ratoon through to next harvest to monitor any effects, including the possibility of an increase in yield due to a healthier plant stand.

LATE SEASON UPDATE

With the excellent results that we have been experiencing with MODDUS so far this season, there is a great deal of interest in a late season use pattern.

With only approximately 3-4 weeks of harvest completed, there are roughly 17 to 18 weeks still to go, potentially pushing harvest into December. This may be an ideal opportunity to target the last round of harvest with another application. The high current soil moisture and the potential for suckering should provide conditions that will give good results.

We are currently working with our scientific team and BSES to develop workable agronomic guidelines for a late season pilot. We will be in touch soon.

Again, many thanks to everybody involved in the program, especially the growers, harvester crews, and BSES. In particular we would like to thank HCPSL who have provided enormous assistance in managing the Herbert data from this exciting project.

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Moddus Murmurs: Issue 1, Aug 06

Update on the Moddus Pilot Project

APPENDIX 3 – Anon. (2006)

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MODDUS®

Issue 2 - December 2006, brought to you by Syngenta

Moddus Murmurs

Moddus Murmurs
Moddus Murmurs

MODDUS®

As the end of the 2006 sugar crush draws closer, it's time to reflect and report on the value of this year's MODDUS Pilot Program. From day one it has been an almighty concerted effort from all involved, and with the potential for MODDUS to substantially drive productivity and profitability, one which has been watched with interest by government, local communities and the entire sugar industry.

From a research perspective, the pilot program has furthered our knowledge of MODDUS and the environmental and agronomic conditions required to ensure maximum response. More importantly, from a profitability and productivity angle, it has generated very positive results.

A total of 117 blocks were treated in the Herbert, 26 at Mackay and 19 in the Burdekin, with the average CCS increases for the three regions being 0.70, 0.46, and 0.87 units respectively.

CCS improvement ranged from a high of 1.8 units, down to a few blocks recording no increase in CCS. The average results were in the range of 0.5 – 1.0 units. This represents an average improvement in gross value of $2-$4 a tonne of cane from MODDUS.

Region	Average CCS Increase	Average Cane Yield (t/ha)	Average Sugar Yield Increase (t/ha)	Average Increase in Gross Value* ($/ha)
Herbert	0.70	78	0.55	$209
Burdekin	0.46	161	0.74	$280
Mackay	0.87	92	0.80	$304

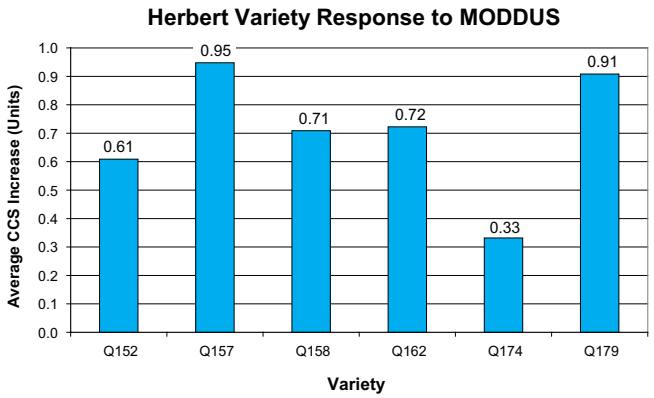
* Based on estimate sugar price = $380/t sugar

Variety Response

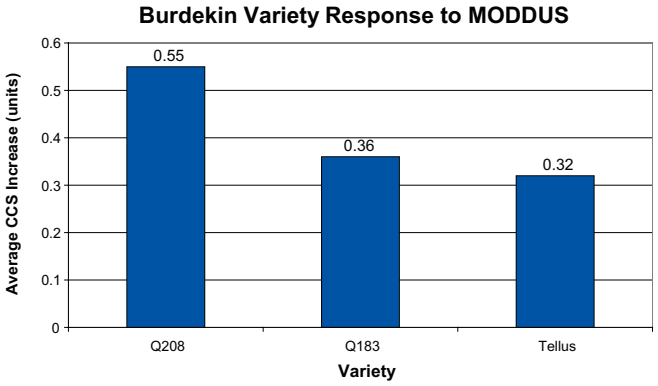
As expected, some varieties responded better to MODDUS than others. Prior to the pilot program, sugar cane varieties were classed as either 'responsive' or 'variable'. 'Responsive' varieties on average show a greater increase in CCS following MODDUS application than 'variable' varieties. 'Variable' varieties can show a good response to MODDUS under the right conditions. 'Responsive' varieties typically have lower average CCS, higher yields and are later maturing; examples include Q138, Q157, Q179 and Q208. 'Variable' varieties usually have a higher average CCS and are early maturing, such as Q121, Q174 and Q186.

Q174 was the least responsive variety in the Herbert with an average increase in CCS of 0.33 units. In contrast, Q157 showed an average increase of 0.95 units in both the Herbert and Mackay. Overall the results confirmed our classifications of varieties as responsive or variable.

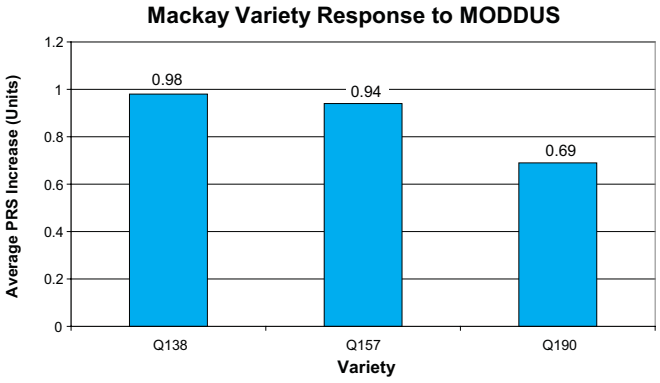
The following graphs reveal the average increase in CCS per variety and region.



Average cane yield for all varieties = 78 t/ha



Average cane yield for all varieties = 161 t/ha



Average cane yield for all varieties = 92 t/ha

MODDUS®

Visual effects of treated blocks

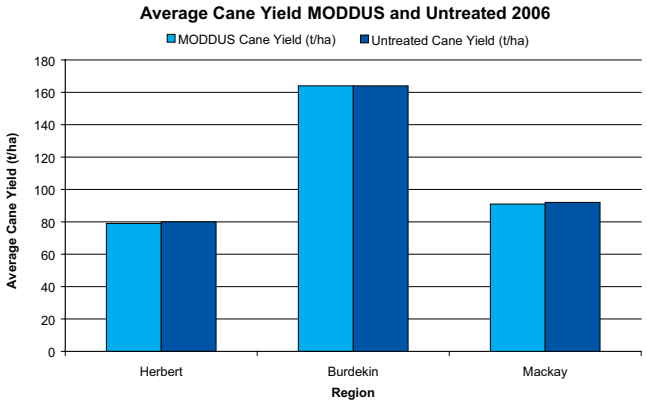
Across all pilot blocks were some obvious visual differences between MODDUS treated and untreated cane. The most prominent was that MODDUS cane had a shortened growing point of 3 to 5cm with slightly shorter, wider and more upright leaves, as well as shortened or aborted flowers.

Lawrence DiBella from BSES, with an untreated plant (left) and a MODDUS treated plant (right)

Yield

As harvest approached, a number of growers were concerned that MODDUS would cause a decrease in yield. This concern evolved due to MODDUS treated cane appearing shorter due to the visual growth effects on the cane top, leaves and flowers. However, during harvest, the extra top and leaves are blown out of the extractor, resulting in no difference in millable stalk yield being delivered to the mill.

Across all of the trials there was no difference in average yield between the MODDUS treated strips and untreated strips as shown in the graph below. This is further supported by the results of previous trials in Australia, as well as experiences from overseas.



Effect on Ratoons

As explained in the accreditation meetings, MODDUS often has a pronounced effect on the visual appearance of the ratoon crop. Ratoons following a MODDUS application may initially be a little slower to emerge, shorter and darker green in colour than untreated ratoons, but have 40 – 50% more tillers. By harvest time the visual effects have disappeared and there is no difference in cane yield.

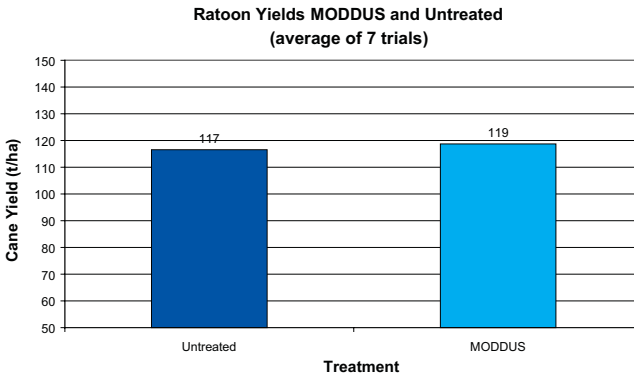
Above: MODDUS treated ratoons 79 days after harvest (27 shoots/m)

Above: Untreated ratoons 79 days after harvest (16 shoots/m)

Moddus Murmurs: Issue 2, Dec 06
Update on the Moddus Pilot Project

MODDUS®

The following graph shows the average yield of MODDUS treated and untreated ratoons from seven trials conducted in the Herbert and Burdekin over the last two years. In some trials there was a trend towards higher ratoon yields following MODDUS application. This has also been proven in Brazil, where it is attributed to the increase in root vigour, which allows the crop to better forage for moisture and nutrients.



MODDUS Review and Planning Workshop

A workshop was held last month in Ingham to review the MODDUS Pilot Program and to consider plans for next season. Representatives from BSES, Canegrowers, Mackay Sugar, CSR, Syngenta and local growers were in attendance. All participants were encouraged to put forward their views on the pilot program, as well as suggestions for MODDUS going forward.

Moddus Review and Planning Workshop Participants.

It was a very valuable meeting for Syngenta as it was an opportunity to hear the thoughts of stakeholders firsthand. All feedback generated from the workshop has been taken on board and will be considered in our MODDUS planning. The general outcomes of the workshop were that: MODDUS is a valuable management tool; the risk share model has benefits for all involved; the grower accreditation process should continue; and Syngenta should maintain its research into variety response, higher rates for larger crops, influence of irrigation and benefits in following ratoon crops.

Participants at the Review and Planning Workshop present their ideas to the group

Risk Share Model

The innovative risk share pricing model was designed to allow growers to capture the benefits of MODDUS, whilst minimising financial risk associated with variable responses. A flexible pricing model such as this allows growers in a range of conditions to economically use the technology to improve their profitability and deliver broader productivity gains to the value chain. Broader productivity gains include achieving more sugar per ha and allowing growers more flexible harvest timing, along with transport and milling efficiencies.

Based on the positive feedback received at the Ingham workshop alongside some suggestions for improvement, Syngenta is in the process of developing the 2007 commercial program.

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Moddus Murmurs: Issue 2, Dec 06

Update on the Moddus Pilot Project

MODDUS Moving Forward

Previous trials have demonstrated that there are no adverse affects on ratoon yields following MODDUS application. We will be monitoring ratoons from this year's treated crops through to next harvest to confirm and quantify additional positive effects, including possible increases in yield due to a healthier plant stand and better root systems allowing more efficient water and nutrient uptake.

Charissa Rixon and Lawrence DiBella inspect ratoons of MODDUS treated cane

The potential for suckering as a result of high soil moisture following North Queensland's heavy September rain and the likelihood that harvest will extend into December has prompted us to undertake some late season applications. Nine blocks were treated in the Herbert Region in mid September and we look forward to presenting these results as soon as they are received.

Syngenta is expecting registration for MODDUS early in 2007, but while this is pending, we are busy working with program partners to put plans in place to help ensure growers achieve optimal results.

We look forward to continuing to work with you as we progress further with MODDUS trials to enhance our knowledge of this very unique and exciting product.

Syngenta representatives with Moddus Accreditation participants

Many thanks again to our pilot program partners, including BSES, HCPSL, Mackay Sugar, CANEGROWERS, CSR, MAPS and the participating growers. The collaboration of the industry in taking the initiative to adopt new technology to assist the competitiveness of the Australian sugar industry has been fantastic. With this commitment we are on our way to enhancing the productivity, profitably and consequent sustainability of the Australian sugar industry.

Yours sincerely,

Bryce Davies
on behalf of the Syngenta MODDUS team

Moddus Murmurs: Issue 2, Dec 06
Update on the Moddus Pilot Project

APPENDIX 4 – Anon. (2006)

MODDUS® Pilot trial

In partnership with Syngenta.

Find out how much Moddus can enhance your sugar crop's production. Take part in an exciting trial exclusive to the cane growers of the Herbert River region.

For further information, please contact the Syngenta Technical Product Advice Line: Freecall 1800 067 108 Freefax 1800 805 871 or visit our website.

www.syngenta.com.au

MODDUS is not yet registered. A registration application is currently before the APVMA. Some details above may be subject to change during the registration process. ® Registered trademark of a Syngenta Group Company ™Trademark of a Syngenta Group Company *Registered trademark. ABN 33 002 933 717 Syngenta Crop Protection Pty Limited 2-4 Lyon Park Road, North Ryde NSW 2113. All products written in uppercase are registered trademarks of a Syngenta Group Company. The information contained in this brochure is believed to be accurate. No responsibility is accepted in respect of this information, save those non-excludable conditions implied by any Federal and State legislation or law of Territory. If you do not wish to receive further information about Syngenta products, please phone 1800 067 108. **SYN058B FEB 06/0XX**

BSES Sugarcane for the future · CANEGROWERS · CSR SUGAR · HCPSL Herbert Cane Productivity Services Ltd

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Contents

MODDUS is a new management tool from Syngenta that can improve the profitability of the Australian sugar industry by enhancing sugar content and providing greater harvesting flexibility.

Harvesting inefficiency

Commercial Cane Sugar (CCS) levels peak in most Australian varieties over a four to six week period. However, it is not feasible or efficient to harvest, transport and mill the entire crop in this short period of time. This problem is compounded by the natural variation in yearly cane production and fluctuations in world sugar prices.

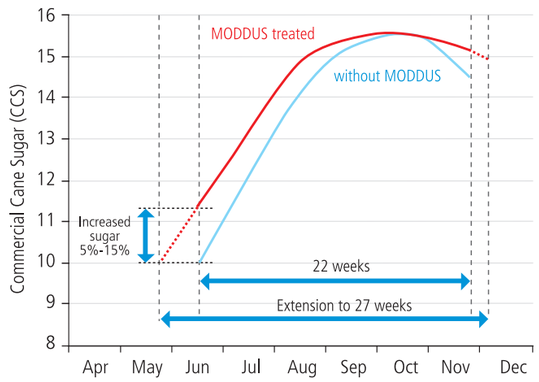
Enhanced sugar content

MODDUS is a sugar enhancer that increases CCS early and late in the season by redirecting the plant's energy from vegetative growth into the production and storage of sugar. It was developed by Syngenta, one of the world's leading crop protection companies.

Proven in Australia

More than 90 experimental and commercial trials conducted by BSES, CSR Sugar and Syngenta throughout all the major sugarcane regions in Australia have confirmed MODDUS consistently increases CCS.

Sugar increase and harvest season potential



Graph 1

Greater harvesting flexibility

Applied before the usual harvesting season, MODDUS inhibits vegetative plant growth and allows earlier harvesting without the penalty of low CCS. Applied later in the season, MODDUS helps maintain the sugar content levels by suppressing suckering and re-growth. MODDUS can also be applied tactically to assist in controlling suckering and regrowth following mid-season rainfall.

Potential industry benefits

MODDUS offers many potential benefits for the Australian sugar industry by extending the harvest period without any compromise in CCS. These benefits include:

Increased productivity

- Increased sugar production (per tonne cut cane)
- Reduced harvesting costs (per tonne of sugar)
- Higher producer returns

Reduced sugar loss

- Suppressed late season CCS decline
- Suppressed mid-season growth resulting from heavy rainfall

Increased harvesting and milling flexibility

- Potential to extend harvest period
- Improved harvesting, milling and transport efficiencies
- Improved viability of cogeneration or ethanol production

How MODDUS works

Active ingredient

MODDUS contains 250 g/L of the active ingredient, trinexapac-ethyl, which belongs to the cyclohexanedione group of compounds. Developed by Syngenta, trinexapac-ethyl is registered for use in a number of crops throughout the world, including sugarcane.

Mode of action

Plants contain natural growth hormones called gibberellins. These compounds, which include gibberellic acid (GA_1), are produced by young tissue and stimulate cell division and elongation. The active ingredient in MODDUS inhibits the synthesis of gibberellic acid, thereby suppressing vegetative growth and enhancing the production and storage of carbohydrates (i.e. sugars) for later use.

Uptake and translocation

MODDUS is rapidly absorbed by the stems and leaves and then translocated upward to the growing parts. MODDUS is rainfast within two hours of application.

Biological activity

The active ingredient in MODDUS, trinexapac-ethyl, has very little direct biological activity. It is converted into the biologically-active acid form within four hours of absorption, slowing plant growth almost immediately. The maximum beneficial impact on sugar levels occurs 35–56 days after application.

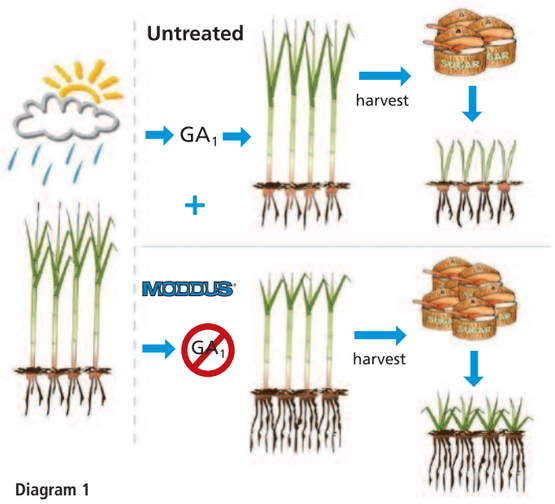


Diagram 1

Crop and environmental safety

Crop safety

MODDUS is well-tolerated by the sugarcane plant. Used correctly, there are no adverse yield effects on the harvested crop or in subsequent ratoon crops. Avoid application drift or overspray onto young plant or ratoon sugarcane. Application drift or overspray onto young ratoon cane will slow the growth of the crop. Depending on the concentration of the drift, ratoon cane will metabolise the product and will recommence normal vegetative growth after 35 to 56 days once the active ingredient has broken down.

Simulated MODDUS drift onto 30 cm ratoon cane 72 days after treatment.

(Syngenta 2005)

Safety to non-target species

At recommended rates MODDUS has very little effect on non-grass species. Drift onto grass crops, such as maize, sorghum, turf and grass pastures, can reduce vegetative growth and biomass production.

Environmental safety

Due to the size and nature of the sugarcane plant, the vast majority of the active ingredient is intercepted and absorbed by the leaves and stems. Very little active ingredient reaches the soil surface. The limited amount of residues that reaches the soil surface or water is rapidly broken down when exposed to sunlight, minimising the potential for leaching. Any residues incorporated into moist soil are broken down by micro-organisms into an acid form (half-life ~1 day), intermediate compounds (half-life ~7 days) then mineralised into carbon dioxide and water (half-life ~3 months). The short persistence of the active ingredient in the environment significantly reduces the potential for bioaccumulation or for it to move through the soil to reach environmentally-sensitive areas, such as the Great Barrier Reef. The active ingredient in MODDUS is practically non-toxic to most wildlife, including birds, bees and soil micro-organisms. However, it does inhibit the growth of aquatic higher plants, algae and marine diatoms.

Visual effects of MODDUS

Standing crop

In most cases, there are few clear visual symptoms of the effects of MODDUS. Some symptoms that may be apparent include:

- A shortening or slight thickening of the top nodes
- Flowering may be inhibited
- Flowers may appear bunched, especially if MODDUS is applied too late
- Plants may appear slightly yellow in some varieties
- Less inclined to lodge

Flowers may appear bunched, especially if MODDUS is applied too late (MODDUS treated right, untreated left)

(Syngenta, 2005)

After heavy rainfall

The application of MODDUS during the season may produce the following visual effects:

- Mild to strong inhibition of suckers, especially if applied before rainfall
- Less vigorous regrowth on top of the plant
- Less lodging

Enhanced root development

By redirecting energy away from foliar growth, MODDUS also improves root development which can enhance the plant's capacity to access soil moisture and nutrients, as well as improving its resilience to insect pests. This deeper, larger and more vigorous root system also assists tillering and re-growth in the following ratoon.

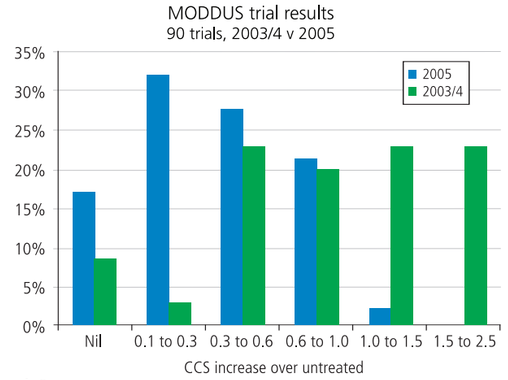
Enhanced root development in a sugarcane plant treated with MODDUS (left), untreated (right)

(Syngenta Brazil)

Improved shoot growth in ratoons

Crops treated with MODDUS have significantly more shoots in the following ratoon crop. These shoots appear darker and may be slightly shorter. The average of seven studies conducted in Australia across a wide range of soil types during 2004 demonstrated that treated crops had 43% more shoots in subsequent ratoon cane than untreated crops. This feature may increase the longevity and vigour of older crops.

Effect of MODDUS on shoot growth in ratoon cane



Graph 2
(Syngenta, 2004)

MODDUS significantly increases the number of shoots in ratoon cane

(Syngenta, 2005)

Agronomic factors for the successful use of MODDUS

To optimise sugar enhancement, MODDUS must be applied at the correct maturity stage and growing conditions. Syngenta has developed a Best Management Practice Program to help producers to maximise the performance of MODDUS in their crops.

Plant growth

MODDUS influences the production of the natural plant growth hormone, gibberellic acid. As such, the crop must be actively growing at the time of application. Do not apply to crops that are under stress due to excessively dry or wet conditions, frost, nutrient deficiency, disease or high insect pressure. In particular, soil moisture and nutrition levels must be sufficient to support an actively-growing plant through to harvest.

Crops with a yield potential less than 70 t/ha may not respond well to MODDUS owing to poor seasonal conditions, nutrient deficiency, stool damage or previous insect or disease challenge.

Timing

Apply MODDUS early in the season for optimum sugar enhancement. If applied during the season to suppress vegetative growth occurring after significant rainfall, apply MODDUS as soon as possible once any symptoms of waterlogging have worn off. This usually takes 3 to 4 days, depending on the soil type and drainage. If applied later in the season, MODDUS should be applied prior to CCS decline.

Flowering

Mature plants are less responsive to MODDUS. Do not use on crops starting to flower. Randomly sample 15 stalks, cut the stems vertically and inspect the formation of the flower within the crown of the plant. A well-formed seed head is indicative of a significant change toward full maturity of the plant. Care should be taken when using flowering as an indicator of maturity, as not all varieties flower and not all flowering varieties flower in all regions.

Varieties (especially Q174A)

In general, early season varieties are less responsive to MODDUS. The varieties Q96, Q117, Q120, Q127, Q152A, Q174A, Q195A, ArgosA and MIDAA must be well within all agronomic constraints and have a tested juice purity of 70–80% before applying MODDUS.

Juice purity

Plants should have a juice purity of 75–85% before application with MODDUS. However, as long as fields comply with all other agronomic factors there is no mandatory requirement for juice purity (excluding less responsive varieties, see above).

Number of green leaves

Crops should have a minimum of eight green leaves. A history of nutrient shortfalls, moisture stress, heavy disease or the plant being in advanced stages of maturity can be seen in a reduced number of green leaves.

Moisture and Temperature stress

Moisture and temperature stress limit vegetative growth. If growth is already limited then MODDUS may have little added benefit. Low humidity and/or high temperatures can cause moisture stress by exceeding the plant's maximum transpiration rate. Do not apply MODDUS if hot, dry conditions have existed for more than a week (>30°C, <50% RH) before anticipated application.

Lodging

Freshly-lodged crops can be heavily stressed due to extensive stalk damage. Do not apply to heavily-lodged crops. Sprawling crops are allowable, as long as adequate coverage of leaves and stems can be achieved. Lodged crops that have re-aligned their top growth may still give a response to MODDUS, provided there is no recent or excessive stalk damage.

Age of crop

Crops that are less than 10 months old may still be productively growing at the time of application. Application of MODDUS in crops younger than 10 months may reduce the total sugar potential of the crop.

Agronomic factors at a glance

Apply at correct maturity stage

- Juice purity must be less than 85%
- Not initiated flowering
- Minimum of 8 green leaves

Do not apply too early

- Do not apply to crops less than 10 months old
- Juice less than 75% (70% on early season varieties)

No benefit will be gained if the crop has stopped growing due to stress from

- Hot, dry conditions
- Lodging and stem cracking

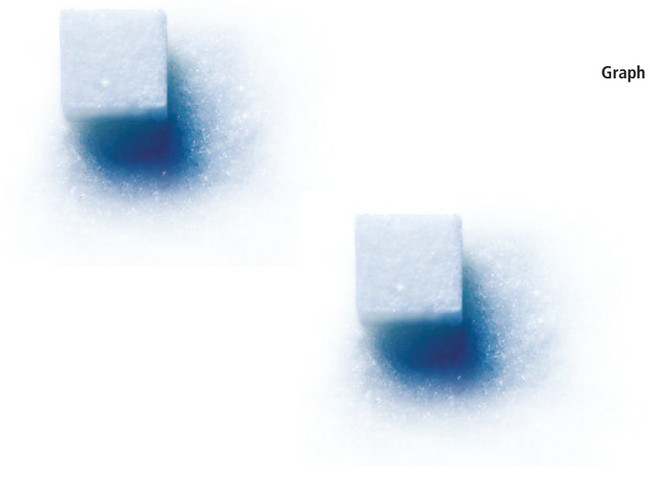
Proven in Brazil and Australia

Extensive research and commercial experience in Brazil and Australia have demonstrated that the application of MODDUS at 800 mL/ha to actively-growing sugarcane can significantly increase CCS.

International data

MODDUS is widely used in the Brazilian sugarcane industry. Commercial experience has demonstrated that:

- The application of MODDUS increases sugar production in most of the major varieties
- The application of MODDUS early in the season and under good conditions, can advance harvest date by at least 20 days
- MODDUS maintains sugar content if harvest is delayed
- MODDUS enhances CCS for early and late harvest. Ultimately CCS levels in untreated crops will peak at similar levels to MODDUS treated cane
- The application of MODDUS late in the season reduces vegetative growth and assists in maintaining sugar content following the onset of rain
- MODDUS improves root development, tillering and initial ratoon re-growth, resulting in better subsequent crops
- MODDUS has greatest effect on well-grown, healthy, vigorous crops.



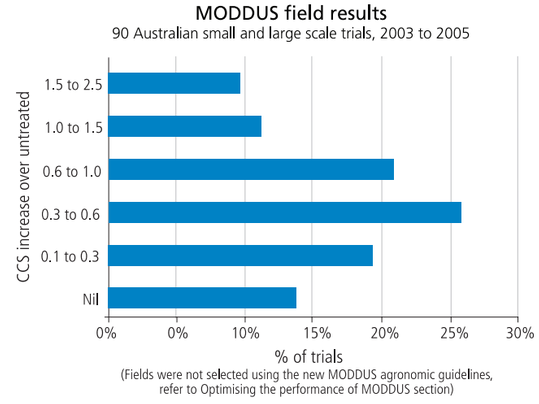
Australian data

Experimental and commercial trials conducted in Australia since 2000 have demonstrated that the application of MODDUS at 800 mL/ha can significantly increase CCS when applied in accordance with label instructions.

To date, more than 90 trials have been conducted at Innisfail, Tully, Ingham, Burdekin, Proserpine, Mackay, Sarina and Bundaberg, as well as in southern Queensland and northern NSW.

MODDUS produced significant increases in more than 90% of those trials. There were no responses that were negative. Those trials that did not record a significant response involved mostly very mature crops that had initiated flowering or were heavily moisture-stressed before, at or after application.

The responses to MODDUS can vary. This variation occurs across a field, between fields, between varieties and between seasons. This variation can be minimised by following the agronomic factors mentioned previously.



Graph 3

Herbert River Region Pilot Program

Why a pilot program?

Currently Syngenta Crop Protection has an application lodged with the APVMA (Australian Pesticides and Veterinary Medicines Association) for the full registration of MODDUS in sugarcane as a sugar yield enhancer. Prior to this registration, use of MODDUS can only be conducted by permit.

A successful permit application was made by Canegrowers (with the support of Syngenta Crop Protection) to the APVMA for a permit to use MODDUS prior to registration. This permit, PER8955, allows for up to 4,000 ha to be treated with MODDUS in the 2006 harvest season.

To better understand how to optimise MODDUS in large scale conditions where environmental and agronomic conditions will vary, it was decided that the best way to use this permit was by undertaking a pilot program.

The Herbert River region was selected for the pilot program as it provides a range of environments and agronomic conditions coupled with significant expertise and collaboration from industry partners including BSES, HCPSL and CSR.

Why a novel risk sharing model?

The results collected from over 90 local trials show that Moddus can increase CCS. However the degree in response can vary based on a number of interdependent factors. To share the risk of this variation in response, Syngenta has developed a novel way to charge for MODDUS.

For the increase in sugar content growers will be charged based on the average response to MODDUS that the selected benchmark fields provide. This response is matched against a pre-agreed sliding scale of the cost of the product. This sliding scale will be based on the incremental increase in the value of sugar that MODDUS provides. A small increase in sugar/ha will dictate a small charge and a large increase will dictate a larger charge. Syngenta's extensive global and Australian research has shown that MODDUS, used correctly, does not have a negative effect on sugar production (see "Proven in Brazil and Australia"). In the situation where there is no response to MODDUS, then only the application fee will be charged.

The Pilot program process: step by step

1. Growers and the aerial operator complete accreditation
2. Growers complete the agreement indicating their willingness to participate in the pilot program and follow the agreed process
3. Growers nominate fields
4. All fields are inspected by HCPSL to confirm suitability
5. A representative number of the inspected fields are appointed for use as benchmark fields by the BSES
6. Syngenta inform the contracted aerial operator which fields will be treated with MODDUS
7. Growers co-ordinate with the aerial operator and HCPSL to organise the correct timing for the MODDUS application
8. MODDUS is applied to all fields (with benchmark fields having 50% treated and 50% untreated)
9. All the crop in the pilot program is harvested
10. The average difference in sugar/ha between the treated and untreated Moddus blocks is calculated by BSES
11. The agreed pricing matrix is applied by BSES based on the above results
12. CSR are informed by BSES of the total value, by grower, to be deducted for payment of MODDUS and application
13. CSR will then transfer these funds to the appropriate companies.

Grower Agreement

- Agreement to allow BSES, HCPSL, CSR Sugar and Syngenta Crop Protection to exchange grower information related to the Pilot Program
- Agreement that any or all of the fields nominated by the grower may become part of the Benchmark Program (see overleaf)
- Agreement to the sliding-scale pricing structure of MODDUS
- Authorisation for CSR Sugar to deduct the payment for MODDUS as instructed by BSES according to the agreed sliding-scale pricing structure for MODDUS and the application fee.

The agreements are not legally binding until the product is applied. Signing the agreements merely ensures that should a grower wish to participate, then all necessary agreements and process are in place.

Field nomination

Growers who complete the accreditation program can nominate fields for possible inclusion in the Herbert River Region Pilot Program. Nominated fields will then be inspected by HCPSL officers and assessed for their suitability (see "Agronomic factors for the successful use of MODDUS"). Growers will be notified which fields have been accepted into the Pilot Program or Benchmark Program (see below). HCPSL officers will then collect the signed Grower Agreement (see previous page).

Benchmark Program

BSES and HCPSL officers will select a representative number of nominated fields for the use as a benchmark. The performance of these fields will be carefully monitored by HCPSL officers and used to determine the average sugar level response. This information will be used by BSES to determine the payment for the increase in sugar content attributable to MODDUS. Half of each benchmark field will be treated with MODDUS. The other half will remain untreated. The fields will be harvested normally, with each treated and untreated area recorded on separate dockets. Growers that have fields in the Benchmark Program will only be charged for the area treated with MODDUS. CSR and all growers participating in the program will be notified by BSES or HCPSL of the total charge. CSR will then subsequently deduct this cost from grower payments for payment to Syngenta (or its nominated company). BSES, HCPSL or Syngenta staff will be in attendance at harvest to assist with this process.

Application of MODDUS

MODDUS will be applied by helicopter to ensure accurate application during the Herbert River Region Pilot Program. Syngenta will provide MODDUS to an accredited aerial operator for application in a timely manner before the start of the harvest season. The objective is to create application efficiencies by having a co-ordinated approach and spraying more than one field at time. CSR will deduct the cost of the aerial application at the end of the season for payment to the aerial applicator.

Harvest and calculation of charges

Accredited growers will harvest their crop within the permit guideline times. The cost of Moddus will then be calculated by BSES as described above. HCPSL officers will then notify the participating growers of the average increase in sugar/ha and the cost of MODDUS using the price matrix.

Good neighbour information

Most crop protection products used in the Australian sugar industry are applied using ground equipment. By comparison, MODDUS will be applied by helicopter during the Herbert River Region Pilot Program.

Plan now to avoid problems later

This increased aerial activity has the potential to raise community awareness and/or concerns about the safety of pesticides being applied. People who are not involved with crop protection products on a day-to-day basis often do not fully understand why these products are used or how they work. In these instances, misconceptions may quickly arise about the perceived risks to human and environmental safety.

The sugar industry can learn from the experience of other agricultural industries in managing community concerns about the aerial application of crop protection products. This collective experience has shown that the best defence against misinformation, misconceptions and mistrust is to clearly and proactively provide accurate information to your neighbours and community.

Study your farm map and note where the nearest houses, roads and communities are located. Often a quick phone call or visit to your neighbour (even if they are a cane grower) or councillor to explain that you will be using a helicopter to apply a product will be appreciated.

Some things you should convey to your neighbours and community about MODDUS

About the product

- You will be using a product to help manage your sugarcane crop
- This product has the potential to significantly increase harvesting, transport and milling efficiencies for the benefit of the wider community
- It is not an herbicide
- It is not a hormone
- It has very little activity on non-grass species
- It does not affect animals
- It is practically non-toxic to humans, fish and wildlife
- It breaks down in the environment very quickly
- When MODDUS is used according to the label, it will not cause damage to environmentally-sensitive areas, such as creeks, waterways and the Great Barrier Reef.

The active ingredient is widely used in Australia and around the world.

About aerial application

- The applicator is accredited with the Australian Aerial Agriculture Association and trained in the use of MODDUS
- The applicator will apply the product to the crop in a professional manner
- The applicator will apply the product in such a manner that it will not drift onto their house or yard
- The applicator will apply the product in such a manner that it will not drift onto sensitive areas, such as waterways and roads.

If they have any concerns

- If they would like any further information, contact Syngenta Crop Protection on 1800 067 108.
- If they have any concerns during application, contact the aerial operator immediately by phone or UHF. Provide a contact name and number.

Application guidelines

Application rate

MODDUS is applied at 800 mL/ha before harvest.

Application method

Aircraft: Apply in a spray volume of 25–60 L/ha. Use the lower spray volume if there is a cross wind of at least five knots. Use the higher spray volumes when applying to dense crops. Ensure complete coverage of all leaves and stems is obtained. Note that only helicopter application will be used in the Herbert River Pilot program.

Ground: MODDUS should be applied in a minimum of 150–500 L/ha water. Use the higher spray volumes when applying to dense crops. Ensure thorough coverage of leaves and stems. Target a fine to medium spray quality.

Mixing

MODDUS is a low odour, highly stable emulsifiable concentrate (EC) formulation that mixes readily with water. Partly-fill the spray tank with water and engage the agitation system. Add the correct amount of product to the spray tank and then fill the tank to the required level. Maintain agitation throughout mixing and spraying operations. It does not require addition of any adjuvants.

Tank-mixing

MODDUS is physically compatible with a wide range of products. However, the biological compatibility of these mixtures may not have been fully tested under all environmental and biological conditions. MODDUS should not be tank-mixed with other products to ensure the growth regulatory response is not adversely impacted.

Re-entry period

Do not enter treated areas until the spray has dried unless wearing cotton overalls and chemical resistant gloves. Wash clothing after each day's use.

Withholding periods

Do not harvest, graze or cut for stock food for six weeks after application. An export slaughter interval is not required when used as directed.

Storage and disposal

Store in closed original container in a cool, well ventilated area. Do not store for prolonged periods in direct sunlight. Empty contents fully into application equipment. Close all valves and return to point of supply for refill or storage.

Safety

MODDUS may irritate the eyes and skin. Repeated exposure may cause allergic disorders. Avoid contact with the eyes and skin. Wear cotton overalls buttoned to the neck and wrist, a washable hat, elbow-length PVC gloves and face shield or goggles during preparation and spraying. If concentrated product or mixed spray comes in contact with the eyes, wash out immediately with water. Wash hands after use. Wash gloves, face shield or goggles and contaminated clothing after each day's use.

First aid

If poisoning occurs, contact a doctor or Poisons Information Centre on 131 126.

Additional hazard information is contained on the Material Safety Data Sheet, which can be obtained from Syngenta.

Always read the label directions before use.

APPENDIX 5 – Anon. (2007)

MODDUS®

Issue 3 - May 2007, brought to you by Syngenta

Moddus Murmurs

MODDUS®

Since the last MODDUS update the sugar price has taken a turn for the worse. To make things even harder the Australian dollar has headed in the opposite direction. Luckily, the risk-share pricing model means that growers will still be able to profitably apply MODDUS in 2007.

2007 MODDUS Program

Only growers who have completed the accreditation course are eligible to participate in the 2007 MODDUS program. The striking MODDUS mobile, equipped with a plasma screen, toured North Queensland during February and March with accreditation participants piling in and praying the air conditioner would stand the humidity! (Thankfully it did!)

In conjunction with BSES, MODDUS accreditation sessions were held in the Tully, Herbert, Burdekin, Proserpine, Mackay and Sarina regions where the 2007 MODDUS program will be conducted. There were a total of 372 attendees at the 35 accreditation sessions, which was a fantastic turn out.

Following the accreditation sessions, interested growers nominated blocks for involvement in the 2007 program. These blocks were inspected and those that fit the agronomic criteria regarding growing conditions, variety and crop age, have been selected for inclusion in the 2007 program.

We have a total of 3000 ha signed up for early season applications this year, with 250 ha in Tully, 1000 ha in the Herbert, 700 ha in the Burdekin, 150 ha around Proserpine, 650 ha at Mackay and 250 ha in the Sarina region. Early season MODDUS applications commenced in May and should be completed by July. Depending on weather conditions there may be opportunities for mid and late season applications as well.

'There were a total of 372 attendees at the 35 accreditation sessions, which was a fantastic turn out.'

syngenta

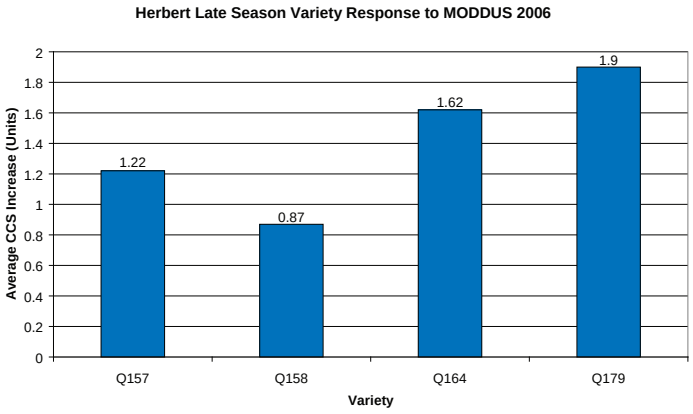
Moddus Murmurs: Issue 3, May 07

Update on the Moddus Pilot Project

MODDUS®

Late season results

Most of the MODDUS work in Australia has focused on crops harvested in the first two rounds of the crushing. In early September 2006, the Herbert received heavy rain across the district and it was a good opportunity to discover how well MODDUS can perform late in the season. Nine blocks in the Herbert were treated with MODDUS in mid September. The total area was 31 ha and included four varieties, Q157, Q158, Q164 and Q179. The blocks were harvested in late November and early December, 9–12 weeks after application. The results were very pleasing with the average CCS increase being an impressive 1.4 units. However, we will continue to evaluate the performance of MODDUS in late season trials in 2007.



2006 Pilot Program Data Analysis

To ensure the accuracy of our benchmarking system, comprehensive statistical data analysis was performed on all results from the 2006 pilot program. We are pleased to report that the analysis confirmed the average CCS increase recorded using MODDUS was statistically significant in all districts and that the benchmark blocks were representative of the growers' results.

This analysis also confirmed that:

- lodged cane received a smaller CCS increase than non lodged cane;
- while flowering cane, or cane in early stages of flowering, achieved a CCS increase when treated with MODDUS, cane that had not yet flowered had a greater increase; and
- cane variety influences the CCS response to MODDUS.

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Moddus Murmurs: Issue 3, May 07
Update on the Moddus Pilot Project

MODDUS®

2006 Pilot Program Charge

The aerial application cost and 90% of the expected MODDUS product cost has been deducted from the March cane pay of growers who participated in the 2006 pilot program. This was originally scheduled to happen in October 2006, but took longer than expected to organise. The good news for growers was they received an additional five months interest free! The other good news was that thanks to Herbert River CANEGROWERS obtaining Sugar Industry Innovation Funding, growers only had to pay 50% of the total 2006 MODDUS product and application costs.

Payment of the final 10% of the MODDUS product cost will be required around June 2007, when the final sugar price is determined. CANEGROWERS will send participating growers an invoice for the specified amount at this time.

The cost of MODDUS is determined by the following calculation:

MODDUS price = 36% of the gross value of the incremental increase in sugar yield per hectare

Registration

MODDUS is not yet registered for use on sugarcane in Australia. We expect to receive registration for MODDUS this year. The Australian Pesticides and Veterinary Medicines Authority has granted Syngenta a permit that allows up to 9000 ha of sugarcane to be treated in 2007/08. This will enable the 2007 MODDUS program to proceed even if registration is not granted in time for the early season applications.

We look forward to updating you on the progress of this year's MODDUS trials. Should you have any further questions, please do not hesitate to contact myself or your local BSES representative.

Yours sincerely,

B. G. Davies

Bryce Davies
on behalf of the Syngenta MODDUS team

syngenta

Moddus Murmurs: Issue 3, May 07

Update on the Moddus Pilot Project

APPENDIX 6 – Di Bella (2004)

BSES Limited

FINDINGS FROM THE 2004 INDUSTRY SURVEY
BSS264 ADOPTION OF AN OPTIMAL SEASON LENGTH
FOR INCREASED PROFITABILITY
by

LP DI BELLA

PR04010

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BSES Limited Publication
Project Report PR04010 **September 2004**

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The Queensland Department of Primary Industries and Fisheries contributed funding to BSES for development of this project. However, the opinions expressed here do not necessarily reflect the views of the Queensland Department of Primary Industries and Fisheries.

CONTENTS

SUMMARY

There is a large potential to increase total sugar production, individual grower and district CCS through better management of harvesting scheduling. Change management will be best implemented through active participation and involvement of all industry sectors.

BSS264 *Adoption of an optimal season length for increased profitability* aims to maximise CCS, sugar yields and industry profitability in the Herbert region by exploiting regional variation in CCS, soil moisture and trafficability.

This report presents the findings from the baseline survey results conducted within BSS264. The survey establishes a baseline on industry participants' views and opinions pertaining to harvest season length, crop management issues associated with an extended season length (and the 2004 early harvest trial), industry infrastructure utilisation, community impacts, development of alternative income streams, industry viability and cash flows. A similar survey will be conducted at the end of the project to assess changes in industry viewpoints and opinions.

1.0 BACKGROUND

There is a large potential to increase total sugar production, individual grower and district CCS through better management of harvesting scheduling. Change management will be best implemented through active participation and involvement of all industry sectors.

BSS264 *Adoption of an optimal season length for increased profitability* aims to maximise CCS, sugar yields and industry profitability in the Herbert region by exploiting regional variation in CCS, soil moisture and trafficability.

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The survey was developed by the industry working team overseeing and reviewing the project and the associated programs. The working team consists of representatives from CANEGROWERS, CSR Sugar, QMCHA, BSES and HCPSL. Prior to our undertaking the survey, the Herbert Regional Industry Board was consulted and subsequently modified and endorsed the contents and intent of the survey.

2.0 SURVEY DESIGN

Two growers from each of the 26 productivity forum areas in the Herbert River area were selected at random to be surveyed. The surveyed group accounts for approximately 7% of sugarcane growers in the Herbert River district, and some have financial interests in harvesting operations in the district.

The productivity forum areas consist of areas with similar climatic conditions and soil types (Figure 1) and each contains approximately 25 growers. The project industry working team believed that this sample size would provide a diverse and unbiased sample group to be assessed. It was decided that the names of participants would remain confidential and would not be disclosed to the project industry working team, industry and the wider community, with the only exception being the survey facilitator. This was to ensure that survey participants would not feel threatened or compelled to put their name to a document in which they could be personally identified. The survey was optional, allowing those selected to refrain from answering the survey if they so wished.

The survey comprised a series of introductory questions regarding the location(s) in which the survey participant farmed. Core survey questions consisted of yes/no questions, short answer questions, and questions where the participant was required to rate their opinions in numerical order of preference (Appendix 1 gives a copy of the survey).

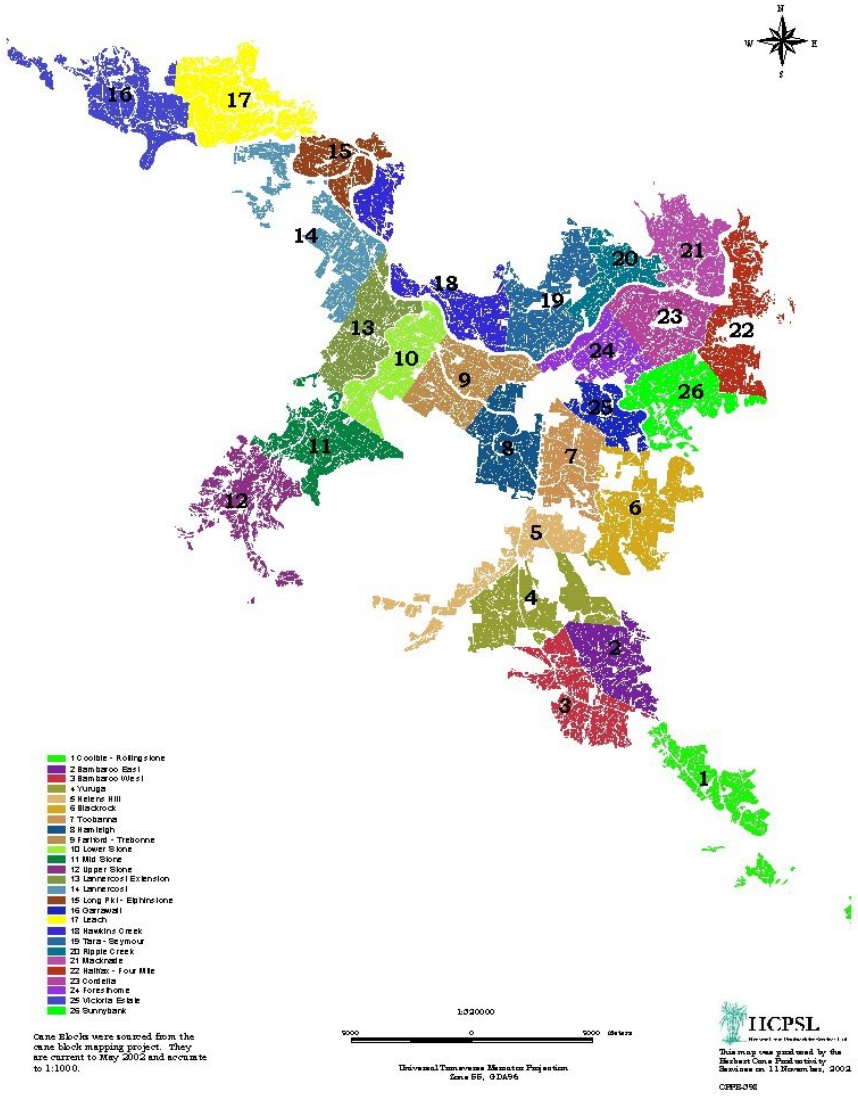

Figure 1 Herbert River Cane Productivity Forum areas

70% of participants completed the survey in a group format at BSES, with the survey facilitator (a BSES Extension Officer acting as the survey facilitator) going through the survey questions. Participants were not permitted to undertaken any dialogue with other participants during the duration of the survey so that people's views were confidential and were not influenced by the more vocal participants. There was also a number of industry observers present, mostly from the project steering group. Their role was to oversee the conduct of the survey and to offer clarification to any of the questions if required. The selected survey participants who could not attend the group meeting contacted by telephone by the survey facilitator and undertook the survey the telephone.

Participants were asked to answer the survey in an honest and sincere manner; to ensure that industry viewpoints were expressed.

The survey facilitator was requested only ask questions from the survey form and not to enter into any other dialogue during the duration of the survey interview.

3.0 SURVEY RESULTS

Forty-eight growers participated in the survey, two declined to be surveyed and two selected growers could not be contacted.

Location of farms from the surveyed group
Table 1 indicates the location(s) that survey participants farm within the Herbert River District; some participants farm in multiple locations.

Table 1 Location of farms (in relation to the productivity forum areas) of survey participants

Location	Number of respondents	Location	Number of respondents
Leach	4	Garrawalt	3
Coolbie-Rollingstone	3	Bambaroo West	2
Bambaroo East	3	Yuruga	2
Helen Hill	3	Blackrock	5
Toobanna	3	Hamleigh	3
Upper Stone	3	Mid Stone	2
Lower Stone	3	Fairford	3
Halifax/ 4 Mile	1	Sunnybank	3
Victoria Est.	6	Foresthome	4
Cordelia	4	Macknade	3
Ripple Creek	2	Tara-Seymour	5
Hawkins Creek	1	Lannercost Ext.	3
Lannercost	2	Long Pkt- Elphinstone	4

Participation in the 2004 early harvest trial
30% of those surveyed participated in the 2004 early harvest trial. The remaining 70% did not participate, but of this group 60% indicated that the early start trial was not offered in their subdistrict.

Reasons for not participating in early crop harvests
Participants were requested to rank on a 1-6 scale (1 being the highest priority and 6 being the lowest priority) in order of preference their reasoning for not participating in early crop harvests. Results are listed in Table 2.

Table 2 Reasons for not participating in early crop harvests

Issue	Ranking					
	1 Highest priority	**2**	**3**	**4**	**5**	**6 Lowest priority**
Ground too wet	29%	17%	6%	11%	11%	
CCS too low	6%	22%	17%	14%	6%	
Competing against high CCS areas	6%	9%	14%	8%	11%	11%
No incentives	20%	9%	8%	8%	20%	6%
Immature crops	3%	9%	17%	17%	14%	
Other (specify reason)	29%		3%			

Participants indicated that other reasons for not participating in the early harvest trial are:

- Not offered in my sub-district/ not asked to participate;
- Mill closed before I had an opportunity to supply;
- Poor mill performance.

Of those who participated in the early harvest trial, would they participate again?

70% of participants surveyed indicated that they would participate again. They indicated that it maybe more attractive by addressing the following issues:

- Compensation for lower CCS;
- Compensation for loss of production due to wet-weather harvesting;
- Allowing growers who own and operate farms in wet and dry areas of the district to be grouped together; to enable them to maximise CCS and yield potentials on their farm;
- Allow harvesting groups who start early in the harvesting season, finish early.

6% of participants surveyed indicated that they would not participate again because field conditions were too wet.

22% of participants surveyed indicated that may participate again. The reasons or concerns expressed by this group were: lack of financial incentives and weather conditions.

Should some parts of the district start and finish harvesting before other parts of the district?

74% of participants indicated that they were in favour of some parts of the district starting and finishing harvesting before other parts of the district.

10% indicated that they were not in favour of some parts of the district starting and finishing harvesting before other parts of the district.

16% indicated that they maybe in favour of some parts of the district starting and finishing harvesting before other parts of the district and gave the following reasons:

- Everyone should be able to start early, if possible;
- Drier areas to finish early if they start early;
- Dependant on crop growth being affected by drought;
- Weather conditions;
- If we can use ripeners;
- Low CCS concerns may prevent participation;
- Wet harvesting conditions may prevent participation;
- Early starters should not be allowed to impact on late starters;
- Mill performance a concern.

Would you be in favour of some areas always having the opportunity to harvest early?
66% of participants indicated that they were in favour of some areas of the district always having the opportunity to harvest cane early.

13% indicated that they were not in favour, while 21% indicated that they may be in favour. The participants who indicated that they may be in favour had similar reasons to those stated in the question above.

On the basis that a 26 week mill operation is required, participants were asked to rate their preferred 22-week harvesting period

Participants were asked to rank their preferences from 1-6 for their prefer 22 week harvesting period, on the basis that the mill requires a 26 week mill operational period. Results are listed in Table 3.

Table 3 Preferred 22-week harvesting period indicated by survey participants

Dates	Ranking					
	1 Highest priority	**2**	**3**	**4**	**5**	**6 Lowest priority**
19 May-20 Oct.	0%	4%	8%	1%	4%	**85%**
26 May-27 Oct.	8%	6%	0%	7%	**77%**	0%
2 June-3 Nov.	13%	21%	17%	**50%**	0%	0%
9 June-10 Nov.	**35%**	23%	**31%**	13%	0%	0%
16 June-17 Nov.	31%	**38%**	13%	4%	10%	0%
23 June-24 Nov.	13%	8%	**31%**	25%	9%	15%

There was a trend for participants farming in the 'drier' areas (Toobanna south, Blackrock, Mid and Upper Stone) to prefer to commence harvesting earlier in June, while the remainder of the district indicated that they preferred to commence harvesting mid to late June.

Table 3 indicates that it may be difficult to achieve a 26-week harvesting season with the current preferred harvesting periods indicated by participants. Based upon the above data, the maximum season length that could be achieved would be a 25 week harvesting season. To achieve the desired 26 week season industry will need to investigate methods to

engage industry commence harvesting on the week commencing 2 June and with a conclusion of harvesting on 24 November.

Do you believe that you have adequate early CCS varieties to allow you to harvest early on your farm?
40% of participants indicated yes, while 40% indicated no.

If cost effective crop ripeners were available, would you consider using such products?
35% of growers indicated that they would use cost effective crop ripeners.

15% of growers indicated that they would not use crop ripeners. The reasons indicated are:

- Cost of chemical;
- Cost of application;
- Lack of control over the weather.

50% of growers indicated that there was insufficient data on the products use and effectiveness.

All participants indicated that they may consider the use of such products if proven to be cost effective and that there would be no adverse effects on ratoon crops.

If incentives were offered, would you consider participating in an extended season length?
81% of surveyed participants indicated that they would consider participating in an extended season length.

What form do you think the incentives should take?
Survey participants were requested to rank in order of priority what form they thought incentives should take. The forms of incentives indicated by participants were:

- Monetary incentives/ Guarantee price/Monetary incentives for lower CCS and loss of yields (86% of responses);
- Start harvesting early, finish harvesting early (21% of responses);
- Share in the value adding / by-products (18% of responses);
- Cover additional costs associated with production and harvesting, ie harvesting prices or ripeners (16% of responses);
- Harvesting my drier and wetter farms at the best times to maximise monetary returns. (2% of responses);
- Maximise employment opportunities (2% of responses);
- The mill provide bins on time (2% of responses);
- Discount for mill mud to undertake ploughout and replant (2% of responses).

From an industry viewpoint, how would you rate the impacts of the opportunities or risks resulting from a 26-week crushing season?
Survey participants were asked to rate their opinions (on a scale of 1-5) for the impact of opportunities or risks resulting from a 26 week crushing season for various industry related issues. Participants were asked to look at the questions from a whole-of-industry view point and not from an individual farm viewpoint. Results are listed in Table 4.

Table 4 Perceived impacts of the opportunities or risks resulting from a 26-week crushing season

Issue	Ranking				
	1 Very positive	**2**	**3**	**4**	**5 Very negative**
Ability to handle bigger crops	42%	30%	13%	2%	13%
Impact on district CCS	15%	13%	30%	26%	16%
Ratooning and yields	23%	25%	17%	21%	13%
Use of harvesting infrastructure	26%	30%	40%	2%	2%
Use of mill infrastructure	28%	28%	38%	6%	0%
Monetary return	17%	16%	31%	19%	17%
Development of alternative income streams	47%	17%	15%	15%	6%
Community impacts	25%	19%	30%	13%	13%
Earlier cash flows	23%	40%	32%	5%	0%
Change in risk profile	11%	33%	27%	14%	15%
Others (please specify)	8%	-	-	-	-

Would you like to make any further comments in relation to the early start trial or optimal season length program?

Participants were asked if they would like to make any further comments in relation to the early start trial or optimal season length program. The participant replies have been grouped into specific groupings for ease of interpretation.

Monetary related comments:

- Money is a great motivator.
- Maximum monetary return can be obtained from harvesting cane at its highest CCS and ratoon ability.
- I believe in early start if possible without financial loss.
- Early start CCS should be in a different pool, not to bring down the district's final average.
- If it is accepted that areas in the district start and finish early and others start and finish later there should be benefits for both miller and grower. Profits and risk should be either shared or compensated.
- Start and finish to maximise yield, CCS and monetary returns.
- Financial compensation for low CCS.
- Compensation needed for poor mill performance, lower CCS and yields in wetter areas.
- The gain and loss of early and late would have to have some financial benefits.
- Group wet area cane with dry area cane giving more money back to my business because I farm two separate farms.
- It costs more money for longer seasons to the growing and harvesting sectors.

Incentive related comments:

- More incentives for the farmer to be involved.
- Compensation in a payment scheme due to loss in CCS from early starts.
- CCS compensation for low CCS.
- Wet weather compensation.
- The cost of ripeners needs to be covered for the CCS loss
- Make up the difference in CCS at the start of the season by compensation.
- Compensation for loss of ratoons in wetter areas due to earlier starts.
- Compensation for lower CCS.
- Compensation for loss of CCS.
- Use of ripeners essential and we need compensation for its use.
- Early start program needs to offer incentives for growers to adopt proposal.

Value adding / by-product related comments:

- We need to have a payment system where the farmer gets paid for all the sugar and by-products that leave the mill.
- By-product involvement is essential for all industry.
- I would like early start trials continue to see if it is possible to generate alternative income streams.
- Millers have to share value adding with farmers.
- Farmers have to share value adding with contractors.
- Incentives for early start from by-products income streams.
- Sharing of income from by-products between industry groups.
- Would like to share in the income of by-products, this would be the greatest incentive.
- Cane payment systems needs to change for by-products.
- Profit share in by-products.

Production related comments:

- I was only in favour of any early start because to finish late was costing too much in loss of production in the next years crops.
- In the drier areas the earlier we harvest, better ratooning would result. Thus helping to have a better crop.

Harvesting related comments:

- A grower should be allowed to follow the sugar around his property from the dry areas to the wetter areas.

Mill related comments:

- More efficient crushing capacity from mill.
- There are three milling trains in the Herbert. One can be turned off early and the other two later.
- Get ‘bugs’ out of the mill.
- No trust in CSR.
- CSR is a hard pill to swallow.
- Up-date the mill.
- I’m not a proud farmer to be under Victoria Mill.

- Mill transport and logistics need to improve.
- A concern will be tramline overloading by machines entering area.
- Reduce cut-to-crush delays.
- Mill needs to improve rail system.
- CSR needs to organise their operations and they need to get their act together.
- Purchase more bins.
- Mill is transferring costs onto growers and harvesting sector by extending season length.
- Improvement in transport system.
- Mill needs to improve its game, ie bin deliveries.

Social related comments:

- I am in a group where farmers regard they are being unfairly treated if the early-start growers finish before them.

Weather related comments:

- There is too much risk with a late finish, ie storms, low CCS, poor ratoons.
- We can't guarantee an early start because of field conditions or weather.
- Late wet will put back early start.
- It can work but weather and ground conditions could hold it back.
- Starting date should depend on seasonal conditions.
- Depends on weather conditions and CCS.
- I can't control the weather.
- Wet conditions in some parts of the district a concern.
- Concerns about signing a contract to supply early cane if conditions are wet.
- Ground wet early.
- I think if the weather permits us to start with the help of ripeners we should start.

Other statements:

- My harvesting contract has two areas in which it cuts. One area may be able to start before the other as it usually has CCS earlier. I personally don't want to start early in my contract because my farm is wet.
- I would like to see data first of all, from both millers and BSES. I would not like to see it being pushed just from the miller only.
- A more determined effort is needed from both sectors. Growers meet their commitments to supply and mills to be ready on time (not half) and harvesters to also be ready for the season.
- Until I have tried early harvest I would not like to make a comment on the start.
- No problems with groups starting earlier.
- Earlier starting groups should not impact on late-starting groups. Earlier starters should be completed in the 22 weeks season. If wet weather occurs, everyone should be equalled out and finish together.
- We went continuous crushing to maximise CCS, yields, etc and now we are going backwards.

4.0 CONCLUSIONS

This survey will be useful as it establishes baseline information and industry views and opinions pertaining to harvest season length, crop management issues associated with an extended season length (and the 2004 early harvest trial), industry infrastructure utilisation, community impacts, development of alternative income streams, industry viability and cash flows.

A similar survey will be undertaken at the conclusion of the project to assess changes in industry viewpoints and opinions.

5.0 ACKNOWLEDGEMENTS

Special thanks to the project working team (representatives from CANEGROWERS, CSR Sugar, QMCHA, BSES and HCPSL).

Thanks to the growers who participated in the survey.

Funding for this activity was provided in part by the sugar industry and the Commonwealth Government through SRDC, and is gratefully acknowledged. BSES is not a partner, joint venturer, employee or agent of SRDC and has no authority to legally bind SRDC, in any publication of substantive details or results of this project.

APPENDIX 1 Copy of the survey undertaken in the study

‘Adoption of an optimal season length for increased profitability’ SRDC project - Early Start Survey

Please indicate the area (s) in which you farm: (please circle)

Coolbie- Rollingstone	Bambaroo West	Bambaroo East	Yuruga
Helens Hill	Blackrock	Toobanna	Hamleigh
Upper Stone	Mid Stone	Lower Stone	Fairford
Halifax / 4 Mile	Sunnybank	Victoria Estate	Foresthome
Cordelia	Macknade	Ripple Creek	Tara- Seymour
Hawkins Creek	Lannercost Ext.	Lannercost	Long Pkt - Elphinstone
Leach	Garrawalt		

2. Have you participated in the early start trial?

☐ Yes (please go to Q4)

☐ No (please go to Q3) ☐ Not offered to growers in my sub district (please go to Q3)

3. Please rank the reasons for you not participating. (Number squares 1-6 in priority with 1 being the highest priority)

☐ Ground too wet

☐ CCS too low

☐ Competing against high CCS areas

☐ No incentives

☐ Immature crop

☐ Other: (please specify) _____

4. If yes to question 2, would you participate again?

☐ Yes (specify ways it maybe more attractive) _____

☐ No (specify reason) _____

☐ Maybe (specify reason) _____

5. Should some parts of the district start and finish harvesting before other parts of the district?

☐ Yes

☐ No

☐ Maybe (specify reason)- _____

6. Would you be in favour of some areas always having the opportunity to harvest early?

☐ Yes

☐ No

☐ Maybe (specify reason)- _____

7. Would you consider implementing a specific farm management program to become a specialist early or late sugar producer?

☐ Yes

☐ No

☐ Unsure (specify reason) ……

8. On the basis that a 26 week mill operation is required, please rate your preferred 22 week harvesting period by numbering the boxes 1-6. (1 = highest preference; 6 = lowest preference).

☐ 19 May – 20 Oct

☐ 26 May – 27 Oct

☐ 2 June – 3 Nov

☐ 9 June – 10 Nov

☐ 16 June – 17 Nov

☐ 23 June – 24 Nov

9. Do you believe that you have adequate early CCS varieties to allow you to harvest early on your farm?

☐ Yes

☐ No

☐ Don’t know

10. If cost effective crop ripeners were available would you consider using such products?

☐ Yes

☐ No (specify reason) _____

☐ Maybe (specify reason eg. Insufficient data) _____

11. If incentives were offered, would you consider participating in an extended season length?

☐ Yes

☐ No

12. What form do you think the incentives should take? (please list in order of priority)?

……

……

……

13. From an industry viewpoint, how would you rate the impacts of the opportunities or risks resulting from a 26 week crushing season? (please circle where 1 = very positive and 5 = very negative)?

Ability to handle bigger crops.	1	2	3	4	5
Impact on district CCS.	1	2	3	4	5
Ratooning and yields.	1	2	3	4	5
Use of harvesting infrastructure.	1	2	3	4	5

Use of mill infrastructure.	1	2	3	4	5
Monetary return.	1	2	3	4	5
Development of alternative income streams.	1	2	3	4	5
Community impacts.	1	2	3	4	5
Earlier cash flows.	1	2	3	4	5
Change in risk profile.	1	2	3	4	5
Others (please specify) ……	1	2	3	4	5

14. Would you like to make any further comments in relation to the early start trial or optimal season length program?

……

……

THANK YOU FOR YOUR COMMENTS AND ASSISTANCE.

APPENDIX 7 – Di Bella (2006)

BSES Limited

FINDINGS FROM THE 2006 'MAXIMISING PROFITABILITY IN THE HERBERT SUGAR INDUSTRY WORKSHOP'

PROJECT BSS264 ADOPTION OF AN OPTIMAL SEASON LENGTH FOR INCREASED PROFITABILITY

by

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PR06001

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The Queensland Department of Primary Industries and Fisheries contributed funding to BSES for development of this project. However, the opinions expressed here do not necessarily reflect the views of the Queensland Department of Primary Industries and Fisheries.

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SUMMARY

In 2003, the Herbert sugar industry established an industry working team to investigate ways to manage the harvest and processing of larger crops and investigate methods of increasing industry profitability.

In 2004, SRDC funded the BSS264 *Adoption of an optimal season length for increased profitability* project. The project aims are to maximise CCS, sugar yields and industry profitability in the Herbert region by exploiting regional variation in CCS, soil moisture and trafficability. The project was also funded to develop economic models, SugarMax and Rainrisk models specific to the Herbert region.

In 2005, SRDC funded the Herbert industry study tour of Southern Africa to investigate the season length issues and farm management systems.

This report presents the findings from an industry workshop conducted within BSS264. The workshop was conducted to gain industry participants' views and opinions pertaining to harvest-season length, crop-management issues associated with an extended season length, industry-infrastructure utilisation, community impacts, development of alternative income streams, industry viability and cash flows. The workshop also presented research undertaken to date and research activities underway.

The workshop highlighted issues and barriers that may be encountered in attempting to increase the Herbert Sugar Industry profitability. These issues and barriers must be addressed to enable progress to occur.

The workshop highlighted the strained relationship between the miller and grower sectors of the industry. It is apparent that this relationship is preventing opportunities for the industry to increase profitability and reducing the regions ability to grow financially.

Clear direction was provided by the workshop were key industry research and development priorities are required. These findings will be incorporated into the BSS264 project work program or will be incorporated into the research priorities of research and development bodies servicing the local industry. Workshop participant highlighted strongly that further research is required in the value adding and value chain areas.

The workshop highlighted that the Herbert sugar industry in genuinely seeks to improve industry profitability and to secure the regions financial position into the future. It is now up to the industry stakeholders and community to enact upon the findings of this report and move the industry forward.

1.0 BACKGROUND

There is considerable potential to increase total sugar production, and individual grower and district CCS through better management of harvesting scheduling and crop management. The project BSS264 *Adoption of an optimal season length for increased profitability* attempts to implement change management through active participation and involvement of all industry sectors. The 'Maximising Profitability in the Herbert Sugar Industry' workshop informed the industry of various research findings and encouraged change management through active participation processes.

BSS264 *Adoption of an optimal season length for increased profitability* aims to maximise CCS, sugar yields and industry profitability in the Herbert region by exploiting regional variation in CCS, soil moisture and trafficability.

This report presents the findings from the 'Maximising Profitability in the Herbert Sugar Industry' workshop (conducted within BSS264) held on 31 January 2006.

The workshop program, questions and survey were developed by the industry working team overseeing and reviewing the project and the associated programs. The working team consists of representatives from CANEGROWERS, CSR Sugar, QMCHA, BSES Limited and HCPSL. Alf Musumeci from Queensland Government Department of Communities undertook the independent role as workshop facilitator.

The one-day workshop format consisted of a number of presentations from various research organisations undertaking research for the BSS264 project and the series of questions that were workshopped in small groups. Appendix 1 gives the workshop agenda.

Invitations in the form of a formal letter were sent to growers, harvester operators, millers, researchers and extension staff in the Herbert River region. The workshop was also promoted through advertisements and articles in the local newspaper (*The Herbert River Express*) and a radio interview. The general community was also invited to the workshop through the newspaper and radio promotions.

2.0 WORKSHOP PRESENTATIONS

2.1 Historical productivity data

Michael Sefton (HCPSL Productivity Data Manager) presented historical productivity data for the Hebert region (Appendix 2).

Findings presented:

- Data presented indicated that there is significant geographical variation throughout the district for CCS and cane yield.
- Trends in CCS and cane yield are different between short and long seasons and need to be separated when analysing data.

- Earlier starts will provide the greatest benefit in the drier areas of the districts, particularly in years when there is little rainfall during the season.
- Optimum TSPH is achieved in most sub-districts between 13-27 September, with the exclusion of drier southern areas that peak earlier between 30 August and 13 September, and the wetter northwestern areas that peak later between 4-18 October.
- In years with larger crops, it appears yield potential in all areas will be optimised by starting earlier.

2.2 Early CCS sampling

Lawrence Di Bella (BSES Extension Officer) reported on the grower early CCS sampling program undertaken in 2004-05 to monitor and develop CCS curves for the May and June period (Appendix 3).

Seven harvesting groups were selected through district (Map 1). The growers within the group nominated and sampled cane blocks that were to be harvested within the first two harvesting rounds for CCS. CCS sampling was undertaken on 16 May and 6 June each year.

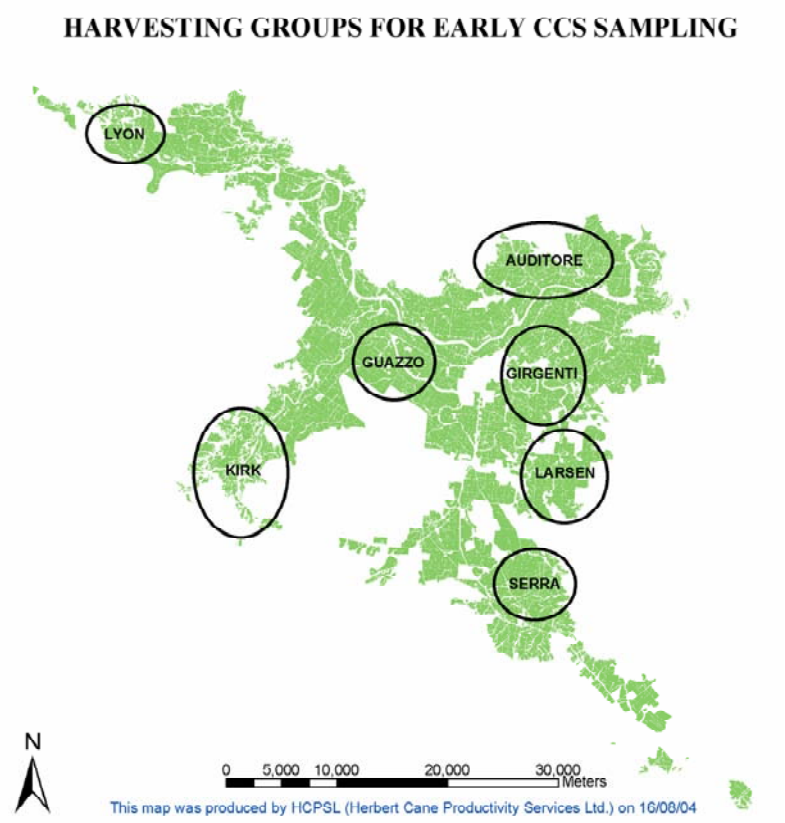


Figure 1 Location of harvesting groups for early CCS sampling

The results to date indicate that CCS increased by 0.43 units per week in 2004 and 0.32 units per week in 2005 during May and June.

2.3 Crop management for early harvested cane

Lawrence Di Bella (BSES Extension Officer) reported on crop-management strategies for early harvested cane (Appendix 3).

Findings reported:

- Variety management is critical to maximise CCS, yield potential, ratooning and profits.
- Adequate areas of cane should be planted to harvest early CCS varieties.
- Select early CCS varieties for harvest.
- A refractometer could be used to assess blocks for CCS potential, prior to harvest.
- Select blocks on farm that normally have higher CCS early and have good traffic access.
- Crop ripeners and crop growth regulators have been found to be cost effective in improving CCS of early harvested cane in some situations.
- Reduced nitrogen rates may be appropriate for early harvested cane to achieve higher CCS or for saving costs on both.
- Controlled-traffic systems or increased row spacing will allow blocks to be harvested in moist soil conditions without damaging stools.
- Harvest crops that were planted or ratooned early the previous year. Crops for early harvest should be close as possible to 12 months of age.

2.4 Crop ripeners / growth regulators

Phil Armytage (Syngenta Technical Service Lead) reported on (Appendix 4):

- Crop ripeners and growth regulators use globally.
- Review of MODDUS™ trial data that indicates that there are significant opportunities to improve CCS and monetary return to the industry with the application of MODDUS™ in particular situations.
- Crop growth responses to MODDUS™
- The 2006 Herbert MODDUS™ pilot application program

2.5 Optimising sugar yield

Di Prestwidge (CSIRO Research Officer) reported on the SugarMax modelling for the Herbert (Appendix 5). The model has been developed to assist industry investigate options to maximise CCS and TSPH. Various scenarios have been developed demonstrating the models capability and opportunities to increase monetary return through the scheduling harvesting differently.

2.6 Rainfall risk

George Antony (CSIRO Research Officer) reported on the Rainfall Risk modelling undertaken for the Herbert region (Appendix 6). The aim of the research is to understand the risk of rainfall that would reduce soil trafficability during harvesting across the region. The data concentrated upon the early and late parts of the season where there was considerable risk associated with extension of a season length. The model has potential to assist industry prioritise bin allocations during a rainfall event, extend SugarMax to schedule trafficable blocks for harvest, show financial costs/ benefits of seasons for different geographical rainfall patterns and for different risk aversions of industry stakeholders.

2.7 A concept for combining harvesting groups for geographical harvesting

Lucio Mastripolitto (Herbert River CANEGROWERS Board member) and Peter Sheedy (Herbert River CANEGROWERS Manager) presented a concept for combining existing harvesting groups across the district (Appendix 7). The concept attempts to minimise the risks associated with wet weather harvesting and to increase industry profitability through the improvement of harvesting scheduling. Lucio stated that he did not have all the answers, but urged industry to consider alternative options to improve industry profitability. Peter highlighted that the Herbert CANEGROWERS organisation will be seeking SRDC funding to investigate further opportunities to evaluate the combining of harvesting groups and the organisation was seeking interest from industry to join a pilot study group.

2.8 Learnings from Southern Africa and Brazil

Andrew Wood (CSR Herbert Productivity Manager) presented learnings and observations made during visits to South Africa, Swaziland and Brazil in relation to season length issues (Appendix 8). The presentation highlighted the issues and opportunities associated with season length in these overseas sugar industries.

2.9 Alternative products from cane

Andrew Wood highlighted that the Australian sugar industry is currently reliant on the returns from crystal sugar, but new products could be made from sugarcane (Appendix 9). The presentation highlighted that the industry may need to review the issue of season length to allow the development and investment in value added by-products of sugarcane.

3.0 WORKSHOP QUESTIONS

Workshop participants formed seven, roughly equal-numbered groups. Composition of the groups was organised by randomly allocating a number between one and seven and having people with the same number form a discussion group. This was done in an attempt to have diversity in the groups. E ach group was allocated a 'group facilitator' to ensure that: (i) everyone was clear in regard to the task at hand; (ii) pens, butcher's paper, etc, were available as needed; (iii) time constraints were met; (iv) someone in the group was recording the group's responses; and (v) individuals had a 'fair go' during group discussions.

The workshop facilitator introduced each question before it was considered by the participants.

3.1 "What are the opportunities to increase ongoing district profitability?" and "What role does season length play with achieving these opportunities?"

The participants were asked to consider "What are the opportunities to increase ongoing district profitability?" and to note "What role does season length play with achieving these opportunities". Specifically they were asked to indicate alongside each identified opportunity whether a longer or shorter season would be preferred. Workshop groups were requested to record their responses on butcher's paper and, in turn, report back to all other groups.

Appendix 10 reports the responses from each discussion group.

After the workshop, the responses were collated and grouped under broad headings. The result of this process is in Appendix 10, and is summarised in Figure 2.

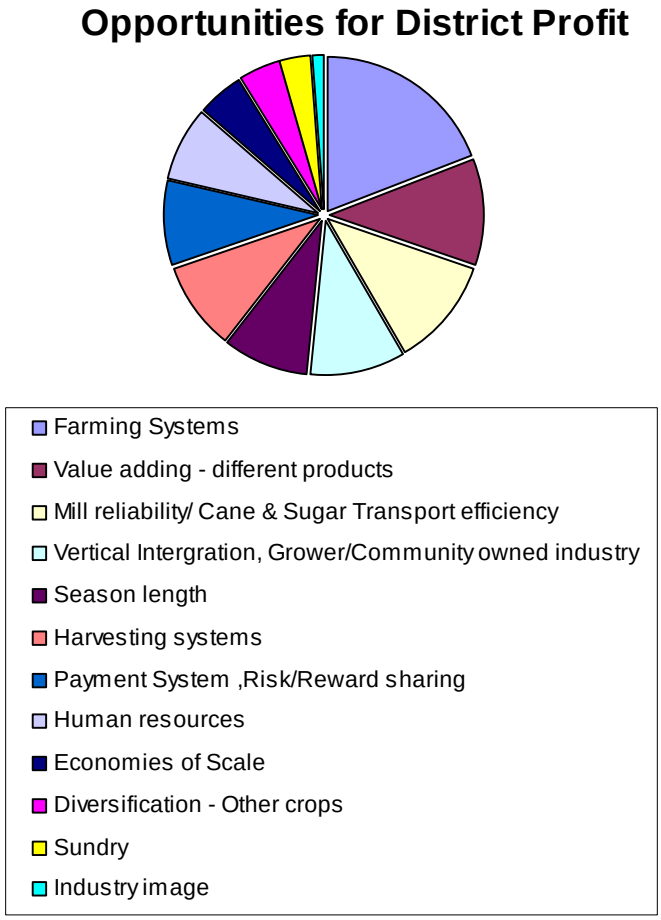


Figure 2 Collated and grouped responses - Opportunities for profitability

Conclusions:

- The responses in relation to season length were incomplete. They did however confirm that the concept of an optimal season length depended on the combination of products and by-products produced, viz
  - A longer season length would be essential to enable value adding to be viable option (ie. co-generation, ethanol and bio-plastics) and to enable better use of capital.
  - While the industry continued to focus on the production of raw crystal sugar, it was perceived that season length should be short to maximise CCS and yield potential. This activity could be sometimes to the detriment of efficient use of industry capital and employment opportunities (especially in the harvesting sector).
- Improvements in farming systems were rated the highest priority. Gains could be made through crop-improvement programs, development of bio-factory crops, improvements in crop agronomy, adoption of alternative farming systems, use of crop ripeners, two-row harvesting, and better monitoring of the crop growth.
- Value adding and vertical integration of the sugarcane business were also perceived as opportunities to increase district profitability.

- Mill reliability and mill transport issues rated very highly. It was perceived that mill reliability and mill transport issues limited or reduced the district's potential to increase profitability. The whole mill-grower relationship was questioned and was viewed as a major impediment to increasing profitability.

3.2 "What are the risks or barriers associated with adopting the opportunities?"

Each participant was asked to consider "What are the risks and barriers with adopting these opportunities" and identify at least three points. During the lunch break, forum facilitators grouped like responses, allocated a heading and reported back to the entire workshop. Appendix 11 reports each response under the allocated heading as they were reported back to the workshop, whilst Figure 3 summarises the frequency of responses under each of the headings.

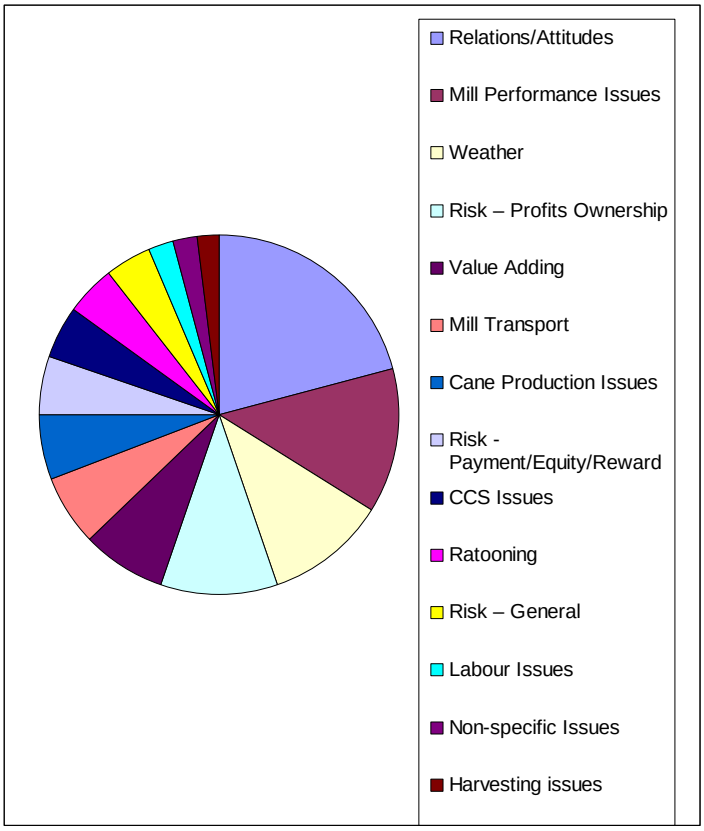


Figure 3 Proportion of responses for the question "What are the risks or barriers associated with adopting the opportunities?"

Conclusions:

- Relationships and attitudes were rated highest. Responses were varied, but mill-grower relationships, and reluctance to change due to social, family, age and perceived monetary gains from changes were prominent.
- Mill performance issues also rated highly. Participants' concerns were in relation to mill performance, mill reliability, transport issues and lack of maintenance of sugar mills and associated infrastructure. These issues contributed to strained relationships between the millowner and growers.
- The issue of profit sharing from value-added by-products appears to be a major impediment to the development and progress of value added by-products in the region.

3.3 "What are the knowledge gaps- what should the industry focus on and what are the future priorities?"

Workshop participants discussed the questions and as a group prioritised their response. Each group was asked to report their highest three priorities to the entire workshop group. Like responses were then grouped and all participants were then asked to vote on the grouped issues they regarded as the highest priorities. Each participant had the opportunity to cast a maximum of three votes. Appendix 12 records all responses, how they were grouped and where votes were cast. Figures 4 summarises the results of the voting process.

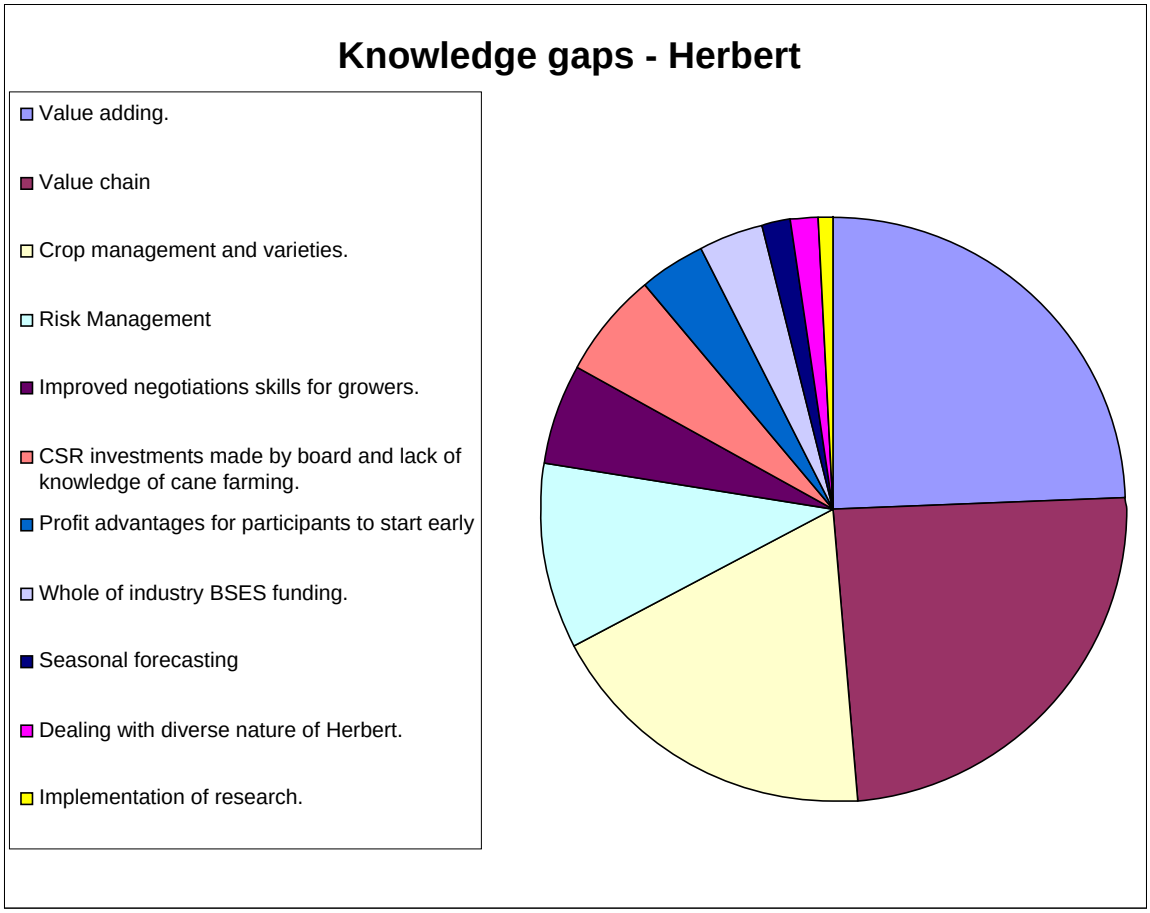


Figure 4 **Proportion of responses for the question "What are the knowledge gaps- what should the industry focus on and what are the future priorities?"**

Conclusions:

- Value-adding and value-chain issues rated the highest, together accounting for almost 49% of responses. Participants believe that there are considerable opportunities in value adding, but responses indicate that there are considerable knowledge gaps in value adding initiatives and understanding of the whole value chain.
- Crop management and varieties also rated very highly. Responses indicated that participants had a strong desire to seek more knowledge on different crop-management techniques and an improved understanding of variety management.

4.0 WORKSHOP EXIT SURVEY

At the conclusion of the workshop, attendants were asked to complete a workshop exit survey. The survey consisted of questions to assess participant view and opinions on various issues associated with the workshop format, industry profitability, season length and other issues associated with crop management. No discussion was permitted during the completion of the survey. Participants were asked to answer the survey in an honest and sincere manner; to ensure that industry viewpoints were expressed.

The survey comprised a series of yes/no questions, short answer questions, and questions where the participants could express their opinion .

4.1 Findings from the Workshop Exit Survey

QUESTION 1 - *Were you satisfied with today's workshop?*

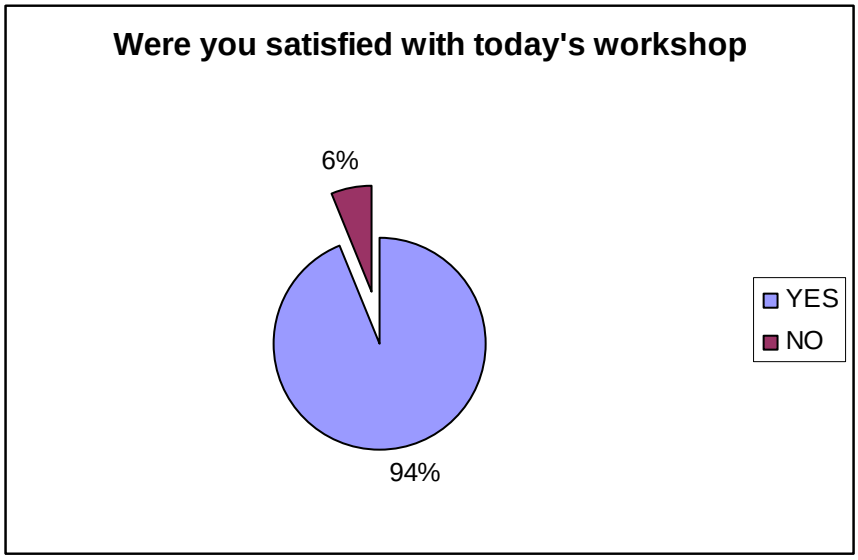


Figure 5 Were you satisfied with today's workshop?

Comments:

- Questions were not clear and decisive – Open to interpretation = confusion.
- Could have been smaller groups.
- The connection between issues identified and barriers were lost for the afternoon session.
- The issues should have been used to identify the R & D items representing season-length implementation.
- Question could have been friendly.
- Too focused solely on season length.
- Agenda and outcome pre-determined.
- More time for informal discussion.

- Time was the essence.
- Round table better for discussion.

QUESTION 2 - ***Has today's workshop convinced you that we should change the way we address season length management?***

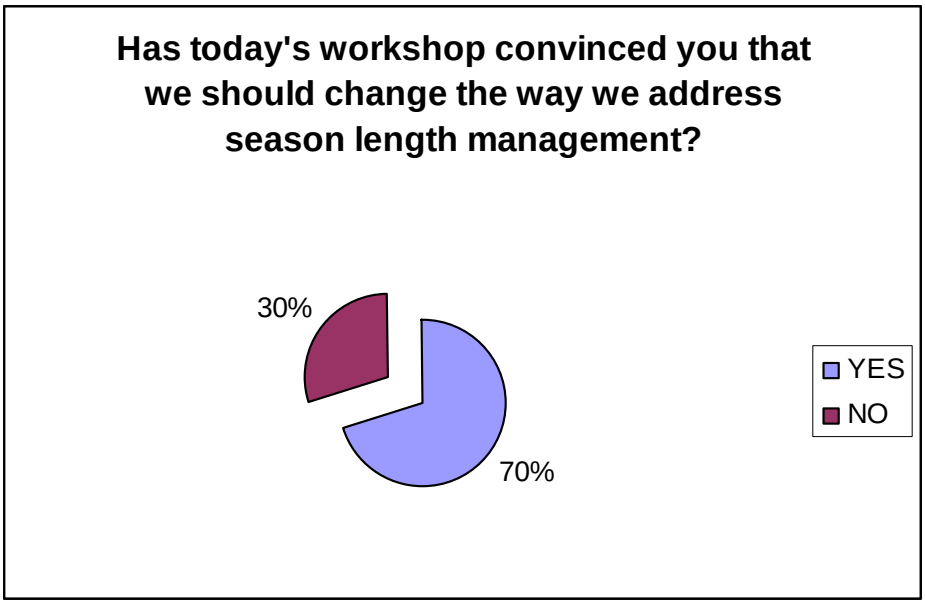


Figure 6 Has today's workshop convinced you that we should change the way we address season length management?

Comments from those who answered yes:

- Lots of data presented that showed issue of harvesting well into December.
- We should talk about the benefits and the negatives.
- Shorter season.
- Go for the shorter season to allow growers/farmers maximum income in positive way.
- Crop optimisation.
- Only if weather permits.
- To maintain CCS and tonnage levels throughout the season.
- Opportunity to increase district profitability.
- We need to look at the bigger picture.
- By better negotiation.
- The lack of knowledge on the component of impact samples objective consideration of options.
- Risks and profit must be shared.
- Identified the issues to focus on.
- Better crops.
- Shorter season.
- Desirable way to harvest

- Base the discussion on season length by using data and not stories.
- Get better CCS with cutting right time.
- Unless value adding is introduced and benefits are shared, seasons length should remain short as possible.
- Economic and social gains.
- Need better economic evaluation of the effects of change on all sections for changes in CCS, yield over 5-year cycle.
- Reconsider cane-payment methods.
- If value adding, the season length could be longer.
- More benefit to grower.
- Late finish, loss of CCS and ratoons.
- Increase district profitability.
- Paradigm shift →longer season length will encourage value adding.
- Only if it benefits everybody.
- Profitability issue.
- Manage to maximise returns.
- The longer the season goes, the costs are too great.
- Gains everywhere.
- So many issues to take into account.
- A complex issue, need debate like this with facts/ tools, etc.. to take to other stake holders.

Comments from those who answered no:

- There's a good reason why.
- Needs to be the focus on how to demonstrate that growers will not be disadvantaged.
- This is about letting the mill off the hook.
- I get no benefit out of a longer season.
- We can't control the weather.
- Reason is apparent. Mill is not going to increase capacity. If we want to grow larger crops then we have to increase the season length regardless.
- I think it is handled well.
- We have too much to risk.
- Need cost and benefit.
- Not really, I think the links is too high for the returns.
- CSR has a lot of catching up to do.
- Lost focus at times.
- The fundamental factors were not identified, ie. mill efficiency, transport capacity etc. This essential background information was not delivered. I do believe some changes in management of crop harvesting will deliver some of the changes needed.
- Current system is proven.
- It shows quite plainly that it should be shorter and that we are losing money as a result.
- No clear reason to change. No advantage to myself or industry.
- No financial gain.
- We should have a shortest possible season and early finish.

QUESTION 3 - ***What was the highlight of the workshop?***

- Being able to have input.
- We hope change for the better.
- Presentation on rain risk.
- Data and tools presented.
- Group discussions/opinions.
- Number of people involved and type.
- When all the dots went up on board.
- Everyone's involvement.
- That value adding is most important.
- Presentations.
- Working and thinking together.
- Address.
- The organisation.
- Working together.
- Partnered harvesting concept.
- Seeing how many pen pushers this industry supports and pays their salary (some are a waste of good space).
- Lucio's presentation – clear, concise, to the point, big-picture thinking.
- Fundamental information on weather (G. Antony) and lovely passionate delivery of need to change.
- The dot board.
- 'Skin the cat'.
- Value adding.
- The vote at the end.
- The address by all was top class.
- Two main topics – Value Adding and Value Chain.
- Exchange of ideas between participants. A very well run workshop.
- Nothing for me.
- Good organisation and facilitation.
- The fact that we had a good number of participants.
- The way people voted.
- Knowing that most farmers do not want to change too much.
- Presentations.
- The number that attended.
- Lucio Mastripolitto and Peter Sheedy, even though I might not agree with everything they said.
- Mastripolitto presentation.
- Lucio Mastripolitto speaking of the need to consider new ways – Good to see CANEGROWERS leading the way.
- Presentation of research.
- Dealing with various factors of season length and crop ripeners.
- Whole workshop
- The voting.
- Alf Musumeci facilitator

- Well presented and enjoyable.
- Process was OK. But agenda outcome was pre-determined.
- Ensuring that everyone had a say.
- Able to say what you want.
- The friendly way it was.
- Getting to hear other people's thoughts.
- The enthusiasm of the participants.
- Workshop around table.
- Prioritising the Knowledge Gap. Good visual display.

QUESTION 4 - *Should some parts of the district start harvesting before other parts of the district?*

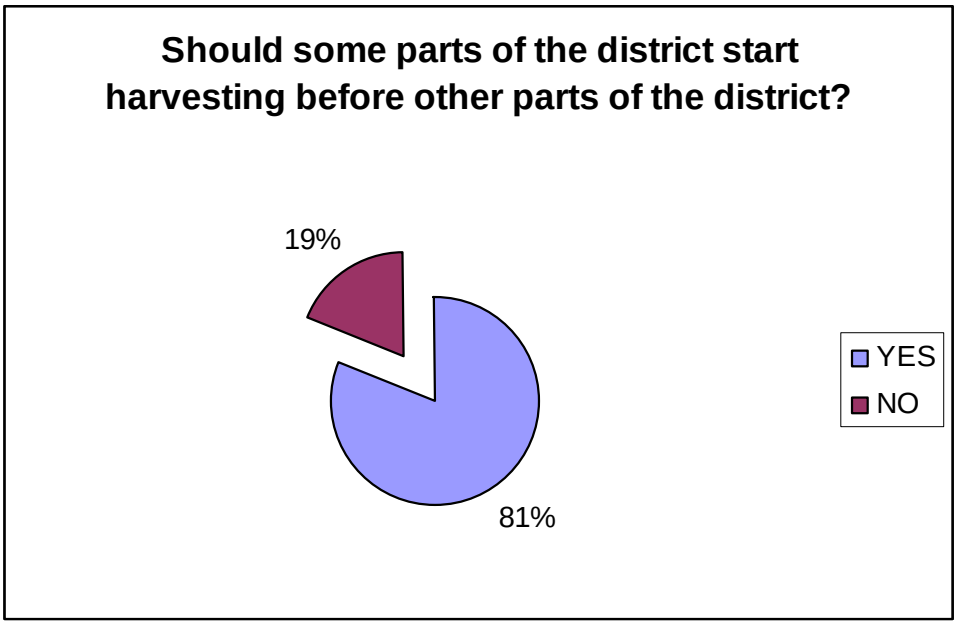


Figure 7 Should some parts of the district start harvesting before other parts of the district?

Comments for yes answer:

- Drier parts of the district - 5 replies.
- Optimise CCS - 19 replies.
- Balance of higher (early CCS) with risk of rainfall.
- Maximise returns.
- Improve district TSPH average.
- Only where weather permits - 2 replies.
- Avoid late cuts.
- Under a special collective arrangement that does not disadvantage others.
- Make more profit - 5 replies.
- Reduce compaction - 2 replies.

- Better weather management - 4 replies.
- Early starters finish early - 3 replies.
- Only with big crops.
- Maintain a fair season length or shorter season.

Comments for no answer:

- Risky with CSR management.
- Has to be an incentive - 3 replies.
- Mixed results on sugar quality and equity.
- No equity - 3 replies.
- Sharing of CCS average and risk of late cane - 2 replies.
- Can not control CCS.
- No personal benefit.

QUESTION 5 - *Should harvesting groups starting early be allowed to finish early?*

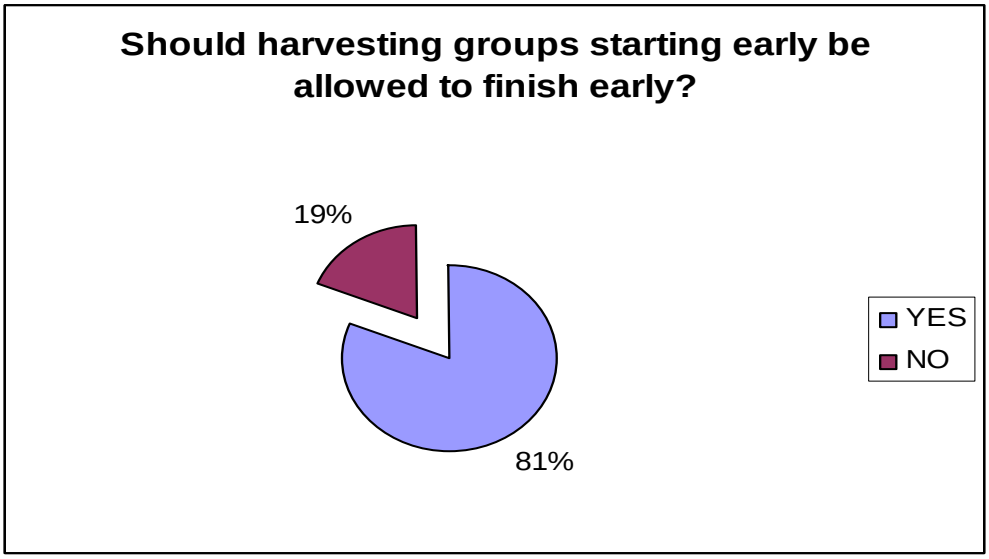


Figure 8 Should harvesting groups starting early be allowed to finish early?

Comments for yes answer:

- Provides an incentive - 16 replies.
- Improved CCS - 6 replies.
- Improved ratoons - 2 replies.
- Everyone should have a equal season length - 4 replies.
- Weather management - 4 replies.
- No cost to growers - 2 replies.
- Assists with crop management.
- Easier to mange logistics (transport) - 3 replies.
- Must start early every year.
- More profit

- Under special collective arrangements.
- Risk sharing - 2 replies.

Comments for no answer:

- Got an advantage by early start.
- Separating district.
- Early harvested areas should not interfere with rest of district, if you can not harvested early.
- Shifts risks to later in season.
- Weather issues
- Finish together - 2 replies.
- All ratooning cane harvested first.
- Too risky with CSR Management.

QUESTION 6 - ***If cost effective crop ripeners/growth regulators were available would you consider using such products?***

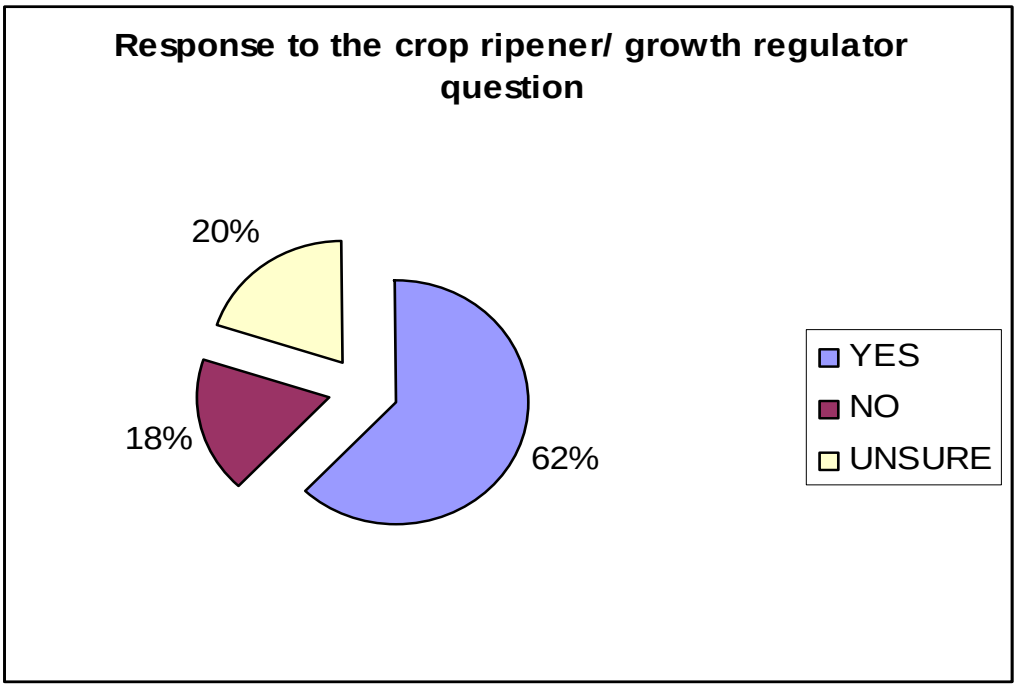


Figure 9 **If cost effective crop ripeners/growth regulators were available would you consider using such products?**

Comments:

- Not proven - 1 reply.
- More research needed - 2 replies
- Needs a clear benefit to growers - 2 replies
- Must be cost effective e- 3 replies.
- Who pays? - 1 reply.

QUESTION 7 - ***Would you consider different harvesting arrangements within your harvesting group if opportunities were available?***

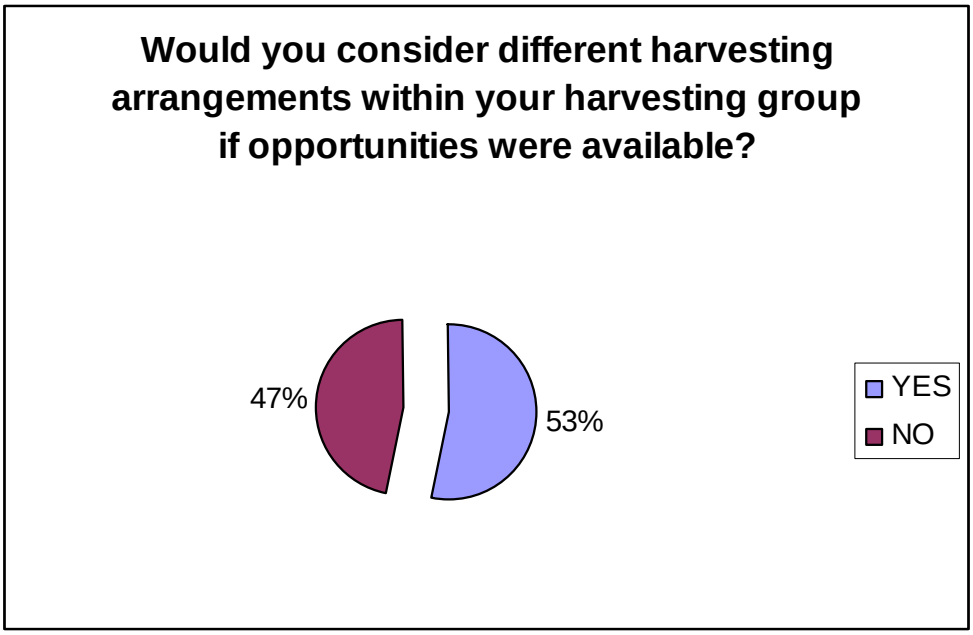


Figure 10 Would you consider different harvesting arrangements within your harvesting group if opportunities were available?

Comments:

- Combine smaller groups - 2 replies.
- Payment on HBP.
- Optimise CCS and tonnes - 5 replies.
- Group rotation and number of rounds.
- Staggered start.
- Reliable bin supply will make a difference.
- Harvest dry areas first.
- Provided equity retained.
- Provided it is not detrimental to the harvesting contractor business.
- Rewards need to be clear.
- Open to suggestions - 2 replies.
- Group rotation - 2 replies.
- Remove equity and install co-operative methods.
- Mill interchange.
- Improve ratoons.
- Weather management - 3 replies.
- Growers from different parts of district in same group.
- Allow for early start.

QUESTION 8 - ***Looking back at last season would it have been better to have started and finished the season earlier?***

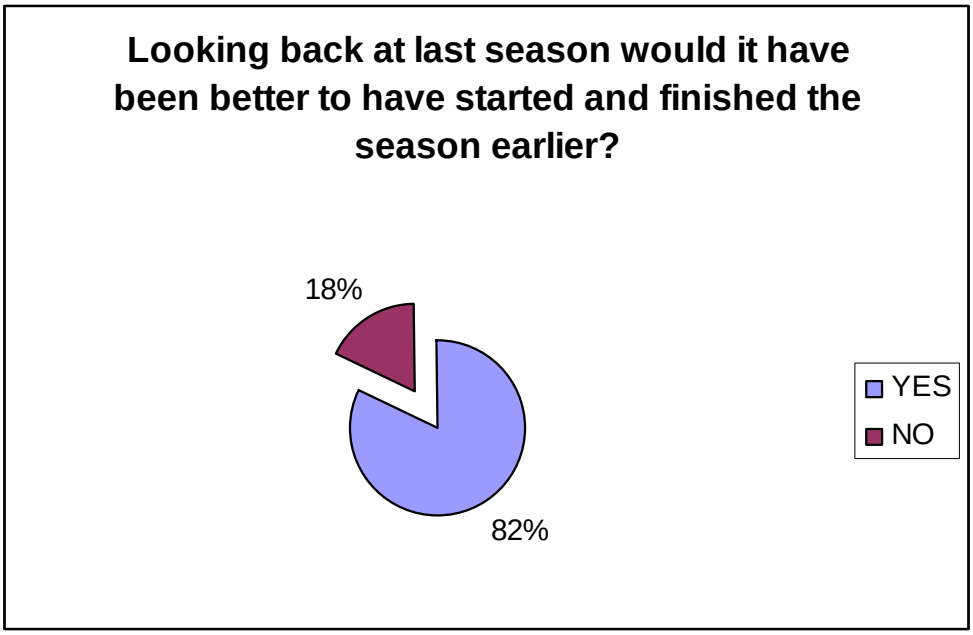


Figure 11 Looking back at last season would it have been better to have started and finished the season earlier?

Comments for yes answer:

- Loss of ratoons - 9 replies.
- Loss of CCS - 9 replies.
- Loss of TSPH - 2 replies.
- Less risk - 2 replies
- More security - 2 replies.
- Finish earlier - 3 replies.
- Loss of yields - 3 replies
- Allow for improved fallow management - 4 replies.
- Mill performance too unreliable - 2 replies.
- Late finish.
- Contract not complete - 2 replies.
- Proves the reasoning for an early start - 2 replies.
- Loss of income to district - 2 replies.
- If mill were operating.
- Weather management.

Comments for no answer:

- Mills need to be more efficient (mill issues) – 6 replies.
- Ground too wet - 5 replies.
- Did not know crop size.
- No CCS underpinning available.

QUESTION 9 - ***If this year's crop estimate is more than 5 million tonnes, should we start the season earlier than last year?***

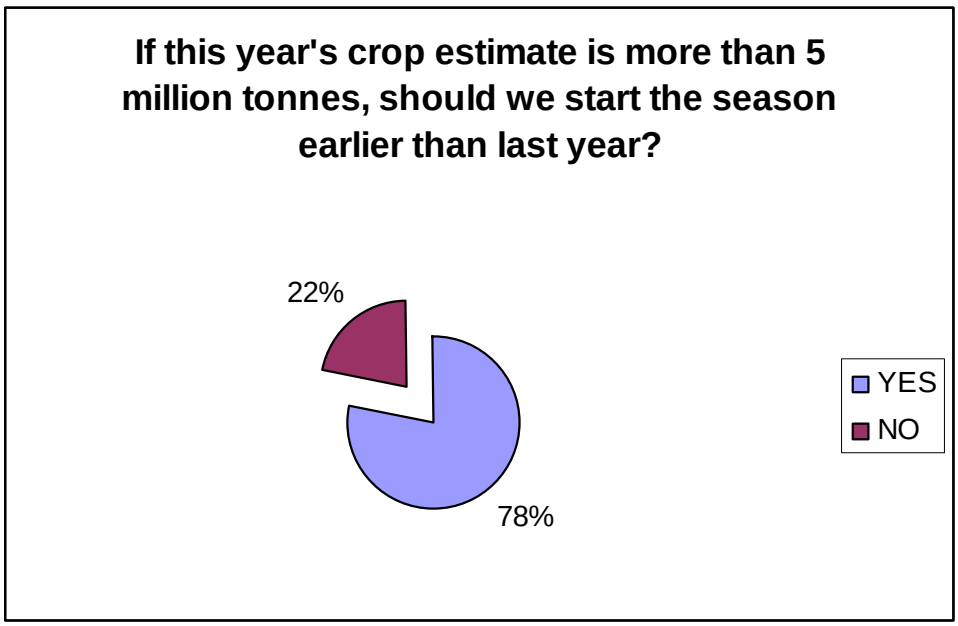


Figure 12 **If this year's crop estimate is more than 5 million tonnes, should we start the season earlier than last year?**

Comments for yes answer:

- Weather issues - 5 replies.
- Need agreement.
- High enough CCS - 2 replies.
- Improve mill reliability.
- 1 week increase.

Comments for no answer:

- Can crush 5 million 15 June to 15 November if mill efficiency is improved.
- Improve mill systems.

QUESTION 10 - ***What is the earliest that the season could start for your area?***

Only growers were asked to answer this question.

Growers also indicated what sub-districts within the region they farmed. Grower responses were also categorised for each date reply based on whether their farm was in a wet or dry area. Dry sub-districts are numbered 1-6 and 11-12 on Figure 13.

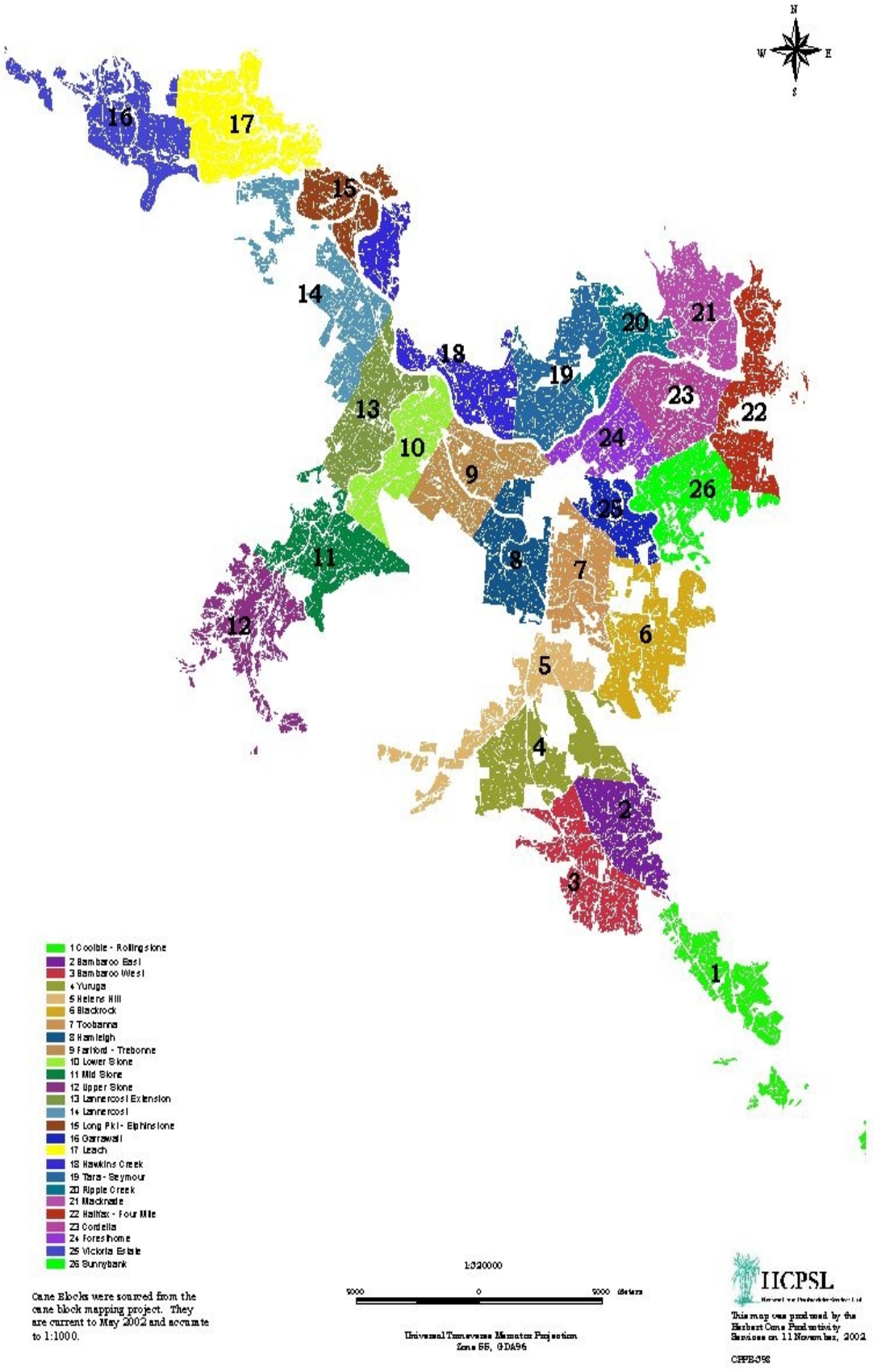


Figure 13 Herbert River Cane Productivity Forum areas

Comments:

- 2% of replies indicated 21-31 (late) May.
  33% of responses came from growers in the wetter areas of the district.

- 23% of replies indicated 1-10 (early) June.
  55% of responses came from growers in the wetter areas of the district.

- 42% of replies indicated 11-20 (mid) June.
  85% of responses came from growers in the wetter areas of the district.

- 27% of replies indicated 21-30 (late) June.
  All responses cane from growers in the wetter areas of the district.

- 2% of replies indicated 1-10 (early) July.
  All responses came from growers in the wetter areas of the district.

- 2% of replies indicated 11-20 (mid) July.
  All responses came from growers in the wetter areas of the district.

- 2% of replies indicated 21-30 (late) July.
  All responses came from growers in the wetter areas of the district.

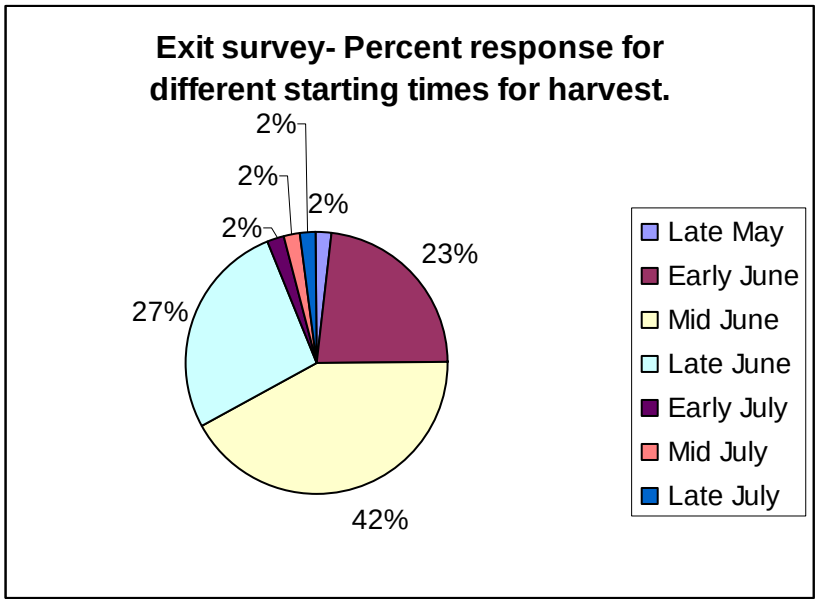


Figure 14 Proportion of favoured starting times for harvest

QUESTION 11 - *What is the latest the season could finish for your area?*

Only growers were asked to answer this question.

Growers also indicated what sub-districts within the region they farmed. Grower responses were also categorised for each date reply based on whether their farm was in a wet or dry area. Dry sub-districts are numbered 1-6 and 11-12 on Figure 13.

Comments:

- 2% of replies indicated 11-20 (mid) October.
  All responses came from growers in the wetter areas of the district.

- 4% of replies indicated 21-30 (late) October.
  All responses came from growers in the wetter areas of the district.

- 11% of replies indicated 1-10 (early) November.
  85% of responses came from growers in the wetter areas of the district.

- 46% of replies indicated 11-20 (mid) November.
  81% of responses came from growers in the wetter areas of the district.

- 28% of replies indicated 21-30 (late) November.
  76% of responses came from growers in the wetter areas of the district.

- 4% of replies indicated 11-10 (early) December.
  40% of responses came from growers in the wetter areas of the districts.

- 3% of replies indicated 11-20 (mid) December.
  33% of responses came from growers in the wetter areas of the district.

- 2% of replies indicated 21-30 (late) December.
  All responses came from growers in the wetter areas of the district.

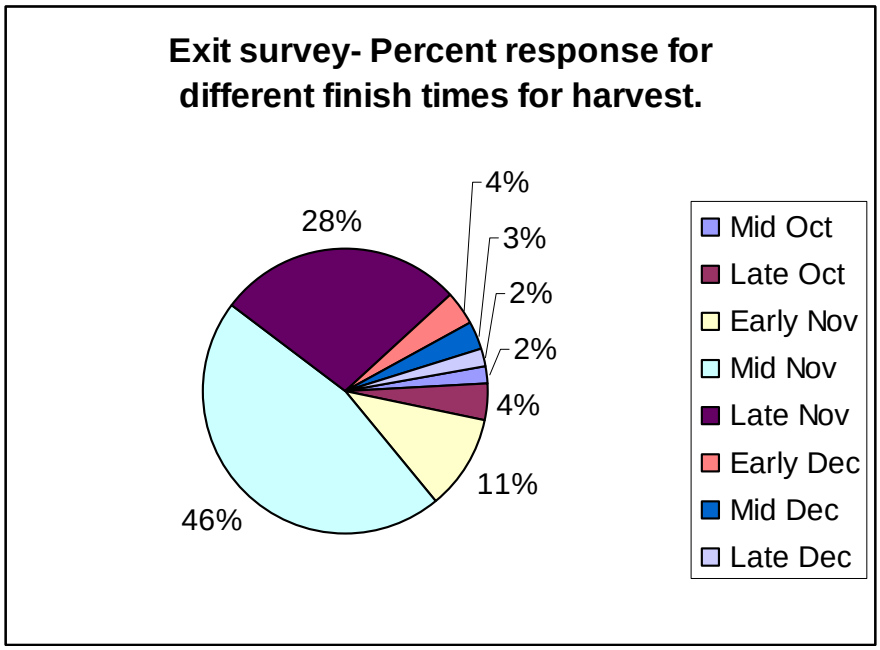


Figure 15 Proportion of favoured finishing times for harvest

QUESTION 12 - *Would you like to make any further comments in relation to the optimal season length program?*

Comments:

- A viable season length is very important. Don't change the goal posts too much. May lose!
- Optimal length is inevitable if we are to grow large crops and mill does not expand. If agreements can be reached on payment for cane, then it will happen.
- This mill has to be more efficient and we would have plenty of time.
- The biggest challenge is to find ways to utilise the research that has already been undertaken on this issue.
- Must be a compromise between growers and millers.
- Reliable mill would be good.
- Economics should be looked at.
- Fix mill up first, then we will talk.
- Those people who start earlier are taking early risk, therefore they should have lessened risk in the end.
- Geographical harvesting, not early start.
- Early start needs to have a new payment formula negotiated by participants.
- As an outsider it's difficult for me to comment on some of the above. If longer seasons occur, it is important to consider how this will impact the families and the broader communities.
- There is a very good reason why we have had season length constraints and that's the weather.
- We don't get any commitment from CSR on improving mill reliability and rolling stock.
- The actual figures show that we are limited to a season length.
- Growers should be compensated for losses for early start and late finish. Also, the farmers should share in the savings to be made.
- A late season not only puts young ratoons at risk of wet weather, but also encourages weed growth due to the cane canopy not closing over. Therefore, spraying twice can be necessary, increasing the extra cost of chemical.
- As short as is reasonably possible.
- Look at minimising the season instead of lengthening it.
- All parties working together for the same goal.
- CSR should pull their weight.
- Great attendance – good workshop – very friendly atmosphere.
- Well done!
- Get mill to 90% availability.
- Underpin CCS to 15 June – 15 November.
- Season length for those at the workshop means different scenarios. From my perspective season length should be 12 months, where possible, to maximise capital investment.
- Things can change very quickly as do weather conditions.
- Once again we seem to be changing what we do because of a shortfall on the milling side.
- As long as there is not cost transfer or business put in jeopardy.

- Identify the hidden costs of current arrangements for realistic comparison for benefits from change.
- If some monetary incentives were forthcoming, we might consider longer seasons, otherwise optimal season length for the Herbert is 22 weeks.
- Value adding opportunities versus lack of mill performance. No.
- Only after a study assess gains or losses to crop harvested over 5-year period. Assess CCS, payment methods, losses to crop (early and late harvest), labour utilisation in the harvesting and milling sectors).
- We must be compensated for any longer season.
- Farmers to be paid for carbon credits.
- Make sure mills are ready for early start. NOTE: Please make available last season harvesting time data so as we can plan this year's harvest to maximise CCS.
- Just do it! NB – I'm not a grower.
- Explore any options.
- Season of 22 weeks for farmer and harvesters.
- CSR not cooperating.
- Fix mill and improve rolling stock.
- No late finish.
- If there is benefits for the whole industry perfect.
- Look at changing the way we are paid for cane – to suit new SugarMax model /concept.
- Up to the mills to start to perform.
- Leave as it is.
- Encourage researchers to present key messages only. Not reams of data.
- Follow-up actions from workshop.
- Continued communication between industry and researchers is important to the success of this project. Good luck in attracting people to the pilot trial!
- Continue to be open in discussions – facts will stop problems.
- Food good.
- Room hot in the morning.
- Lack of participation of women in the decision making process is an industry problem.
- Decisions about longer seasons (if it means longer hours) will affect women.
- Group rotation question - how to achieve a 12-month-old crop every time.
- Farmer is supposed to get a benefit but there is a real risk.
- Miller definitely gets a benefit from a longer season and this is why they are interested.
- Farmer should not wear the cost.
- SugarMax and Rainfall risk modelling is nothing new to growers.
- Fix the mill to become more reliable (as Tully mill), then we can consider extending the season.

5.0 CONCLUSIONS

The workshop was a worthwhile opportunity for the Herbert industry and community to discuss openly the opportunities to maximise profitability in the Herbert Sugar Industry.

The workshop co-ordinators were pleased with the level of participation and response of the participants during the workshop process.

The workshop highlighted issues and barriers that may be encountered in attempting to increase the Herbert Sugar Industry profitability. These issues and barriers must be addressed to enable progress to occur.

The workshop highlighted the strained relationship between the miller and grower sectors of the industry. It is apparent that this relationship is preventing opportunities for the industry to increase profitability and reducing the regions ability to grow financially.

Clear direction was provided by the workshop were key industry research and development priorities are required. These findings will be incorporated into the BSS264 project work program or will be incorporated into the research priorities of research and development bodies servicing the local industry. Workshop participant highlighted strongly that further research is required in the value adding and value chain areas.

The workshop highlighted that the Herbert sugar industry in genuinely seeks to improve industry profitability and to secure the regions financial position into the future. It is now up to the industry stakeholders and community to enact upon the findings of this report and move the industry forward.

6.0 ACKNOWLEDGEMENTS

Thanks to the project working team (representatives from CANEGROWERS, CSR Sugar, QMCHA, BSES, HCPSL, CSIRO).

Thanks to Queensland Government Department of Communities for their assistance.

A special thanks to Alf Musumeci (Queensland Government Department of Communities) for accepting and undertaking the role as workshop facilitator.

Thanks to the industry and community groups who participated in the workshop.

Thanks to SRDC and BSES for funding the BS264 project.

APPENDIX 1 – Workshop program

Dear industry stakeholder you are invited to the:

"MAXIMISING HERBERT SUGAR INDUSTRY PROFITABILITY WORKSHOP"

Date: 31st January 2006
Venue: Royal Hotel
Time: 8:00am- 3:00pm

Items for discussion:

- Season length optimisation;
- The issues and advantages associated with season length management;
- Crop management;
- Use of crop growth regulators;
- Cane productivity and CCS;
- Crop management modelling;
- Harvest management.

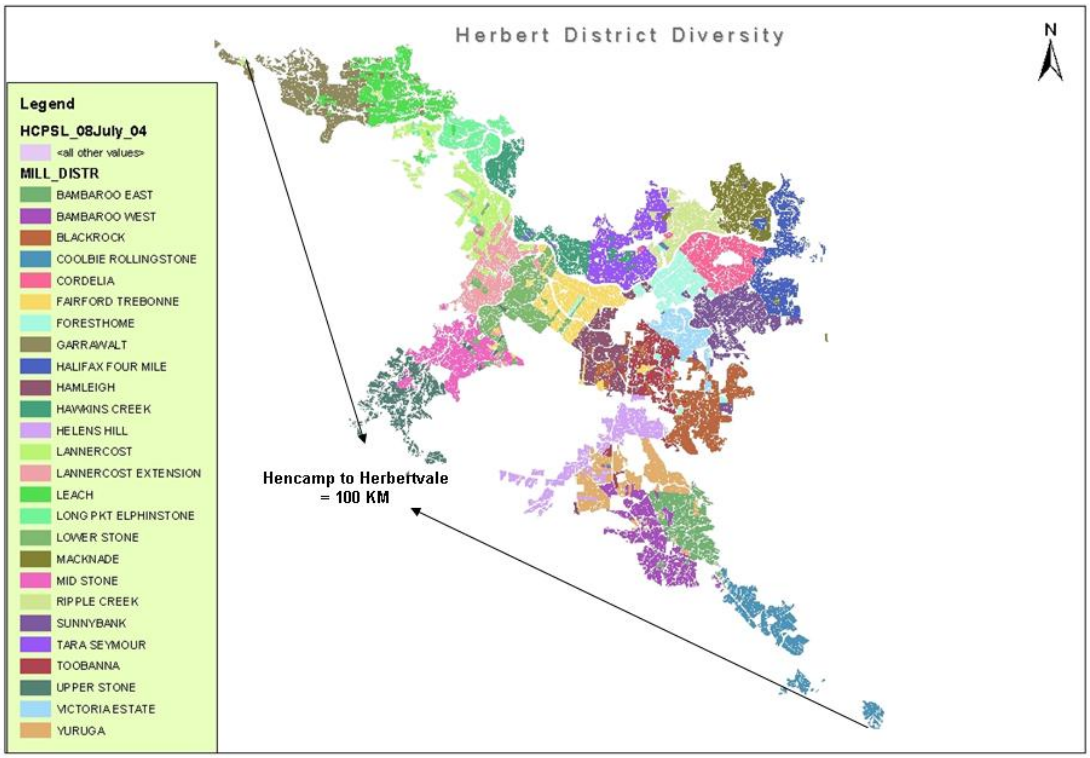
Cost: $16 for lunch

RSVP: 26th January 2006
(for catering purposes)

Phone BSES Herbert Office on 4776 2500 to confirm your attendance.

APPENDIX 2 – Sefton presentation

Historical CCS trends



Week Conversion Chart

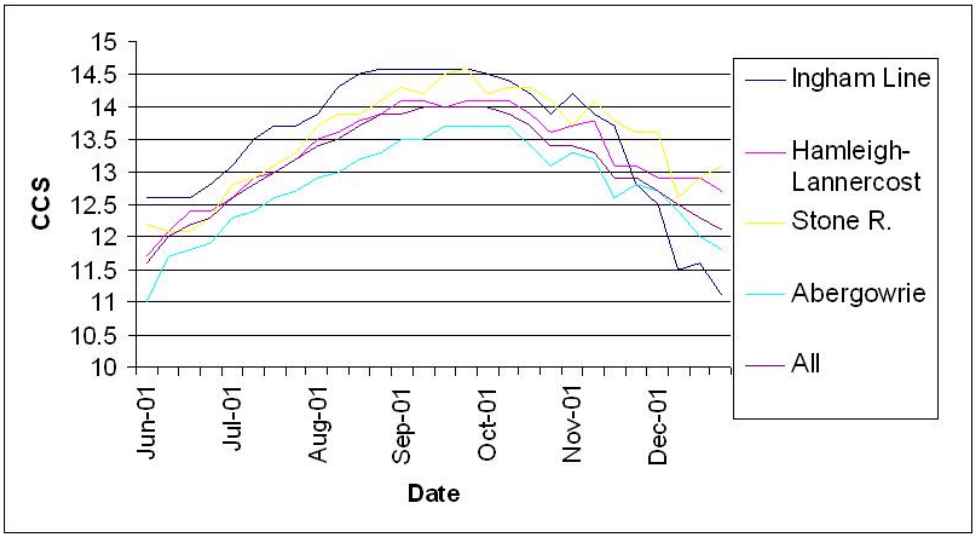
dates of interest

- Week 13- 1 June
- Week 15- 14 June
- Week 18- 5 July
- Week 28- 13 Sept
- Week 30- 27 Sept
- Week 33- 18 Oct
- Week 37- 15 Nov
- Week 40- 6 Dec

HCPSL Herbert Cane Productivity Services Ltd

BSES Sugarcane for the future

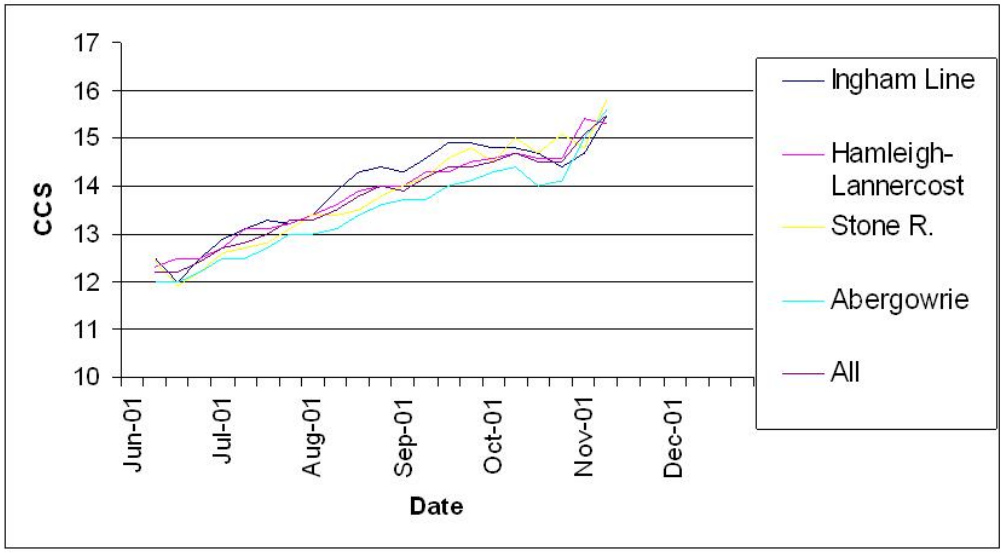
CCS curves 1993-2002



HCPSL Herbert Cane Productivity Services Ltd

BSES Sugarcane for the future

CCS curves 1999-2002



HCPSL Herbert Cane Productivity Services Ltd

BSES Sugarcane for the future

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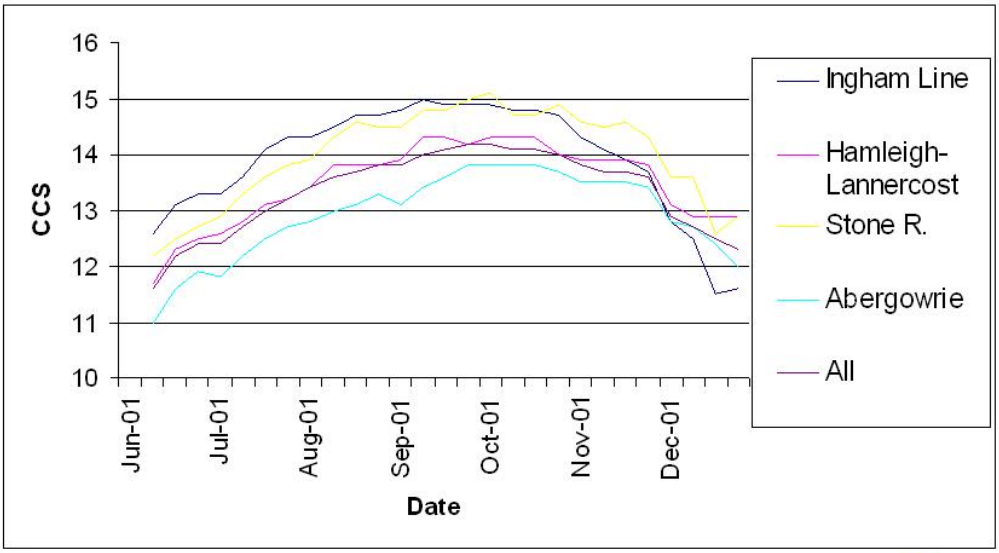
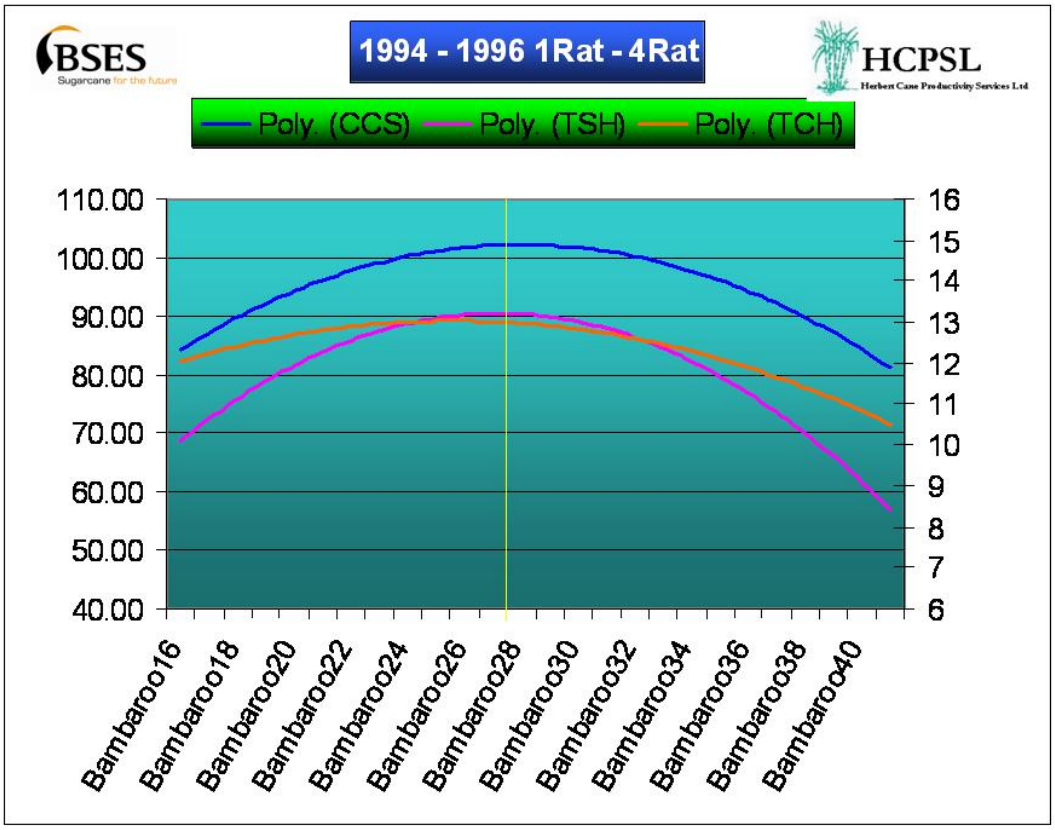


HCPSL Herbert Cane Productivity Services Ltd

BSES Sugarcane for the future


BSES
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HCPSL
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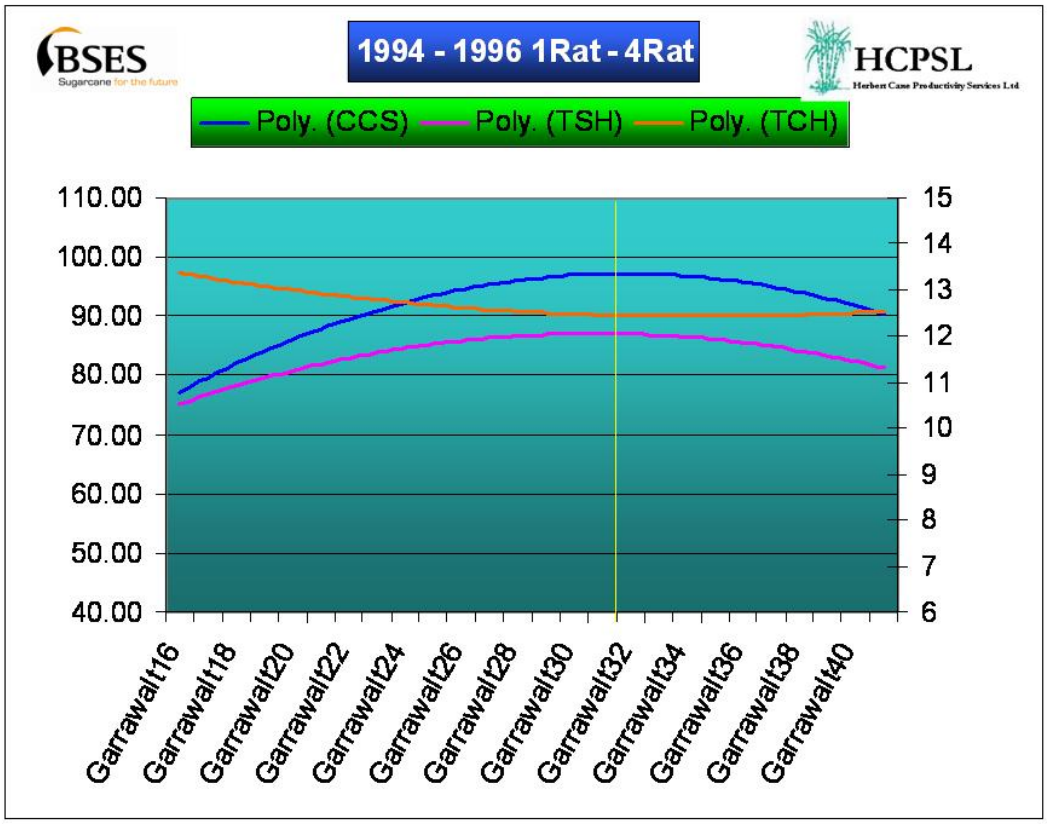
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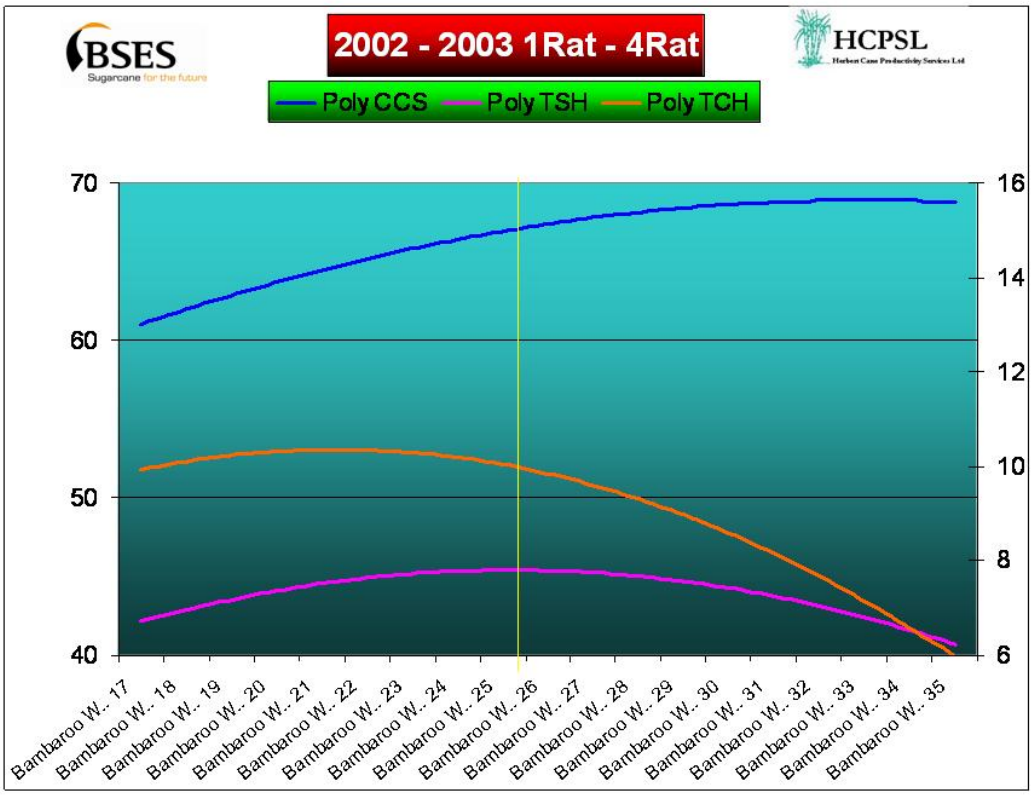
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BSES
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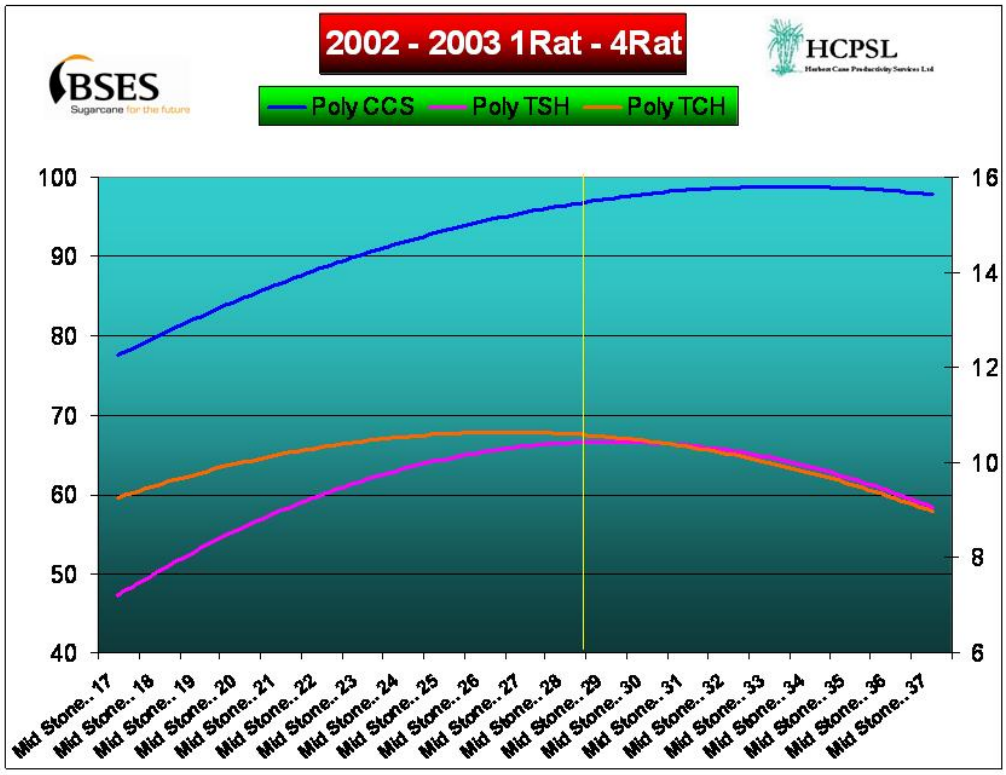
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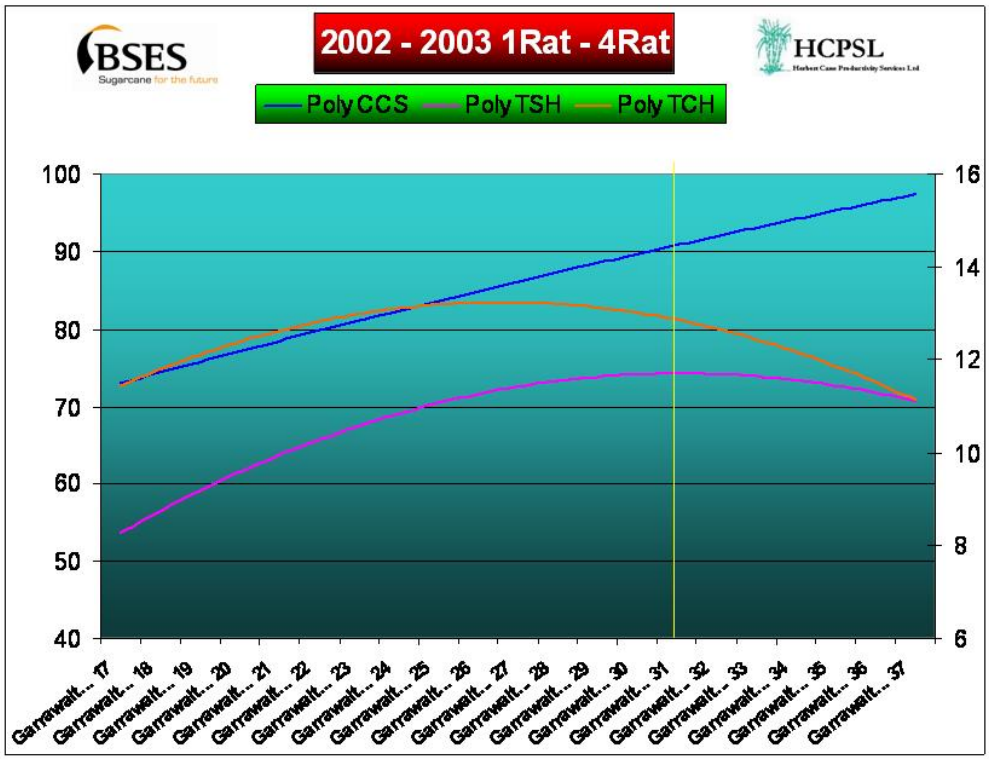
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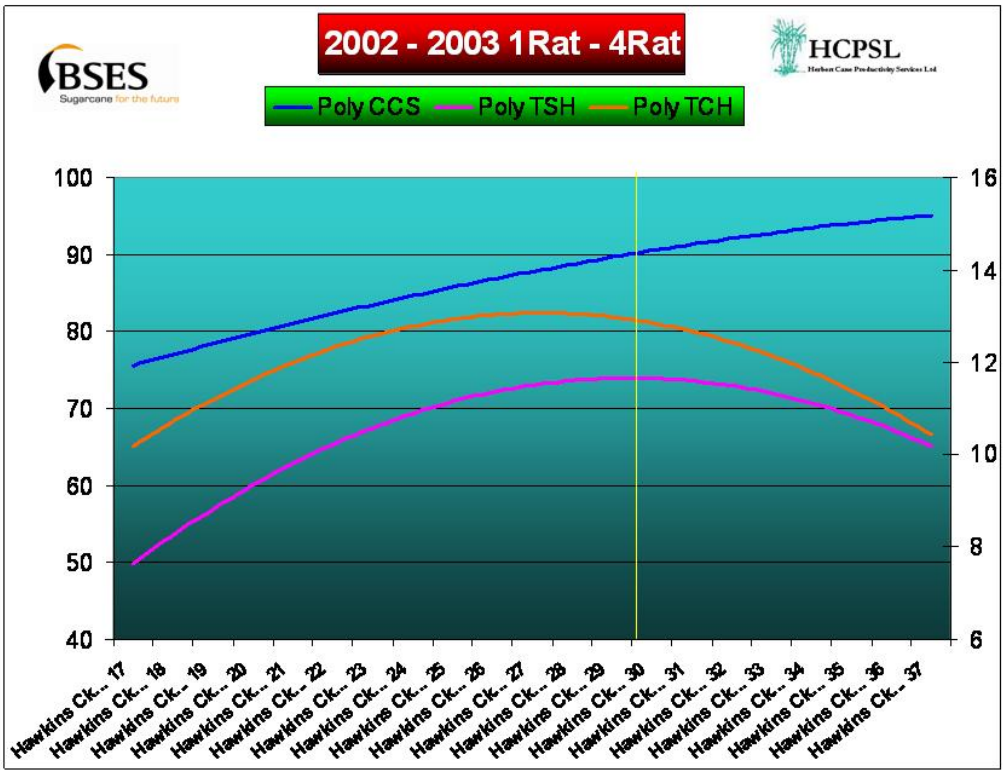
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Conclusions

- Optimium TSPH is achieved in most sub-districts between weeks 13th of Sept. and 27th of Sept. , with the exclusion of:
    - Bambaroo and Coolbie/ Rollingstone areas- between August 30 and Sept 13.
    - Lannercost, Long Pocket- Elphinstone, Leach and Garrawalt areas- between Oct 4 and Oct 18

- In drier years earlier starts will maximise sugar yield potential in the drier areas of the district

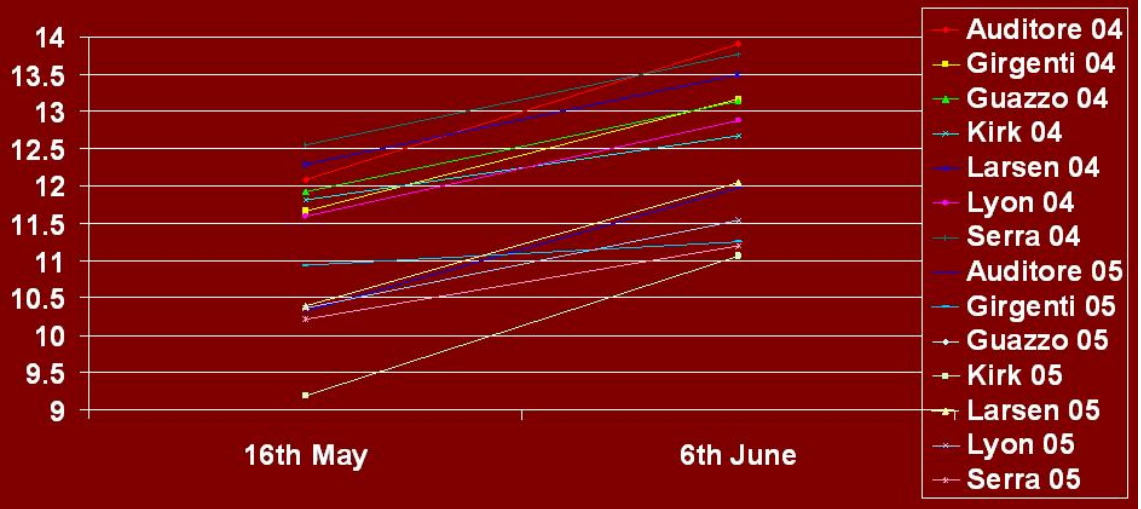
BSES Sugarcane for the future

HCPSL Herbert Cane Productivity Services Ltd

APPENDIX 3 – Di Bella presentation

Early CCS sampling

Grower small mill sampling.



CCS increased 0.43 units per week from May- June 2004

CCS increased 0.3183 units per week from May-June 2005

Crop management for early harvest

BSES Sugarcane for the future

Crop management for early harvest

Variety management is critical to maximise CCS, yield potential, ratooning and profits.

Good planning is essential!

BSES Sugarcane for the future

Variety x time of harvest-

June/July: Q115, Q157, Q174, Q186, Q190, QC84-621

July/Aug: Q96, Q115, Q120, Q157, Q174, Q186, Q190, Q200, Q204, QC84-621

Aug/Sept: Q96, Q115, Q120, Q135, Q157, Q164, Q187, Q190, Q194, Q195, Q200, Q204, Argos, QC84-621

Sept/Oct: Q135, Q157, Q158, Q162, Q164, Q187, Q194, Q195, Q215, Q216, Argos, QC84-621

Oct/Dec: Q135, Q157, Q158, Q162, Q164, Q187, Q215, Q216, Argos

Note: Varieties may perform differently in some sub-districts.

BSES Sugarcane for the future

Crop management for early harvest

- Plant an adequate area of cane on your farm to harvest early CCS potential varieties.
- Select cane blocks that are suitable for early harvest.
- Consider using a refractometer to assess blocks for CCS potential, prior to harvest.

BSES Sugarcane for the future

Crop management for early harvest

- Harvest varieties which mature early and have high early CCS.
- Harvest blocks that normally have higher CCS. Some soils tend to produce crops with higher CCS than others.

BSES Sugarcane for the future

Crop management for early harvest

- Plan at least one year in advance for early harvest. Identify the right block, have the right variety growing in it and manage it for early harvest.
- Harvest crops that were planted or ratooned early the previous year. Crops for early harvest should be close as possible to 12 months of age.

BSES Sugarcane for the future

Crop management
Time of harvest trials.

Stone River trial:
Variety Q157:

TREATMENT	DATE HARVESTED IN 2004	TCPH	CCS	TSPH
Early harvest	22/6/04	97	12.5	12.1
Later harvest	15/7/04	91	12.9	11.7

Harvested 26/6/05

BSES Sugarcane for the future

Crop management
Time of harvest trials.

Crop growth at the Mutarnee Variety x Time of harvest trial. 24/01/06

Crop management for early harvest

- Crop ripeners / growth regulators have been found to be cost effective to improve CCS of early harvested cane, in some situations.
- Syngenta will present more data later in the workshop.

BSES Sugarcane for the future

Crop management Nitrogen x time of harvest trials

Grower	Nitrogen rate (kgN/ha)	CCS	TCPH	Gross $/ha	$/ha minus nitrogen fertiliser costs
Minato	116	14	78	1404	1260
	150	13.9	79	1413	1227
Morley	98	11.4	103	1203	1082
	156	11.4	103	1205	1010
Steine	115	12.8	76	1151	1007
	153	12.9	75	1151	961

Assumptions used:
Sugar price- $270/ton
Harvesting and levies- $6.80
Nitrogen value- $1.24/kg of nutrient
Date harvested- 23/6/05

BSES Sugarcane for the future

Crop management
Nitrogen x time of harvest trials

Russo trial

Fertiliser blend	CCS	TCPH	Gross $/ha	$/ha minus fertiliser costs
GF501 (lower nitrogen rate)	14.3	112	2107	1815
GF560 (higher nitrogen rate)	13.76	121	2110	1751

Assumptions used:
Sugar price- $270/ton
Harvesting and levies- $6.80
Fertiliser cost:
GF501- $563.20
GF560- $558.80
Nutrients for each fertiliser blend:
GF501- 122kgN/ha, 21kgP/ha, 86kgK/ha, 12kgS/ha
GF560- 163kgN/ha, 18kgP/ha, 96kgK/ha, 23kgS/ha

BSES Sugarcane for the future

Crop management-
Consider controlled traffic systems

- Consider implementing a controlled traffic system or consider increasing row spacing, so that blocks can be harvested in moist soil conditions without damaging the stool.

BSES Sugarcane for the future

Crop management- Consider controlled traffic systems

Photo.

Harvesting of a controlled traffic block early in the season.

Block located at Bilyana.

APPENDIX 4 – Armytage presentation

Facilitated industry workshop on Season Length Optimisation

syngenta

Philip Armytage
Tech Services lead, Sugar / Cotton

31st January 2005

Early sugar

Ripeners and
Plant Growth Regulators

Moddus

What it does
What it doesn't do

Herbert pilot program 2006

Ripeners and Plant Growth Regulators

Ethrel: ethylene ripening gas

Artificial ripening

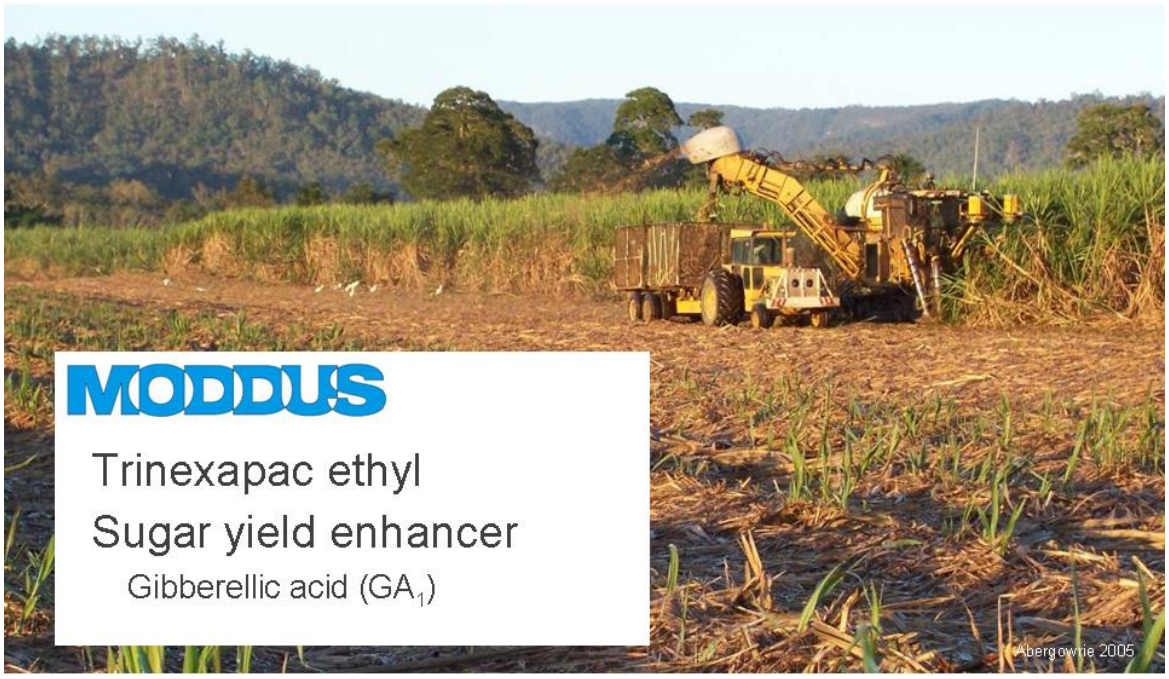
syngenta

Images: Bananas.com, Victory seeds, Syngenta

Ripeners and Plant Growth Regulators

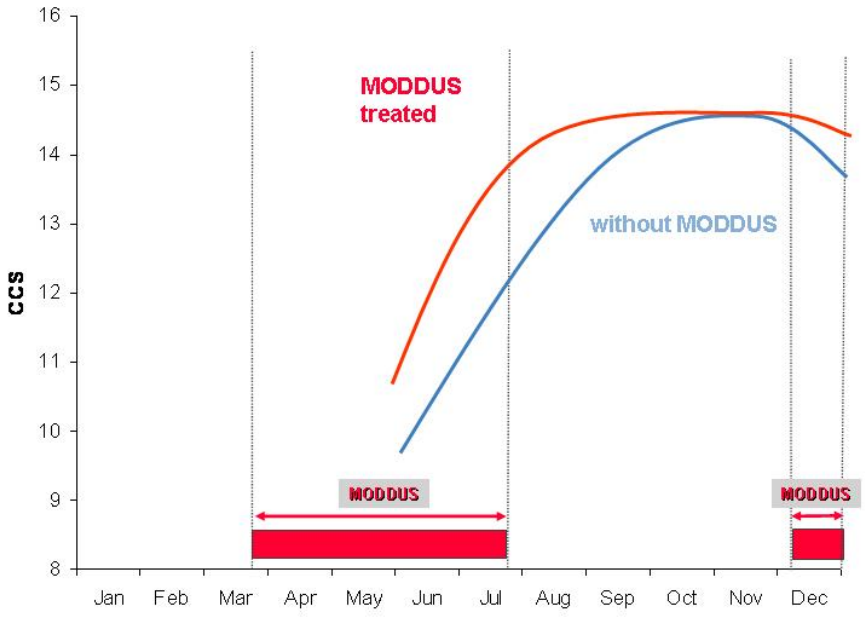
syngenta

Ripeners and Plant Growth Regulators



5 syngenta

MODDUS - What does it do?



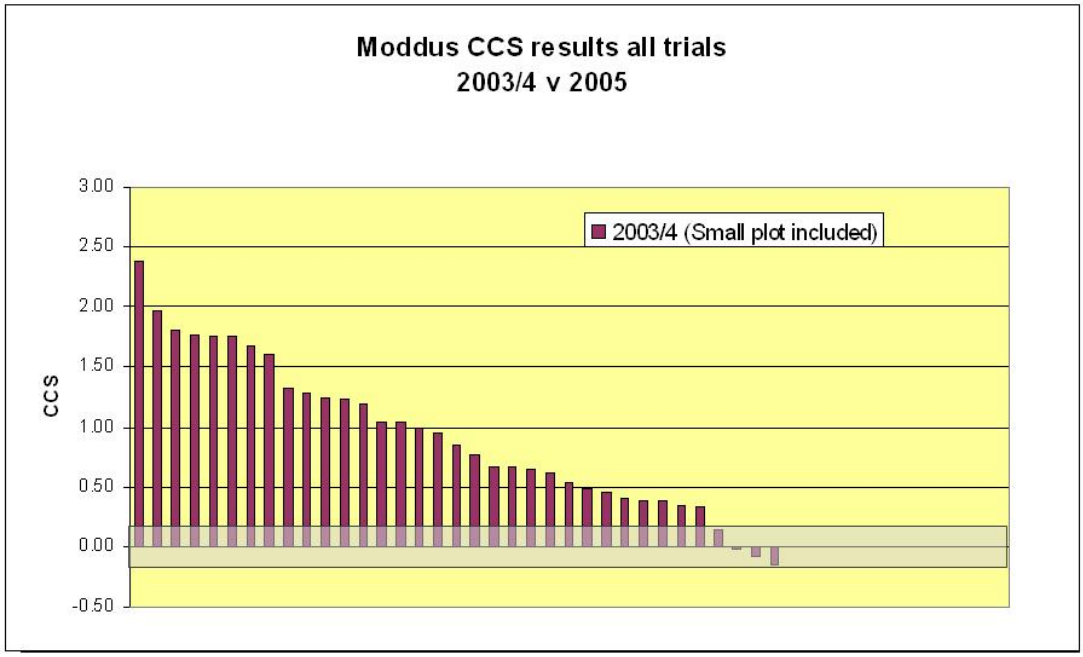
Application window

Use patterns

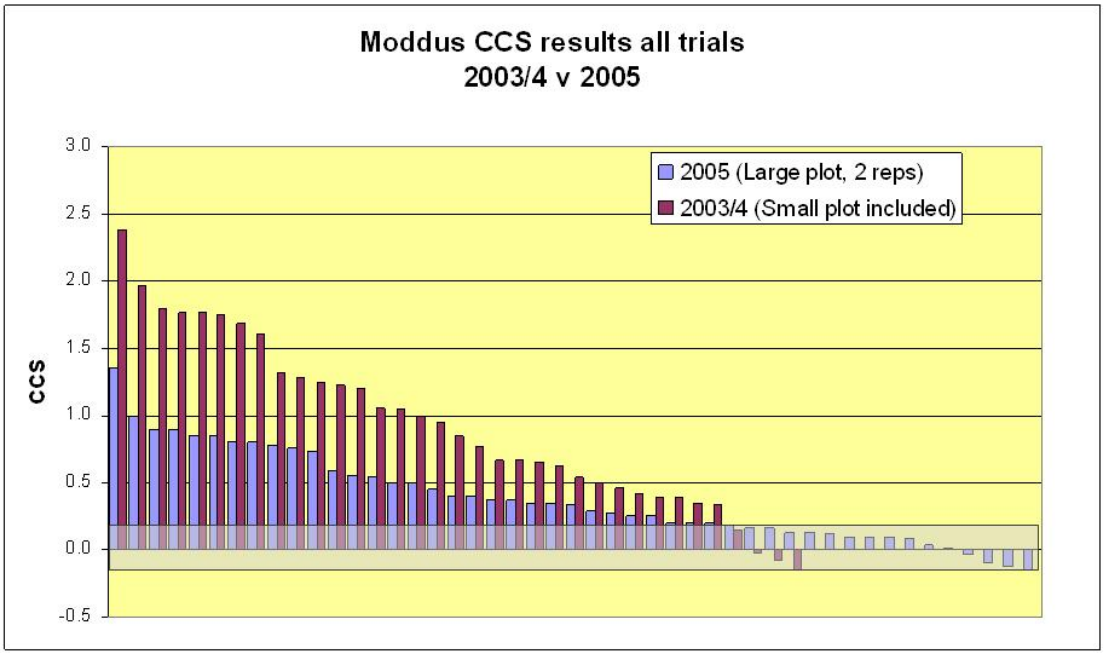
Maturity / Stress

Source: Syngenta Brazil

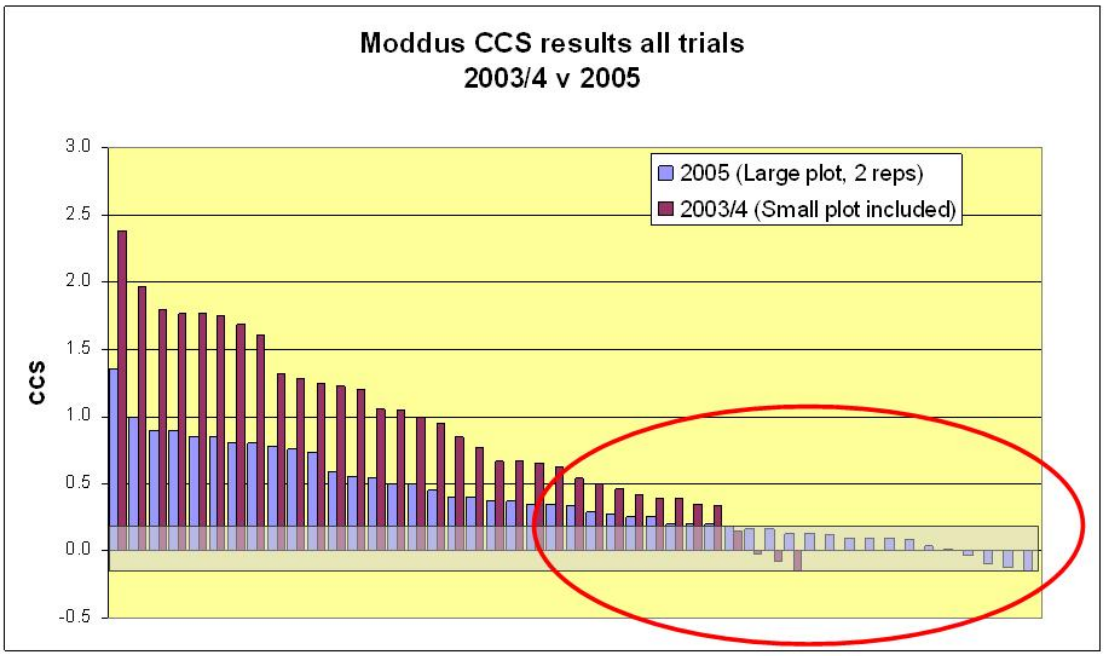
6 syngenta



7 syngenta



8 syngenta



MODDUS - Making it work

Maturity / Flowering

Stress
- Soil moisture
- Disease / Nutrition

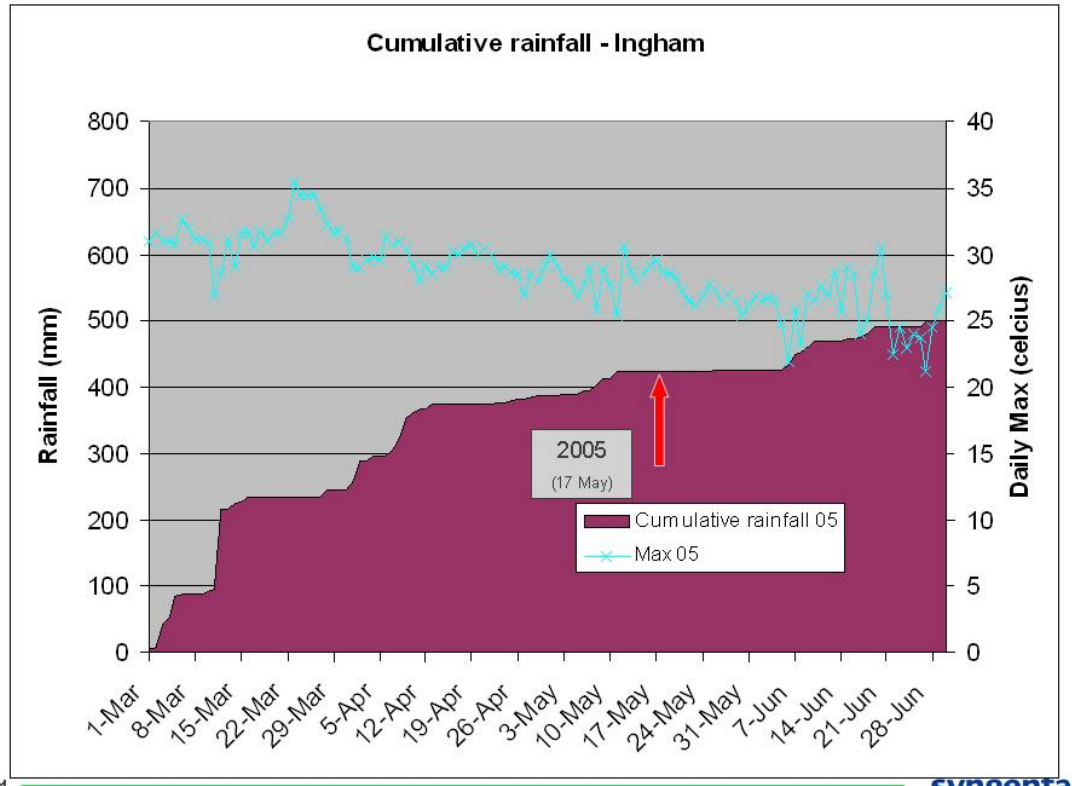
Green leaves

Juice purity

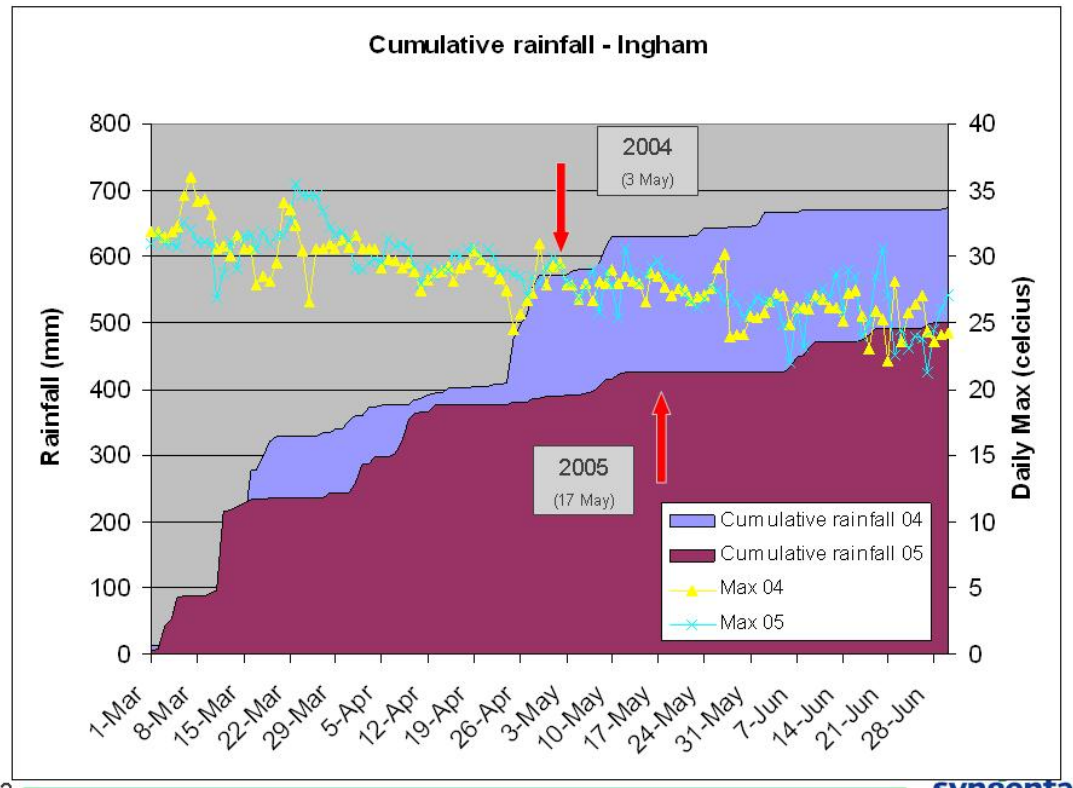
Q174…

(Q152 Q120 Argos MIDA Q117 Q127 Q195 Q96)

Lodged crops



11 syngenta



12 syngenta

Visual effects from MODDUS

13

syngenta

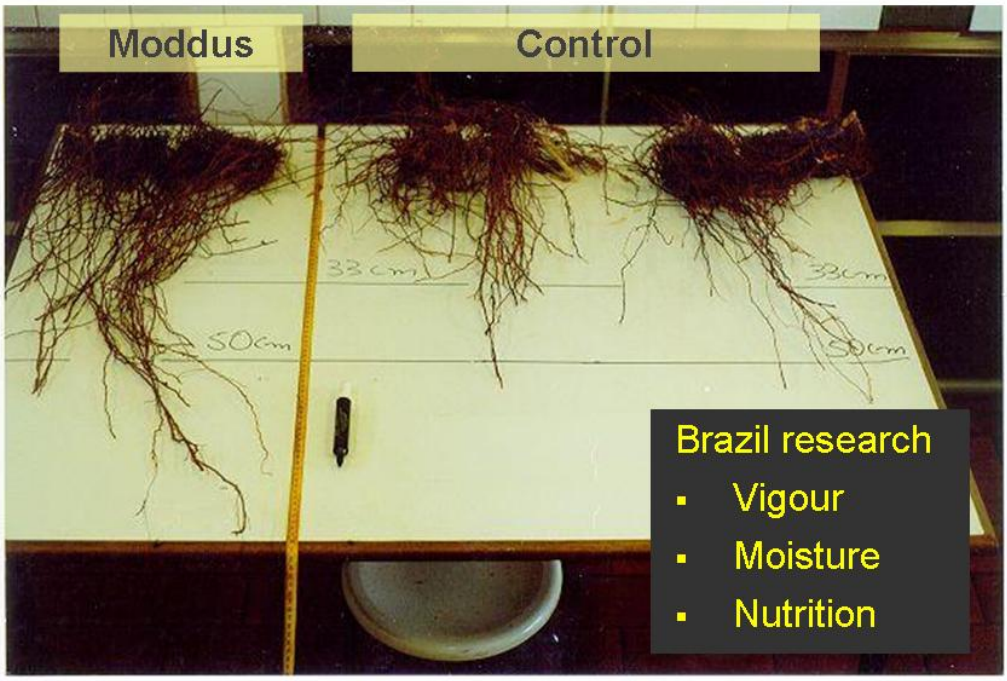
Mid season rainfall

Inhibiting growth

- Suckers
- Top growth

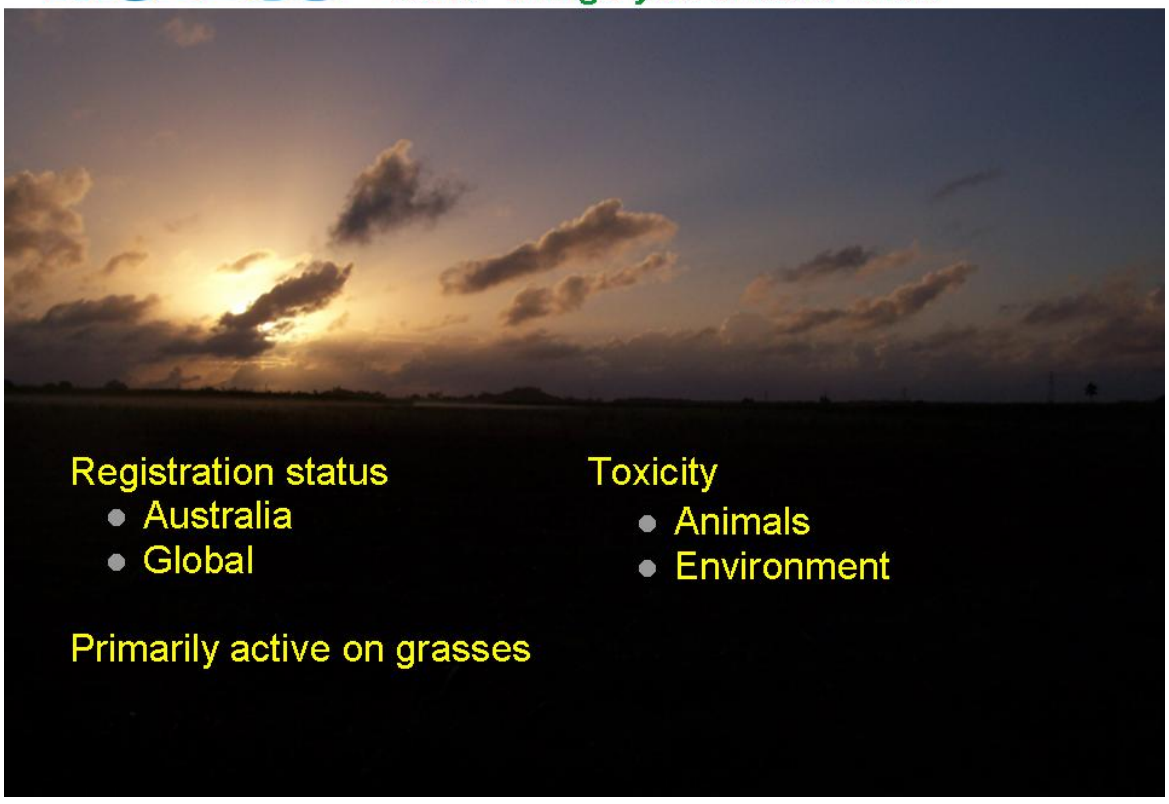
CCS decline

syngenta


Moddus
Control
33 cm
50cm
Brazil research
Vigour
Moisture
Nutrition

MODDUS Ratoon effects

MODDUS - Other things you should know

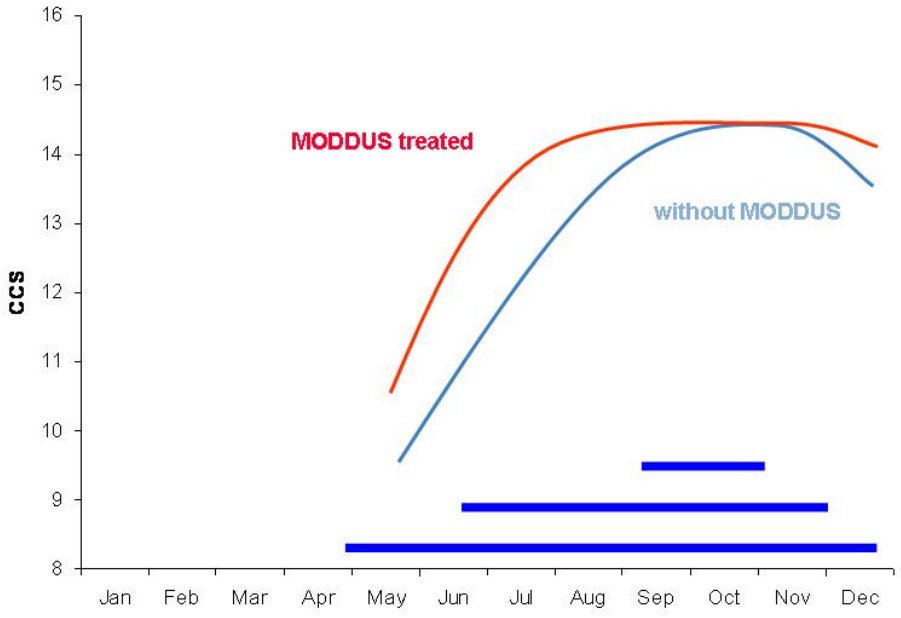


Registration status
- Australia
- Global

Primarily active on grasses

Toxicity
- Animals
- Environment

MODDUS and season length



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Herbert pilot program 2006

CANEGROWERS

4,000ha large scale permit

User accreditation

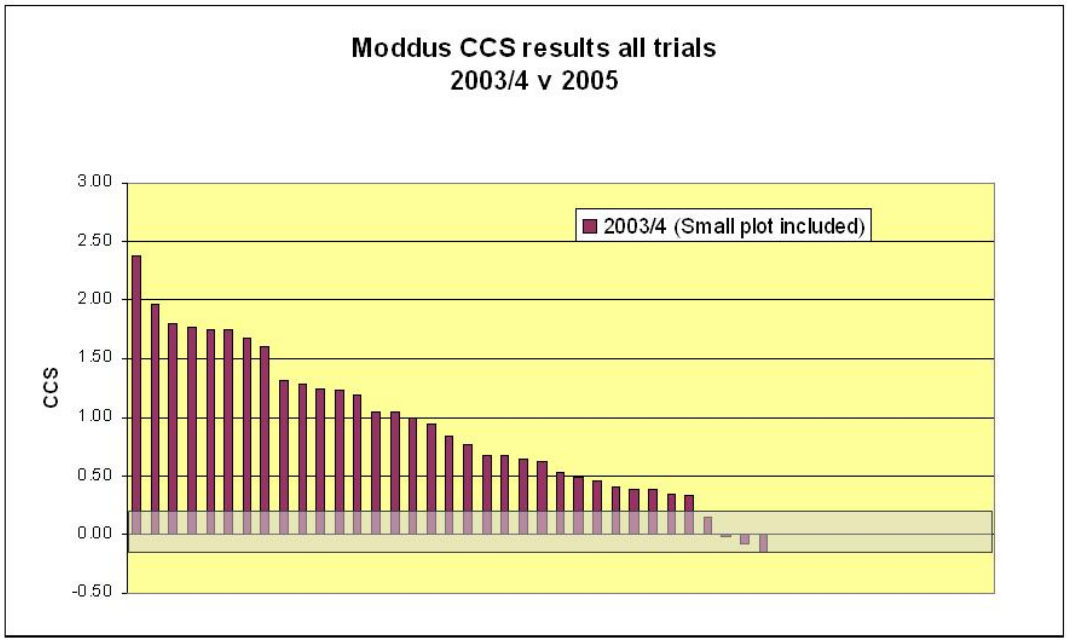
- Grower and aerial applicator
- Good neighbor program

Field inspection

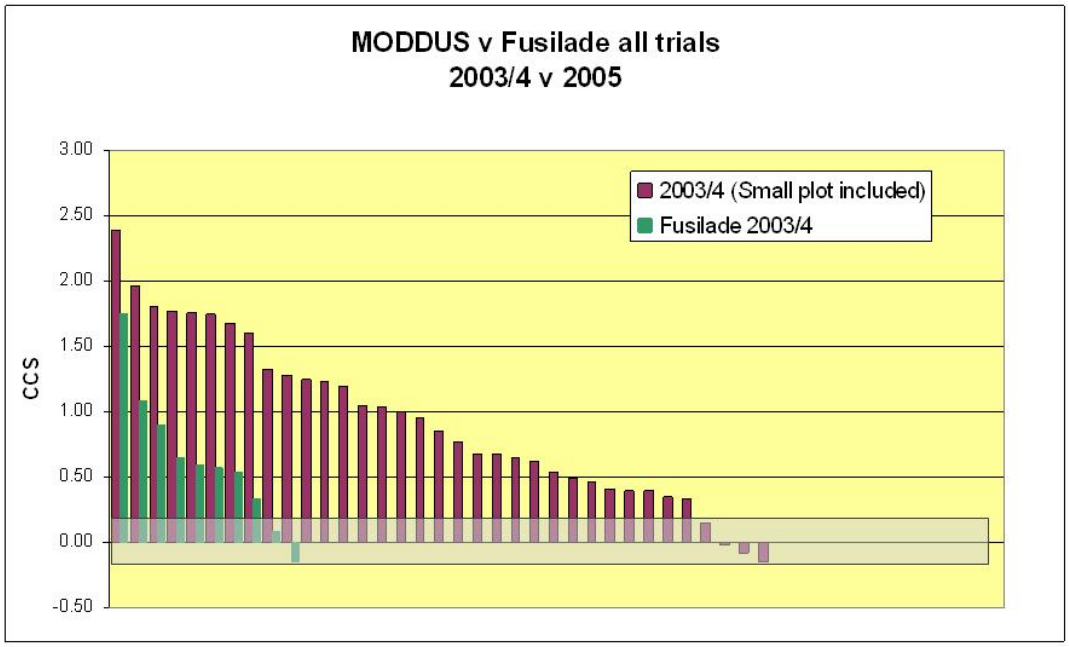
- HCPSL field visit
- Data collation

syngenta

South Africa and Fusilade



25 syngenta



26 syngenta

APPENDIX 5 – Prestwidge presentation

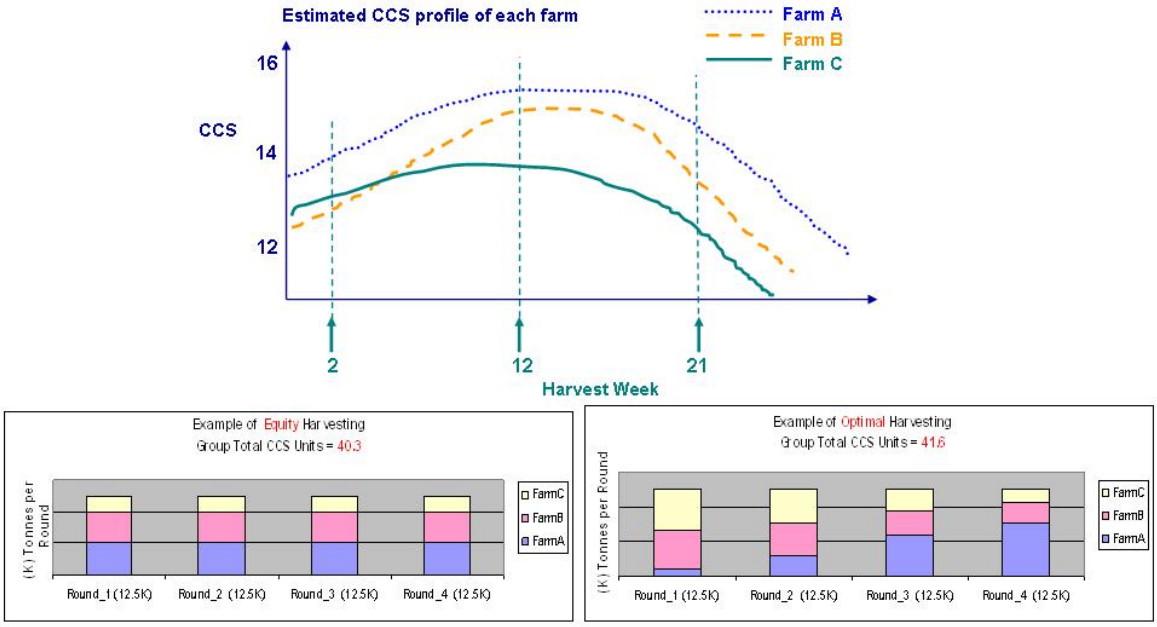
Optimising Sugar Yield

CSIRO Sustainable Ecosystems
Di Prestwidge
Andrew Higgins
Adam Power
Luis Laredo

Presentation Content

- **Introduce SugarMax concepts**
- **How SugarMax has been modelled for the Herbert**
- **Example of Region-wide harvest schedules**
  - Ordering Harvesting by Districts
- **Examples of Harvesting Group harvest schedules**
  - Harvesting 2 groups as 1 group
  - Harvesting using Wet and Dry machines
  - Harvesting by scheduling Varieties
- **Examples of Farm level harvest schedules**
  - Ordering Harvesting by Varieties / Ratoons / Wet and Dry Blocks

SugarMax concept:- aims to provide an optimal time of harvest schedule to gain the maximum amount of sugar using historical CCS and Cane Yield trends.



(SugarMax also uses Cane Yield trends to estimate Sugar Yield)

SugarMax concepts:-

Harvest Scheduling implications:-

- **Transport scheduling**
  - Line capacity, Siding capacity, Loco runs
- **Harvester and Siding Logistics**
  - Harvesting costs, Movement costs, Harvester RDO rosters, Siding Rosters
- **On-Farm operations**
  - Irrigation scheduling, Nutrient management, Ripeners management, Plough-out Re-Plant decisions

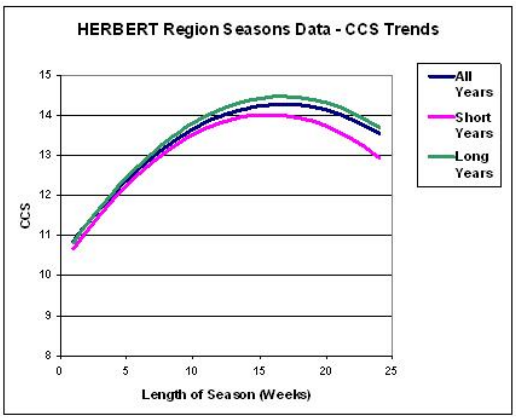
SugarMax in the Herbert

Maximising Sugar within:-

- the Region by optimally scheduling Districts
- Harvesting Groups by optimally scheduling Farms (or sets of Blocks from Farms)
- Farms by optimally scheduling (a) Variety and/or (b) Wet/Dry Blocks

Using historical CCS and Cane Yield trends from Long and Short seasons

- All years data (1990-2004) (approx. 22 weeks)
- Long seasons data (1993-1997, 2004) (approx. 24 weeks)
- Short seasons data (1990-1992, 1999-2003) (approx. 18 weeks)



Region-wide – optimally scheduling Districts (Example using Lawrence & Andrew's nominated Districts for Rounds)

DISTRICT (Tonnes)	ROUND_1	ROUND_2	ROUND_3	ROUND_4	ROUND_5	ROUND_6
SUNNYBANK	264 K					
BAMBAROO WEST	135 K					
BAMBAROO EAST	102 K	34 K				
HELENS HILL		177 K				
YURUGA		154 K				
FAIRFORD TREBONNE		249 K				
COOLBIE ROLLINGSTONE		130 K				
HALIFAX FOUR MILE		236 K				
MACKNADE			218 K			
UPPER STONE			153 K			
TOOBANNA			142 K			
TARA SEYMOUR			235 K			
BLAC KROCK		22 K	252 K			
RIPPLE CREEK				151 K		
CORDELIA				214 K		
LANNERCOST				195 K		
HAMLEIGH				159 K		
MID STONE				185 K		
FORESTHOME				97 K	74 K	
VICTORIA ESTATE					119 K	
HAW KINS CREEK					198 K	
LOWER STONE					246 K	
LANNERCOST EXTENSION					186 K	
LEACH					246 K	79 K
LONG PKT ELPHINSTONE						147 K
GARRAWALT						274 K

SugarMax model estimated an average Region-wide gain of $0.25/tonne (approx.$1.24M)

(Example using: –

- LD&AW suggestions

- District CCS trends ONLY

- Short years data

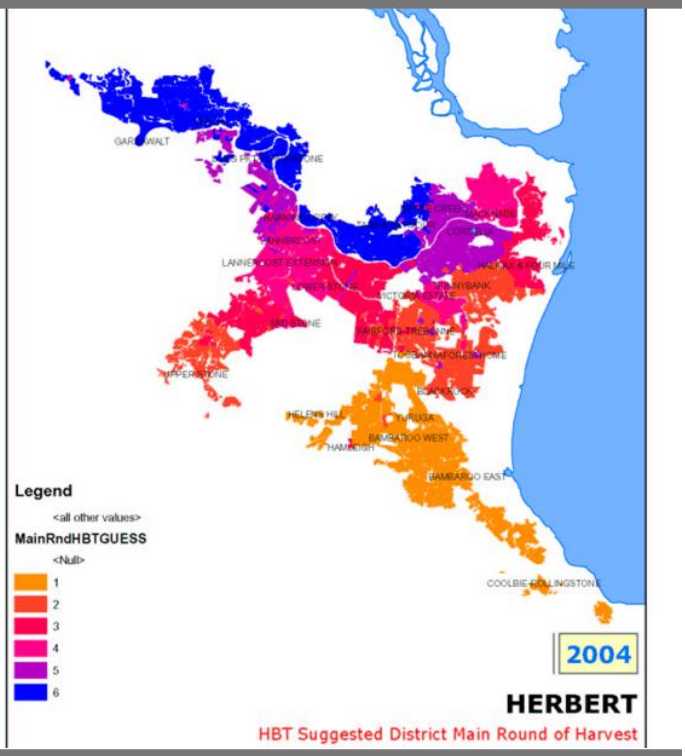
- Max. of 100% per Round

- Sugar price of $270/t)

Region-wide – optimally scheduling Districts (using Lawrence and Andrew suggestions)

MAP OF REGION showing an Optimal Harvest Schedule for DISTRICTS

(showing Main Round of Harvest for each District)



Region-wide – optimally scheduling Districts

Examples of Region-wide harvest schedules - changing Years of data, Max. % per Round and CCS/TCH trends

Example	*Years*	*Modelled*	*CCS/TCH*	*Max % per Round*	*$/tonne Gain*
1	Short	LD&AW	CCS	100%	$0.25
2	Short	LD&AW	CCS	50%	$0.06
3	Short	LD&AW	CCS+TCH	50%	$0.20
4	Short	SugarMax	CCS	100%	$0.63
5	Long	SugarMax	CCS	100%	$1.51
6	Long	SugarMax	CCS	50%	$1.27

**Note: This table shows the benefits from a Long season are greater than from a Short season. (2006 should be a Long season)

Harvest Group – optimally scheduling Farms
(Example of scheduling 2 Groups harvesting as 1 Group)

**(Using:- LD&AW District Rounds; District CCS trends ONLY
Short years data; Max. of 70% per Round; Sugar price of $270/t)**

SUGARMAX Optimised Results: hbt-2groups-harvesting-as-1group
EXAMPLE GROUP EXAMPLE GROUP

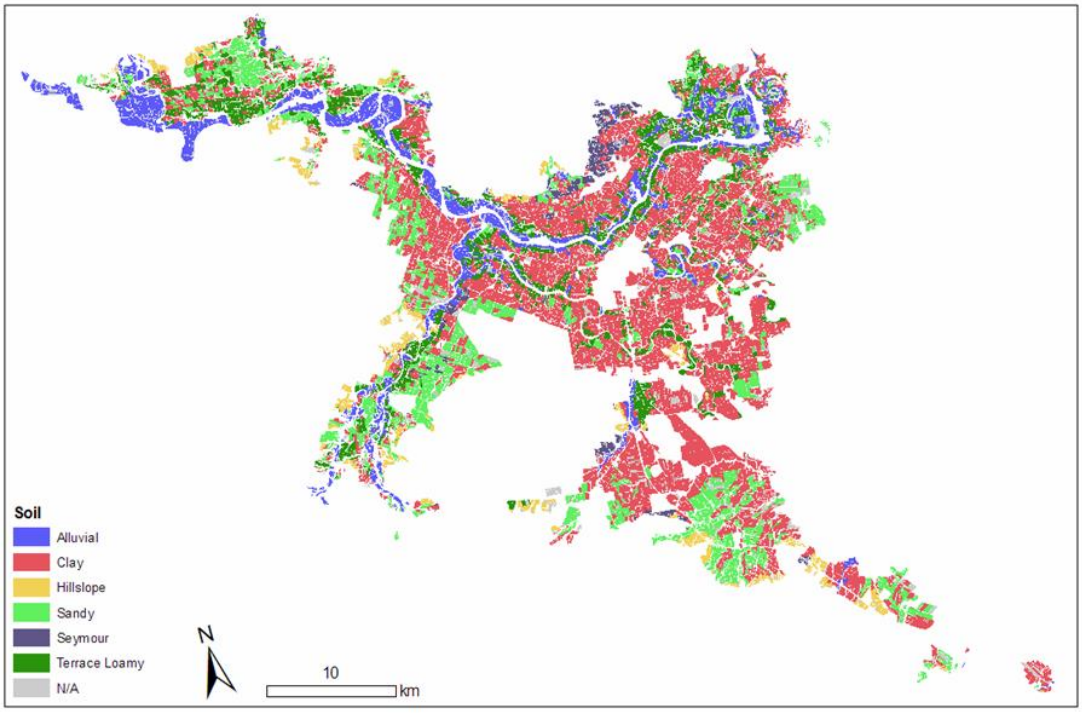
Sugar Price ($/t):- $270 *Rounds :-* 6 *Season Length :-* 22 *Maximum % taken per Round :-* 70 *TCH Trends Used? :-* No

Equity $ / Tonne:-	$35.45	*Optimised $ / Tonne:-*	$36.29	*$ / Tonne gained:-*	$0.84
Equity Gross ($):-	$3,378,202	*Optimal Gross ($):-*	$3,458,680	*Gross Gained ($):-*	$80,477

Optimal Harvest Schedule - Tonnes (%) per Round

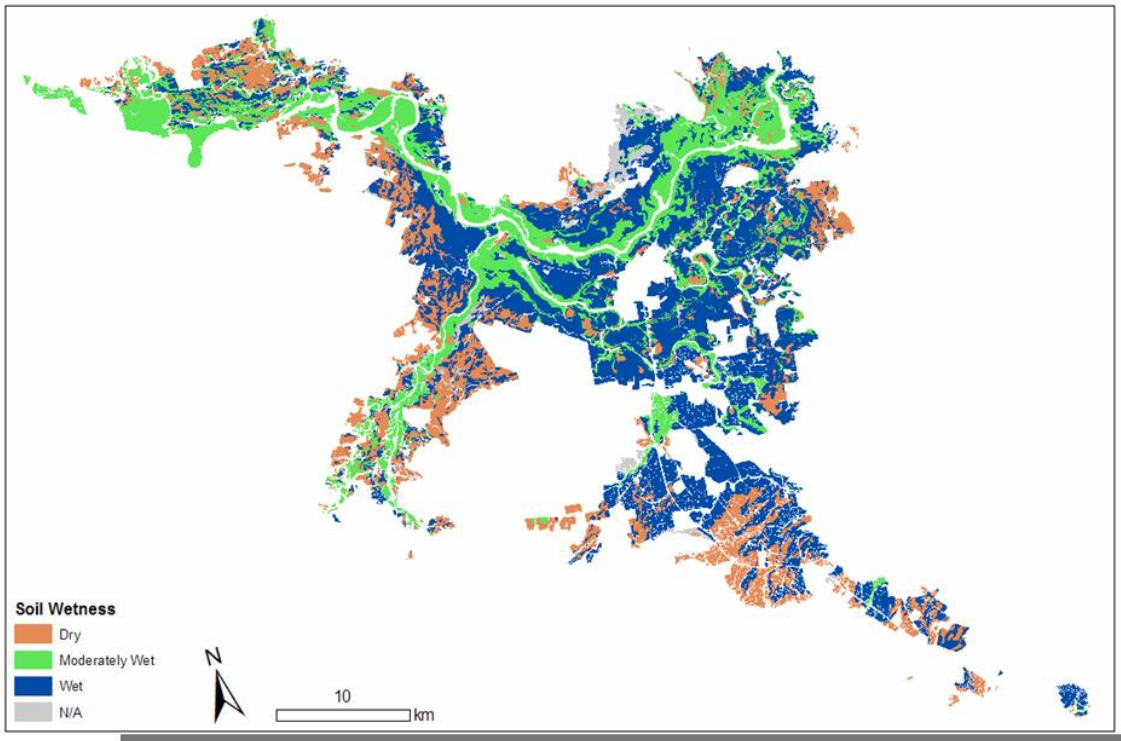
Grouped by FARM	*Rnd 1*	*Rnd 2*	*Rnd 3*	*Rnd 4*	*Rnd 5*	*Rnd 6*	*Total Tonnes*
FARM_1_A	0 (0%)	8,776 (23%)	0 (0%)	0 (0%)	19,061 (51%)	9,531 (26%)	37,368
FARM_2_A	1,902 (43%)	2,567 (57%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	4,469
FARM_3_B	5,420 (70%)	2,323 (30%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	7,743
FARM_4_B	2,209 (29%)	5,396 (70%)	104 (1%)	0 (0%)	0 (0%)	0 (0%)	7,709
FARM_5_B	0 (0%)	0 (0%)	18,957 (50%)	19,061 (50%)	0 (0%)	0 (0%)	38,019
TOTAL	9,531 (10%)	19,061 (20%)	19,061 (20%)	19,061 (20%)	19,061 (20%)	9,531 (10%)	95,307

Harvest Group - optimally scheduling Farms
(Example of scheduling Wet and Dry Blocks) - (Soils Distribution)



Harvest Group - optimally scheduling Farms

(Example of scheduling Wet and Dry Blocks) (Soil Wetness Distribution)



Harvest Group - optimally scheduling Farms

(Scheduling Wet and Dry Blocks across the season)

(Scheduling 2 Groups harvesting as 1 Group

– Dry Blocks scheduled towards end of season)

Equity $ / Tonne:-	$35.67	*Optimised $ / Tonne:-*	$35.71	*$ / Tonne gained:-*	$0.03
Equity Gross ($):-	$2,727,758	*Optimal Gross ($):-*	$2,730,197	*Gross Gained ($):-*	$2,439

Optimal Harvest Schedule - Tonnes (%) per Round

Grouped by FARM	*Rnd 1*	*Rnd 2*	*Rnd 3*	*Rnd 4*	*Rnd 5*	*Rnd 6*	*Total Tonnes*
GROUP_A_FARM_10-Wet	2,374 (34%)	1,137 (16%)	0 (0%)	3,511 (50%)	0 (0%)	0 (0%)	7,022
GROUP_A_FARM_11-Wet	0 (0%)	0 (0%)	1,611 (50%)	1,611 (50%)	0 (0%)	0 (0%)	3,221
GROUP_A_FARM_12-Wet	0 (0%)	1,277 (50%)	0 (0%)	1,277 (50%)	0 (0%)	0 (0%)	2,553
GROUP_A_FARM_13-Wet	2,430 (50%)	0 (0%)	2,294 (47%)	136 (3%)	0 (0%)	0 (0%)	4,860
GROUP_A_FARM_14-Wet	0 (0%)	0 (0%)	1,699 (50%)	1,699 (50%)	0 (0%)	0 (0%)	3,398
GROUP_A_FARM_15-Wet	2,843 (50%)	704 (12%)	2,139 (38%)	0 (0%)	0 (0%)	0 (0%)	5,685
GROUP_A_FARM_1-Wet	0 (0%)	4,179 (50%)	4,179 (50%)	0 (0%)	0 (0%)	0 (0%)	8,358
GROUP_A_FARM_4-Wet	0 (0%)	770 (50%)	770 (50%)	0 (0%)	0 (0%)	0 (0%)	1,540
GROUP_A_FARM_5-Wet	0 (0%)	964 (50%)	0 (0%)	964 (50%)	0 (0%)	0 (0%)	1,929
GROUP_A_FARM_6-Wet	0 (0%)	1,055 (15%)	0 (0%)	3,406 (50%)	2,350 (35%)	0 (0%)	6,811
GROUP_A_FARM_7-Wet	0 (0%)	2,368 (50%)	2,368 (50%)	0 (0%)	0 (0%)	0 (0%)	4,737
GROUP_A_FARM_8-Wet	0 (0%)	2,606 (50%)	0 (0%)	0 (0%)	2,606 (50%)	0 (0%)	5,212
GROUP_A_FARM_9-Wet	0 (0%)	233 (50%)	233 (50%)	0 (0%)	0 (0%)	0 (0%)	466
GROUP_B_FARM_1-Dry	0 (0%)	0 (0%)	0 (0%)	912 (7%)	6,269 (50%)	5,357 (43%)	12,537
GROUP_B_FARM_2-Dry	0 (0%)	0 (0%)	0 (0%)	1,778 (50%)	1,778 (50%)	0 (0%)	3,557
GROUP_B_FARM_4-Dry	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2,290 (50%)	2,290 (50%)	4,580
TOTAL	7,647 (10%)	15,293 (20%)	15,293 (20%)	15,293 (20%)	15,293 (20%)	7,647 (10%)	76,465

Harvest Group - optimally scheduling Farms
(Example of scheduling Wet and Dry Blocks)

(Example of scheduling Wet and Dry blocks within a Group)

SUGARMAX Optimised Results: Herbert. Example of harvesting Wet and Dry blocks in a group

GROUP EXAMPLE GROUP

Sugar Price ($/t):- $270 *Rounds :-* 6 *Season Length :-* 18 *Maximum Percent taken per Round :-* 100 *TCH Trends Used? :-* No

Optimised $ / Tonne:- $35.34 *$ / Tonne gained:-* $0.06 Dry
Equity $ / Tonne:- $35.28

Equity Gross ($):- $1,884,184 *Gross Gained ($):-* $3,153
Optimal Gross ($):- $1,887,336

Grouped by WETNESS — *Optimal Harvest Schedule - tonnes (%) per round*

	Rnd 1	Rnd 2	Rnd 3	Rnd 4	Rnd 5	Rnd 6	Total Tonnes
Dry	0 (0%)	0 (0%)	0 (0%)	0 (0%)	7777 (59%)	5341 (41%)	13118
Mod. Wet	5341 (30%)	10682 (59%)	1938 (11%)	0 (0%)	0 (0%)	0 (0%)	17960
Wet	0 (0%)	0 (0%)	8744 (39%)	10682 (48%)	2905 (13%)	0 (0%)	22330
TOTAL	5341 (10%)	10682 (20%)	10682 (20%)	10682 (20%)	10682 (20%)	5341 (10%)	

Harvest Group - optimally scheduling Varieties

(Example of scheduling Varieties across a Group using District trends)

Optimised $ / Tonne:- $16.22 *$ / Tonne gained:-* $0.82
Equity $ / Tonne:- $15.40

Equity Gross ($):- $318,456 *Gross Gained ($):-* $16,885
Optimal Gross ($):- $335,342

vty_code — *Optimal Harvest Schedule - tonnes (%) per round*

	Rnd 1	Rnd 2	Rnd 3	Rnd 4	Rnd 5	Rnd 6	Total Tonnes
0	1155 (10%)	2311 (20%)	2311 (20%)	2311 (20%)	2311 (20%)	1155 (10%)	11555
127	0 (0%)	999 (81%)	233 (19%)	0 (0%)	0 (0%)	0 (0%)	1232
137	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	173 (100%)	173
141	0 (0%)	0 (0%)	594 (36%)	162 (10%)	223 (13%)	672 (41%)	1651
155	0 (0%)	0 (0%)	307 (100%)	0 (0%)	0 (0%)	0 (0%)	307
157	0 (0%)	0 (0%)	0 (0%)	387 (100%)	0 (0%)	0 (0%)	387
158	845 (77%)	250 (23%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1095
159	0 (0%)	0 (0%)	0 (0%)	1141 (100%)	0 (0%)	0 (0%)	1141
173	67 (10%)	134 (20%)	134 (20%)	134 (20%)	134 (20%)	67 (10%)	668
26	0 (0%)	393 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	393
6	0 (0%)	0 (0%)	556 (100%)	0 (0%)	0 (0%)	0 (0%)	556
62	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1467 (100%)	0 (0%)	1467
83	0 (0%)	48 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	48
TOTAL	2067 (10%)	4135 (20%)	4135 (20%)	4135 (20%)	4135 (20%)	2067 (10%)	

Farms - optimally scheduling Varieties / Ratoons / Wet/Dry Blocks

(Example of Farm scheduling Varieties using District level trends)

	$/tonne t GAINED	Variety	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6
Farm A	$0.98	0	16%	22%	23%	19%	10%	10%
		108	0%	0%	0%	100%	0%	0%
		127	0%	0%	100%	0%	0%	0%
		13	0%	100%	0%	0%	0%	0%
		134	0%	0%	100%	0%	0%	0%
		135	0%	0%	0%	0%	100%	0%
		137	0%	0%	100%	0%	0%	0%
		141	0%	0%	0%	17%	83%	0%
		155	0%	100%	0%	0%	0%	0%
		157	0%	0%	100%	0%	0%	0%
		158	0%	100%	0%	0%	0%	0%
		159	0%	0%	33%	67%	0%	0%
		16	0%	0%	0%	0%	100%	0%
		26	7%	5%	11%	0%	0%	77%
		6	0%	0%	100%	0%	0%	0%
		83	100%	0%	0%	0%	0%	0%
		88	0%	100%	0%	0%	0%	0%
Farm B	$0.42	0	16%	22%	23%	19%	10%	10%
		137	0%	0%	100%	0%	0%	0%
		141	0%	0%	0%	51%	49%	0%
		26	10%	39%	36%	15%	0%	0%
		85	51%	0%	0%	0%	0%	49%

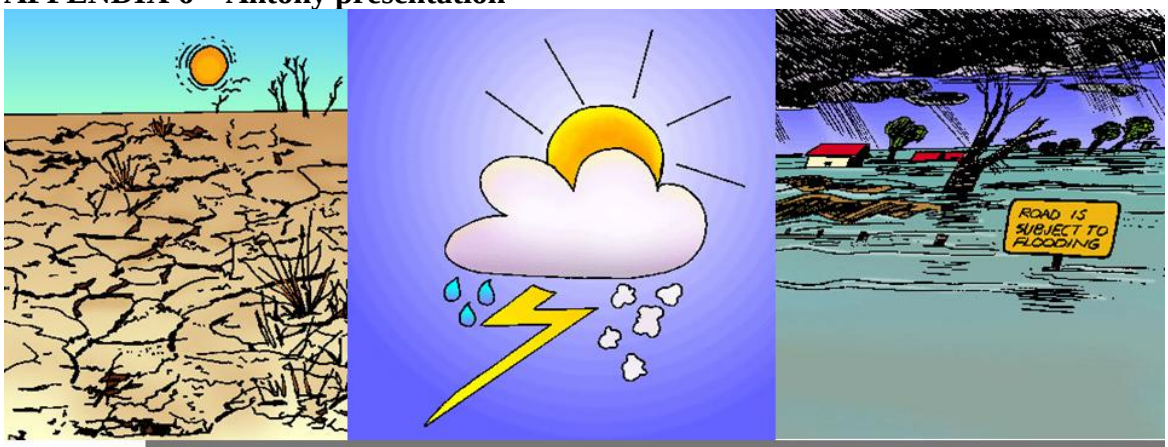
SugarMax summary

SugarMax:-

- Maximises Sugar across Farms, Groups, Region
- At no additional cost
- By optimising harvest schedules
- Develops revised schedules during season in response to changed conditions

BUT what happens if it RAINS???????

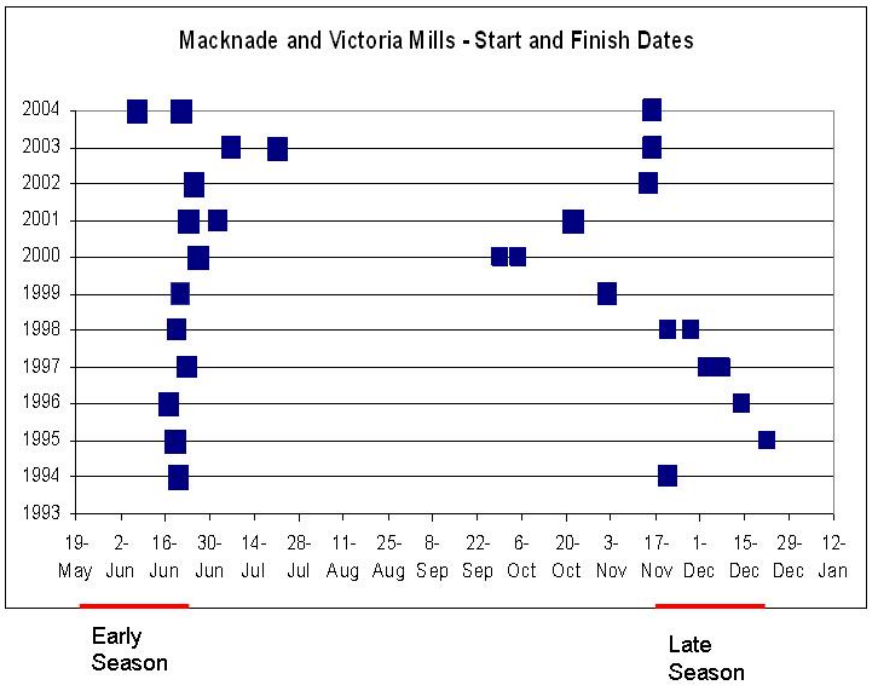
APPENDIX 6 – Antony presentation



Rainfall Risk in the Herbert region

CSIRO Sustainable Ecosystems
Di Prestwidge
George Antony
Andrew Higgins
Adam Power
Luis Laredo

Recent season lengths in the Herbert



Optimising Harvesting Season Length – Rainfall risk distribution across the region

Aim: To understand the risk of rainfall that would reduce soil trafficability during harvesting across the region

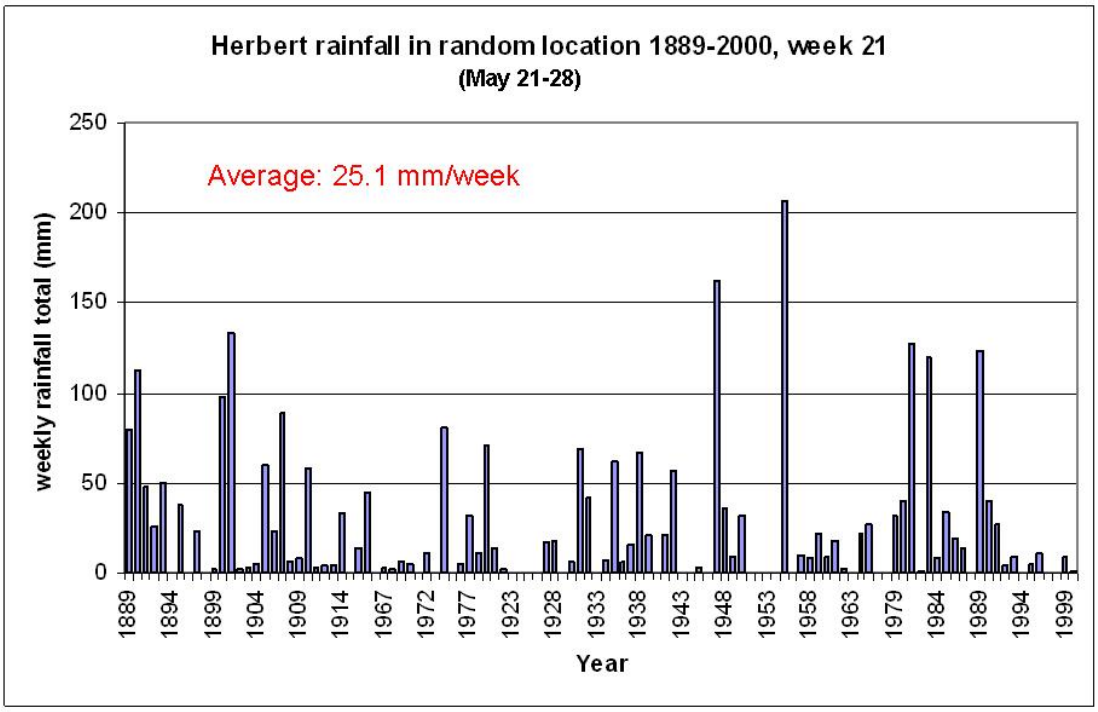
- Uses actual historical rainfall data
- Interpolated for each 5km grid across the region
- Concentrates on
  - Early Season (May 21 to June 17, weeks 21 to 24)
  - Late Season (Oct 23 to Nov 19, weeks 43 to 46)

Wetday rules

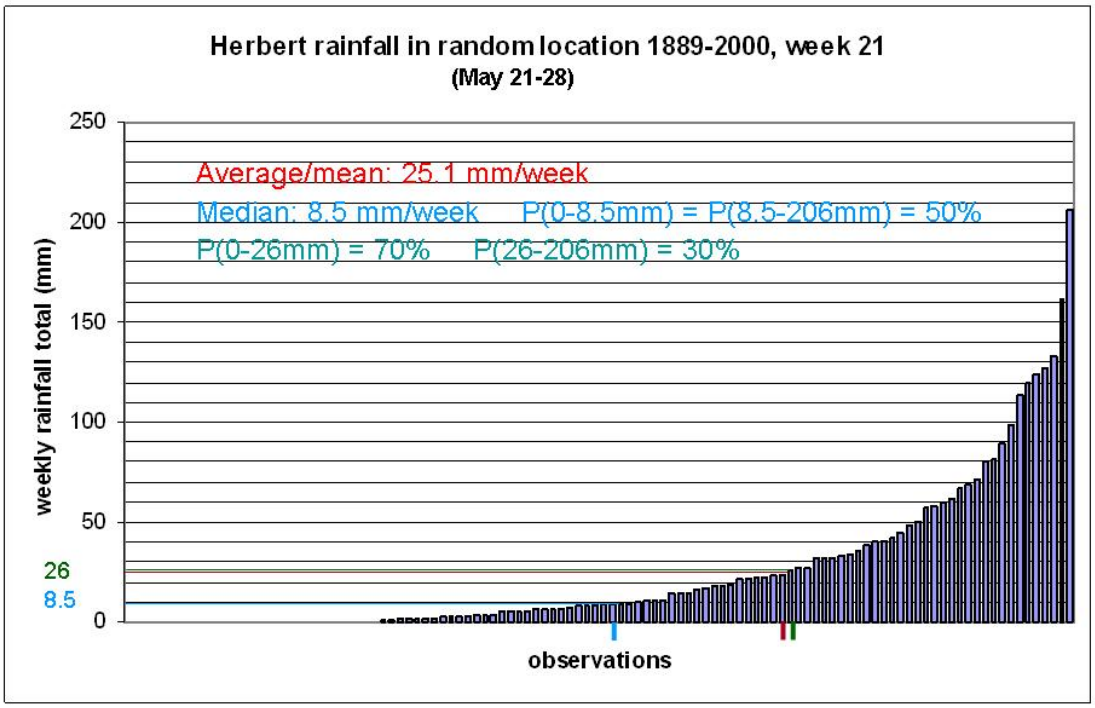
Aim: To represent the impact of rainfall levels on harvester operations

- Based on local expert opinion
- **WETDAYS1** - total no. of wet (W) days for the week
  - **if rain between 10mm and 20mm then that day is WET (W) (RULE 1)**
  - **if rain between 20mm and 30mm then that day + 1 are WET (WW)**
  - **if rain >=30mm then that day + 2 are WET (WWW)**

Rainfall probability – raw data



Rainfall probability – distribution

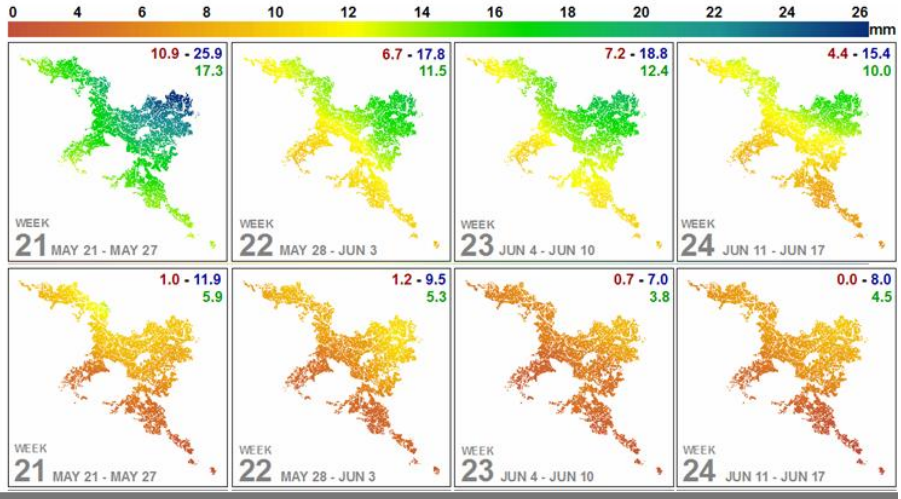


Average vs median weekly rainfall

EARLY Season Weeks

Average Weekly Rainfall

Median Weekly Rainfall

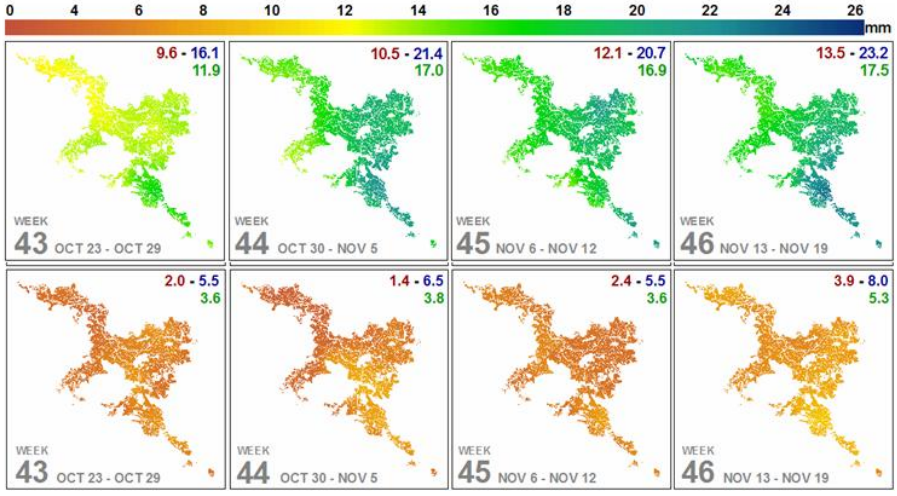


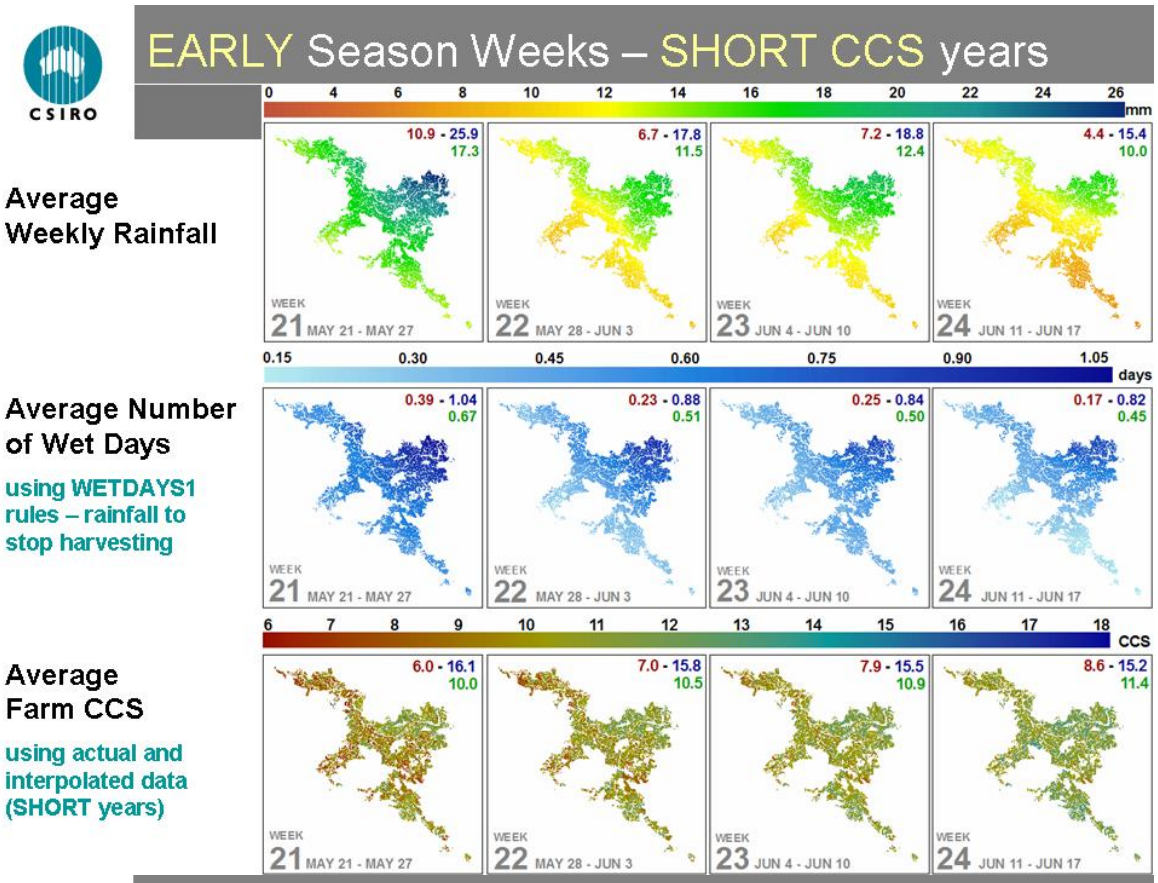
Median weekly rainfall

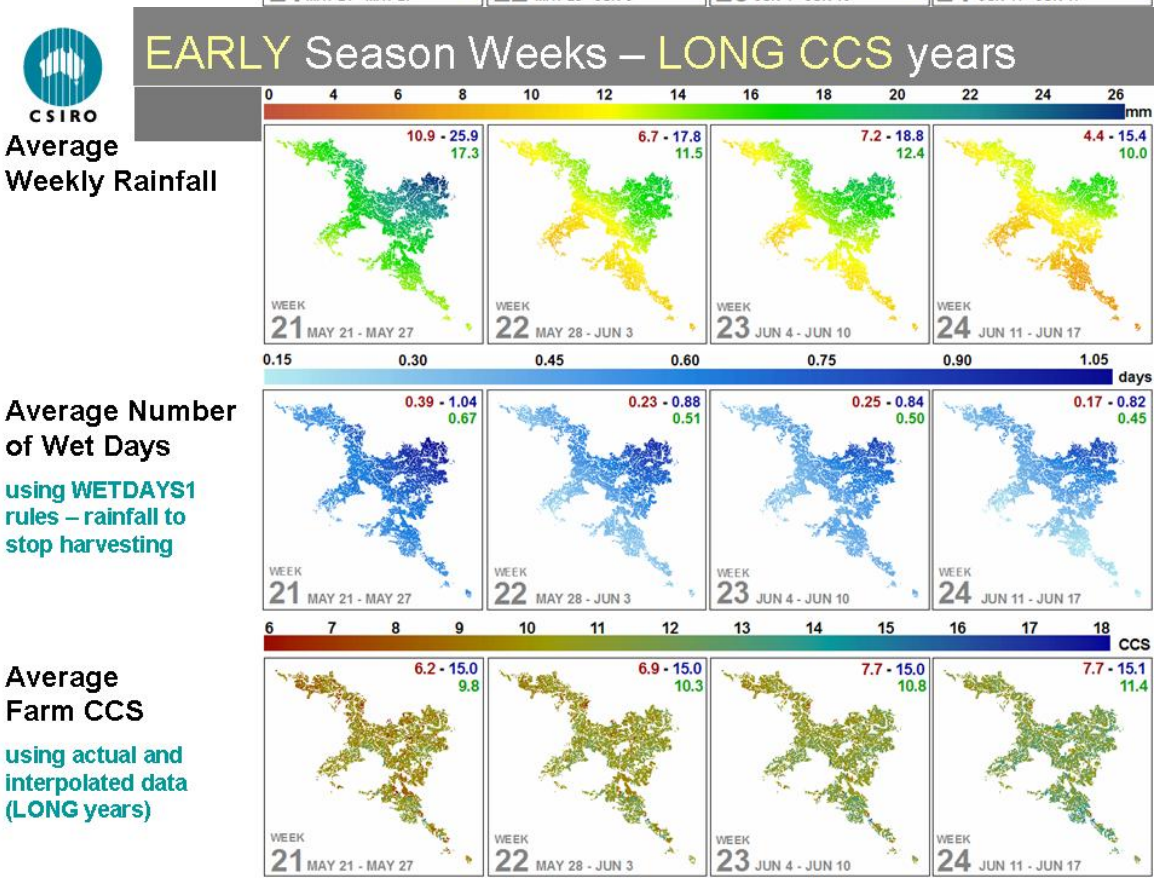
LATE Season Weeks

Average Weekly Rainfall

Median Weekly Rainfall




EARLY Season Weeks – SHORT CCS years
0 4 6 8 10 12 14 16 18 20 22 24 26
mm
10.9 - 25.9
17.3
6.7 - 17.8
11.5
7.2 - 18.8
12.4
4.4 - 15.4
10.0
WEEK 21 MAY 21 - MAY 27
WEEK 22 MAY 28 - JUN 3
WEEK 23 JUN 4 - JUN 10
WEEK 24 JUN 11 - JUN 17
Average Weekly Rainfall
0.15 0.30 0.45 0.60 0.75 0.90 1.05
days
0.39 - 1.04
0.67
0.23 - 0.88
0.51
0.25 - 0.84
0.50
0.17 - 0.82
0.45
Average Number of Wet Days
using WETDAYS1 rules – rainfall to stop harvesting
6 7 8 9 10 11 12 13 14 15 16 17 18
CCS
6.0 - 16.1
10.0
7.0 - 15.8
10.5
7.9 - 15.5
10.9
8.6 - 15.2
11.4
Average Farm CCS
using actual and interpolated data (SHORT years)


EARLY Season Weeks – LONG CCS years
0 4 6 8 10 12 14 16 18 20 22 24 26
mm
10.9 - 25.9
17.3
6.7 - 17.8
11.5
7.2 - 18.8
12.4
4.4 - 15.4
10.0
WEEK 21 MAY 21 - MAY 27
WEEK 22 MAY 28 - JUN 3
WEEK 23 JUN 4 - JUN 10
WEEK 24 JUN 11 - JUN 17
Average Weekly Rainfall
0.15 0.30 0.45 0.60 0.75 0.90 1.05
days
0.39 - 1.04
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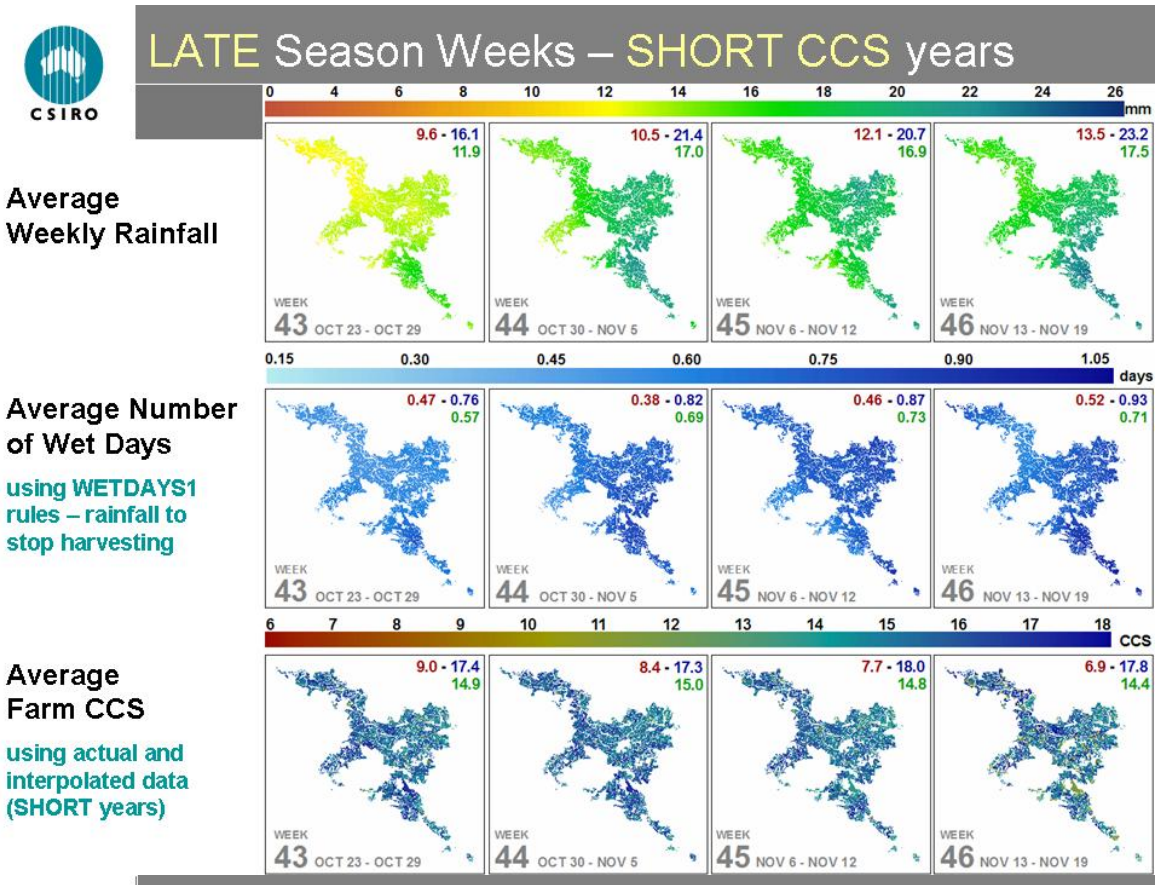
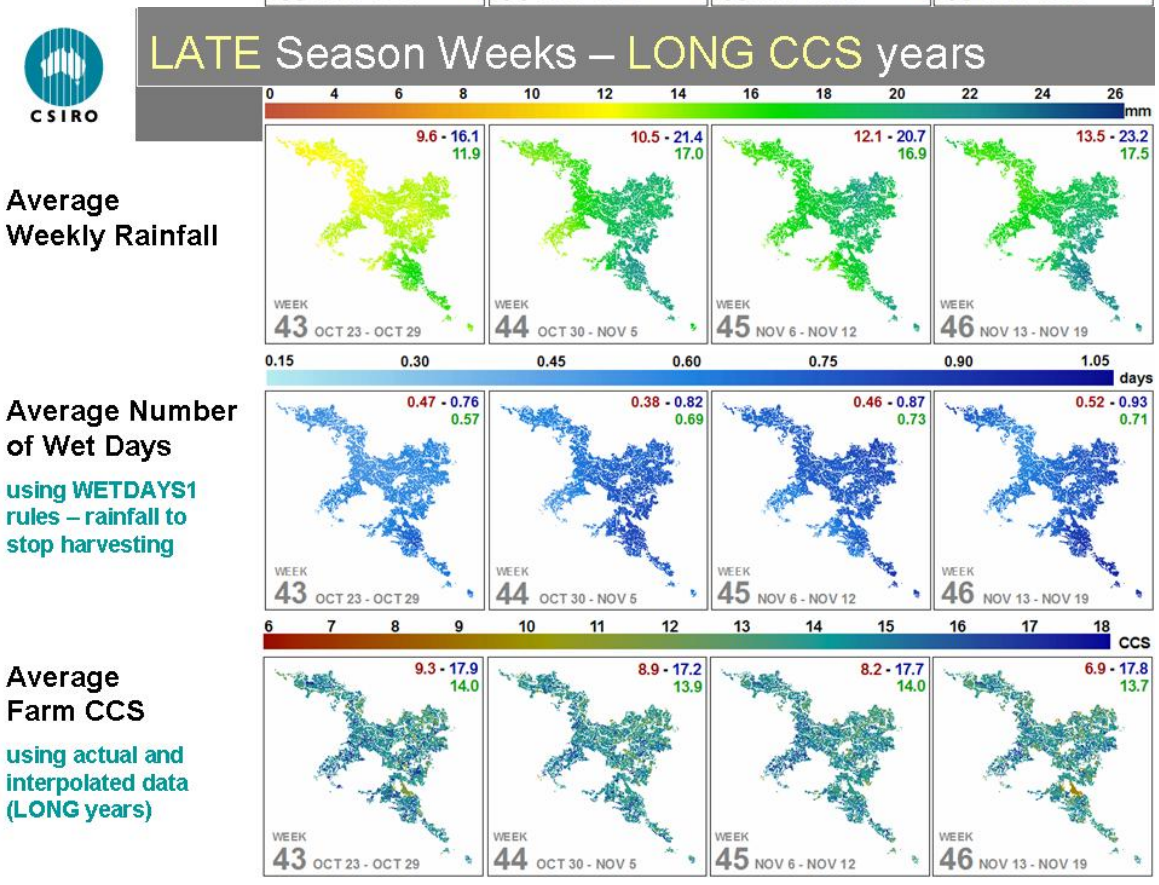
0.25 - 0.84
0.50
0.17 - 0.82
0.45
Average Number of Wet Days
using WETDAYS1 rules – rainfall to stop harvesting
6 7 8 9 10 11 12 13 14 15 16 17 18
CCS
6.2 - 15.0
9.8
6.9 - 15.0
10.3
7.7 - 15.0
10.8
7.7 - 15.1
11.4
Average Farm CCS
using actual and interpolated data (LONG years)


LATE Season Weeks – SHORT CCS years
0 4 6 8 10 12 14 16 18 20 22 24 26
mm
9.6 - 16.1
11.9
10.5 - 21.4
17.0
12.1 - 20.7
16.9
13.5 - 23.2
17.5
WEEK 43 OCT 23 - OCT 29
WEEK 44 OCT 30 - NOV 5
WEEK 45 NOV 6 - NOV 12
WEEK 46 NOV 13 - NOV 19
Average Weekly Rainfall
0.15 0.30 0.45 0.60 0.75 0.90 1.05
days
0.47 - 0.76
0.57
0.38 - 0.82
0.69
0.46 - 0.87
0.73
0.52 - 0.93
0.71
Average Number of Wet Days
using WETDAYS1 rules – rainfall to stop harvesting
6 7 8 9 10 11 12 13 14 15 16 17 18
CCS
9.0 - 17.4
14.9
8.4 - 17.3
15.0
7.7 - 18.0
14.8
6.9 - 17.8
14.4
Average Farm CCS
using actual and interpolated data (SHORT years)


LATE Season Weeks – LONG CCS years
0 4 6 8 10 12 14 16 18 20 22 24 26
mm
9.6 - 16.1
11.9
10.5 - 21.4
17.0
12.1 - 20.7
16.9
13.5 - 23.2
17.5
WEEK 43 OCT 23 - OCT 29
WEEK 44 OCT 30 - NOV 5
WEEK 45 NOV 6 - NOV 12
WEEK 46 NOV 13 - NOV 19
Average Weekly Rainfall
0.15 0.30 0.45 0.60 0.75 0.90 1.05
days
0.47 - 0.76
0.57
0.38 - 0.82
0.69
0.46 - 0.87
0.73
0.52 - 0.93
0.71
Average Number of Wet Days
using WETDAYS1 rules – rainfall to stop harvesting
6 7 8 9 10 11 12 13 14 15 16 17 18
CCS
9.3 - 17.9
14.0
8.9 - 17.2
13.9
8.2 - 17.7
14.0
6.9 - 17.8
13.7
Average Farm CCS
using actual and interpolated data (LONG years)

Inclusion of rainfall risk in harvest decisions

- **Shows financial costs/benefits of extended seasons for**
  - Different rainfall patterns and
  - Different risk aversion of stakeholders
- **Potential to extend SugarMax to schedule trafficable blocks for harvest**
- **Possible future work**
  - Incorporation of climate forecast information for in-season decisions
  - Linkage to forecasting the following year's crop

Thank You

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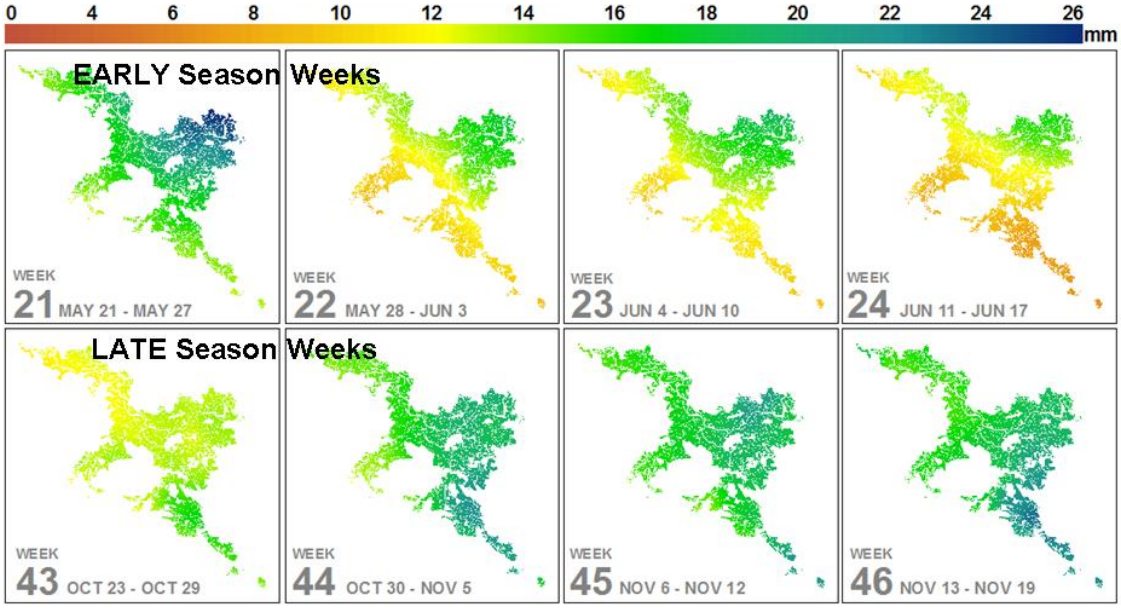
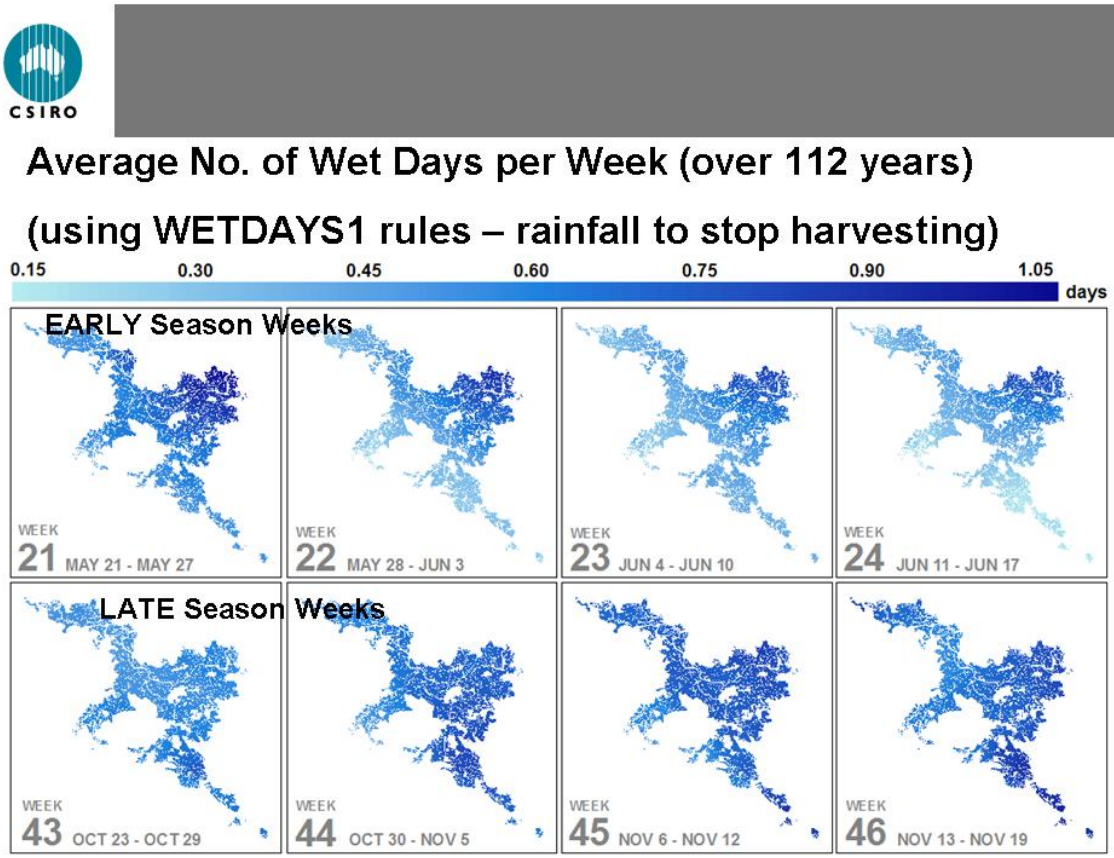

Average weekly rainfall (112 years data)
0 4 6 8 10 12 14 16 18 20 22 24 26
mm
EARLY Season Weeks
WEEK 21 MAY 21 - MAY 27
WEEK 22 MAY 28 - JUN 3
WEEK 23 JUN 4 - JUN 10
WEEK 24 JUN 11 - JUN 17
LATE Season Weeks
WEEK 43 OCT 23 - OCT 29
WEEK 44 OCT 30 - NOV 5
WEEK 45 NOV 6 - NOV 12
WEEK 46 NOV 13 - NOV 19


Average No. of Wet Days per Week (over 112 years)
(using WETDAYS1 rules – rainfall to stop harvesting)
0.15 0.30 0.45 0.60 0.75 0.90 1.05
days
EARLY Season Weeks
WEEK 21 MAY 21 - MAY 27
WEEK 22 MAY 28 - JUN 3
WEEK 23 JUN 4 - JUN 10
WEEK 24 JUN 11 - JUN 17
LATE Season Weeks
WEEK 43 OCT 23 - OCT 29
WEEK 44 OCT 30 - NOV 5
WEEK 45 NOV 6 - NOV 12
WEEK 46 NOV 13 - NOV 19

APPENDIX 7 - Mastripolitto and Sheedy presentation

A CONCEPT FOR COMBINING HARVEST GROUPS FOR GEOGRAPHICAL HARVESTING

CANEGROWERS
Herbert River

Optimising the Herbert's Harvest

The real goal.

A new concept in grouping and working co-operatively.

CANEGROWERS
Herbert River

Optimising the Herbert's Harvest

There is more than one way to skin a cat.

The Herbert has unique characteristics.

50 years ago – All harvested manually.

CANEGROWERS
Herbert River

Optimising the Herbert's Harvest

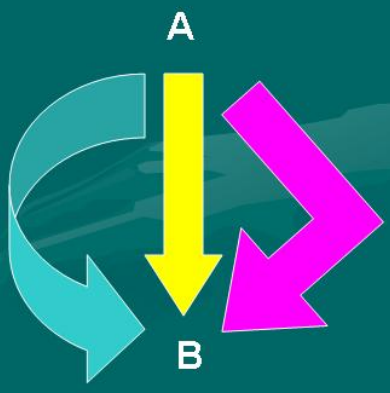
Innovation and enterprise has paid off.

Fully mechanised harvesting green.

CANEGROWERS
Herbert River

Optimising the Herbert's Harvest

There are many ways of getting from Point A to Point B.



In the end – we want the best smartest way.

CANEGROWERS Herbert River

Optimising the Herbert's Harvest

Processing a 5 million Tonne Crop

Numerous possible scenarios

15th June to 15th November

CANEGROWERS Herbert River

Optimising the Herbert's Harvest

Starting possibilities????

One Possibility

Say 5th June or some other early start date

Both Mills go after 2 or 3 weeks

CANEGROWERS
Herbert River

Optimising the Herbert's Harvest

Partnered approach to work during the early start period (Before both Mills run together)

- **Then the core season**
- **Then partner before ratooning cane is cut**
- **Then finish the season**

CANEGROWERS
Herbert River

Optimising the Herbert's Harvest

Make Hay while the Sun Shines

WIN FOR:

- Growers
- Harvesters
- Mills

CANEGROWERS
Herbert River

Optimising the Herbert's Harvest

New Approach to Harvest → **More Cane and Sugar**

↓

Upgrade Capacity

CANEGROWERS
Herbert River

APPENDIX 8 – Wood 'learnings' presentation

Season length issues

- Set by mill capacity
- For given crop size the smaller the mill capacity the longer the season length
- Season length ranged from 31-45 weeks

Season length issues

- Daily crushing rates are small by Australian standards
- Sth. Africa's largest mill has a lower daily crushing rate than Macknade.

Harvesting Operations

- Nearly all cane cut by hand
- Larger farms cut cane every day of season
- Cut to crush period is several days
- Lower rainfall than Herbert

Advantages of longer seasons

- Better use of milling and cane transport infrastructure
- Lower capital outlay in relation to crop size
- More attractive employment period for seasonal workers
- Smaller work force for harvesting

Main disadvantage is low sucrose levels

Crop ripeners

- Used extensively in Southern Africa
- 60-70% crop treated in 2005
- Used early and late in season
- Main ripeners Ethrel and Fusilade Super
- Used in combination or separately depending on variety
- Ripeners are not the silver bullet

Cane suitable for chemical ripening

- > 8 green leaves per stalk
- Actively growing
- No signs of stress
- No sign of lodging
- No sign of flowering (Ethrel suppresses flowering)

Summary

- Long seasons are accepted as part of growing cane in Southern Africa
- Growers and millers have similar discussions about season length
- Growers aware of cane age at harvest
- Growers aware of when ripeners will work
- Less nitrogen applied and drier (cane more likely to ripen naturally)

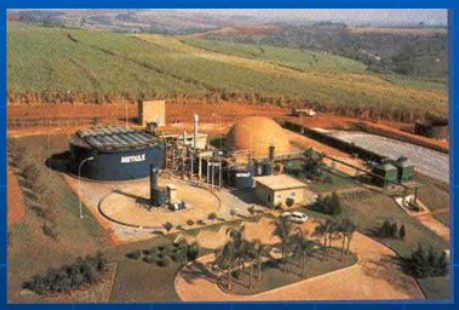
Brazil

Season length in Brazil

- Generally around 30-32 weeks
- Most mills start in mid April and finish in mid to late November
- Much of cane in Centre South grown on large farms and mill estates

Crop ripeners

- **Moddus, Glyphosate, Ethrel and Fusilade**
- **Trials in Brazil have shown that Moddus is effective in increasing CCS throughout the season**
- **Trials also suggest that Moddus stimulates root growth and ratooning**



Geographical harvesting

- Easy to conduct geographical harvesting on large farming units
- Multiple harvesters operating
- GIS based record keeping to identify most profitable sequence of blocks for harvest

Summary

- Longer seasons are accepted in Brazil
- Blocks for harvest based on variety and crop age
- Wide spread use of crop ripeners/ growth regulators
- Geographical harvesting to exploit most mature cane with high CCS

APPENDIX 9 – Wood 'alternative products' presentation

Alternative products from cane

Alternative products

- Electricity
- Ethanol
- Fibre board
- Furfural
- Wax
- Bioplastics
- Alcohol for beverages
- Pharmaceutical products

Season length issues

- Continuous supply of cane desirable
- Longer seasons more attractive for development of alternative products

Value adding in the Herbert

Herbert Regional Plan identifies the following value adding opportunities:

- Co-generation
- Ethanol
- Bio-plastics

APPENDIX 10 - Responses from the workshop questions "What opportunities to increase ongoing profitability?" and "What role does season length play with achieving these opportunities?"

Responses in respect of the role season length plays in achieving the opportunities is indicated in red as follows:
S- shorter season length
L- longer season length
N/A- not applicable
Where there is no indication, the respondents did not comment.

Group 1

- Cane varieties – Management of current varieties and breeding of new ones. N/A
- Access to CSIRO tools. N/A
- Target finish of season 15/11. S
- Not willing to cut below mill 10 CCS. S

Group 2

- Better, more reliable and port/milling fewer breakdowns. N/A
- Good partnerships between all participants. N/A
- Better varieties. N/A
- By products. (more an option with longer season length)
- Increase in human capacity better understanding. N/A
- Decrease growing costs eg. Min. till. S
- Adopt BMP. N/A
- Sidings more and bigger capacity. S
- Some control of geo groupings. N/A
- Better use of existing capital areas. L
- Co-generation –innovative bagasse storage?
- Focussing on HR specific issues
    - What's important to HR people
    - All areas.
- Repositioning ourselves (media & worldwide) as green, premier custodians of the land**.**
- Vertical integration.
    - Our business
    - Partial integration of between stakeholders.
- Traffic (weighbridge) control.

Group 3

- Earlier finish will promote more opportunities.
- Providing pricing mechanism addresses the prop oration to each party.
- Shorter season would benefit (needs modelling economics).
- For crystal sugar production (season length is critical).
- Early finish is better.
- A grower's future depends on a viable season length.
- Alternate crops (companion crops) to use existing infrastructure!

- Pricing mechanism to cater for everything produced from cane!
- Grower needs reward for cutting when CCS is lower.
- Partnered harvesting rewards need to cover all the costs of shifting if necessary.
- Improve soil balance (fertility)
- Improve profitability by improving mill performance (re-investing in reliability) to process more!

Group 4

- To grow the pie. L
- Value adding – for district. L
- Lowering costs and maximising profit. N/A depends
- Better milling performance.
    - Milling Capacity
    - Transport Restraints (Storing on Pad.) L
- Grower monitoring of CCS. N/A
- GPS harvester overlay CCS. N/A
- Maximise Harvester capacity for those who can start early (no harvester migration.) L
- Outside 22 weeks – Risk shared. L

Group 5

- Geographical harvesting eg. Roaming. N/A
- 2-row harvesting. N/A
- Mill efficiency. L
- Minimum tillage. N/A
- Bed forming. N/A
- Sugar by products. L
- Value adding. L
    - Co generation.
    - Plastic.
    - Electricity etc.
    - Fertiliser.
- Farm rationalisation. N/A
- Extended hours harvesting. N/A
- Variety Management. N/A
- Complimentary crop diversification (during rotation.) S
- Drainage –farm layouts. N/A
- Capital rationalisation eg Harvesters. N/A
- Training.
    - Employment Opportunity.
    - The next generation.
    - Young people. S,L, N/A
- Equity.
    - Harvest.
    - Risk and Reward. N/A

Group 6

- Farmers to own mill - S
- Cut costs – Two row harvesting to improve economics N/A
- Optimum return from current crop
  (CCS and season length and ratooning ability.) S
- Different products/alternatives from crop eg co generation. L
- Diversification. N/A
- Make mill more efficient throughout year. Particularly at peak harvesting times (transport & mill operation.) S
- Improved varieties suited to area – Better CCS at different times. S or L
- Form large district co-ops to buy machinery, fertiliser and fuel. N/A
- Community bank and lending facility. N/A

Group 7

- Alterative (products e.g. co-generation within existing system (Storage of baggage.) L
- Minimising season length for growers and harvesters. Works well for sugar crystal only?
- Mill then continues on, farmers can then work off farm. Need new profit share arrangement!
- On farm monitoring for CCS. Shorter season increase profit.
- Complimentary crops eg. Bambaroo. Shorter season increase profit.
- Change of forum to maximise return eg. Mackay and preliminary discussion with CSR. N/A
- Establish more trust for millers and growers. Transparency required.
- Investigate. Close Lucinda and transport sugar from Townsville. L
- Controlled traffic (influence costs.) N/A
- Wide swath harvesting N/A

Issue	Season length comment	Responses No.	Responses %
Payment System ,Risk/Reward sharing		**8**	**9.0%**
Providing pricing mechanism addresses the proportion to each party.	No comment		
Pricing mechanism to cater for everything produced from cane.	No comment		
Grower needs reward for cutting when CCS is lower.	No comment		
Partnered harvesting rewards need to cover all the costs of shifting if necessary.	No comment		
Outside 22wks – Risk shared.	Longer season		
Risk and Reward.	N/A		
Mill then continues on, farmers can then work off farm. Need new profit share arrangement!!	No comment		
Change of formula to maximise return eg. Mackay and preliminary discussion with CSR.	No comment		
Diversification - Other crops		**4**	**4.5%**
Alternate crops (companion crops) to use existing infrastructure!	No comment		
Complimentary crop diversification (During Rotation.)	Shorter season		
Diversification.	N/A		
Complimentary crops eg. Bamboo.	Shorter season		
Economies of Scale		**4**	**4.5%**
Better use of existing capital.	Longer season		

Farm Rationalisation.	N/A		
Capital rationalisation eg Harvesters.	N/A		
Wide swath.	No comment		
Farming Systems		**17**	**19.1%**
Adopt BMP.	N/A		
Minimum tillage.	N/A		
Bed forming.	N/A		
Fertiliser.	No comment		
Drainage –farm layouts.	N/A		
Controlled traffic (influence costs.)	No comment		
Access to CSIRO tools.	N/A		
Decrease growing costs eg. Min. till.	Shorter season		
Improve soil balance (fertility)	No comment		
Grower monitoring of CCS.	N/A		
GPS harvester overlay CCS.	N/A		
Optimum return from current crop (CCS and season length and ratooning ability.)	Shorter season		
On farm monitoring for CCS. increase profit.	Shorter season		
Cane varieties – Management of current varieties and breeding of new ones.	N/A		
Better varieties.	N/A		
Variety Management.	N/A		
Improved varieties suited to area – Better CCS at different times.	N/A		
Human resources		**7**	**7.9%**
Increase in human capacity better understanding.	N/A		
Focussing on HR specific issues	No comment		
What's important to HR people	No comment		
Training.	No comment		
Employment Opportunity.	No comment		
The next generation.	No comment		
Young people.	N/A		
Harvesting systems		**8**	**9.0%**
Some control of geographic groupings.	N/A		
Maximise Harvester capacity for those who can start early (no harvester migration.)	Longer season		
Geographical harvesting eg. Roaming.	N/A		
2 row harvesting.	N/A		
Extended hours harvesting.	N/A		
Cut costs – Two row harvesting. improve economics	No comment		
Wide swath.	No comment		
Harvest.	No comment		
Industry image		**1**	**1.1%**
Repositioning ourselves (media & worldwide) as green, premier custodians of the land**.**	No comment		
Mill reliability/ Cane & Sugar Transport efficiency		**10**	**11.2%**
Better, more reliable and port/milling fewer breakdowns.	N/A		
Sidings more and bigger capacity.	Shorter season		
Traffic (weighbridge) control.	No comment		
Improve profitability by improving mill performance (re-investing in reliability) to process more!	No comment		
Better milling performance.	No comment		
Milling Capacity	No comment		
Transport Restraints (Storing on Pad.)	Longer season		
Mill efficiency.	Longer season		
Make mill operation and transport more efficient throughout year. Particularly at peak harvesting times.	Shorter season		
Investigate closing Lucinda and transport sugar from Townsville.	Longer season		
Season length		**8**	**9.0%**
Target finish of season 15/11.	Shorter season		
Not willing to cut below mill 10 CCS.	Shorter season		

Earlier finish will promote more opportunities.	No comment		
Shorter season would benefit (needs modelling economics).	No comment		
For crystal sugar production (season length is critical).	No comment		
Early finish is better.	No comment		
Growers future depends on a viable season length.	No comment		
Minimising season length for growers and harvesters. Works well for sugar crystal only?	No comment		
Vertical Integration, Grower/Community owned industry		**9**	**10.1%**
Good partnerships between all participants.	N/A		
Vertical integration.	No comment		
Our business	No comment		
Partial integration of between stakeholders.	No comment		
Equity.	No comment		
Farmers to own mill -	Shorter season		
Form large district co-ops to buy machinery, fertiliser and fuel.	No comment		
Community bank and lending facility.	N/A		
Establish more trust for millers and growers. Transparency required.	No comment		
Value adding - different products		**10**	**11.2%**
By products.	Longer season		
Co-generation –innovative bagasse storage?	No comment		
Value adding – for district.	Longer season		
Sugar by products.	Longer season		
Value adding.	Longer season		
Co generation.	No comment		
Plastic.	No comment		
Electricity etc.	No comment		
Different products/alternatives from crop eg co generation.	Longer season		
Alterative products e.g. co-generation within existing system (Storage of baggage.)	Longer season		
Sundry		**3**	**3.4%**
All areas.	No comment		
To grow the pie.	No comment		
Lowering costs and maximising profit.	N/A		
	TOTALS	**89**	**100%**

APPENDIX 11 - Individual responses under specific categories pertaining to- "What are the risks or barriers associated with adopting an optimal season length?"

Risk - Payment/Equity/Reward

- Pay system for Harvester crews.
- Hourly rate for harvester's crews.
- Reward for risk.
- Payment calculation.
- Equity between Grower's vs. Compensation.
- A system to reward growers for early start and a penalty for late crushing.
- Remuneration systems – cane payment, harvesting etc.
- Price signal to encourage early season start.
- Rewards aren't forthcoming as expected.
- More return incentives to the grower and harvester contractor.
- Current cane payment formula.
- Grower payment arrangements.
- A payment system to better represent the industry.
- Equitable payment system.

Relations/Attitudes

- Know what we don't know.
- District is risk averse.
- No cooperation for joint benefit.
- Longer season may be detrimental to family life.
- Effect on family life.
- Time spent with families.
- Inter-personal relationships.
- Tools, facts and skills to educate and gain acceptance.
- Decision making.
- Keep our young people on the land.
- Old attitudes miller/Grower/Harvesting Contractors.
- Business, Resources and thoughts of growers.
- Limited business skills.
- Sugar parading in short season thinking.
- Talking – let's just do it.
- We jump into the wrong scenario (don't look at all the options first up).
- Must be win-win.
- Tradition – "it's also been done that way"- wasn't been done before, risk higher.
- Belief that early cut farmers are making a sacrifice for no/little reward.
- Knowing that change will benefit everyone.
- Barrier: Inability to see big picture, district-wide advantage.
- Change of comfort zone.
- Where are we heading as a district?
- Success determined by perceptions not facts.
- Age based reluctance to change or re-invest.
- The ability to change mentally or physically or dollars.

- Grower and miller agreement.
- Agreement on changes between parties.
- Resistance to change.
- Barrier – Hard to get agreement from all sectors to change.
- Commitment that CSR has capacity to crush it all.
- Harvester acceptance.
- Miller acceptance.
- Farmer acceptance.
- Lack of trust between the parties.
- All to think as one team.
- Agreement by Grower and Miller.
- Grower/Miller relationship.
- Tradition.
- Murphy's Law (He's a bastard).
- Mill and Grower agreement.
- Lack of trust.
- Us versus them.
- Resources for Ingham kept in the district.
- People's attitude.
- If we don't change or seize opportunity we won't be there.
- Contract with CSR and unions.
- Contract with miller.
- Relationship with miller.
- Millers and Growers pulling different ways.
- Different agendas.
- Getting everyone to agree.
- Not a farmer owned mill or vice versa.
- CSR.
- Suspicion of Mill/Growers motives.
- Private ownership of mill.

Risk – General

- Ability to negotiate share of income is big risk for longer seasons.
- Too early harvest
- No change from 22 weeks for just Raw Sugar.
- 22 week for crystal sugar.
- No barriers to adopting 22 week season if mill is willing mill is not willing.
- Season length.
- The real impact of season length is not measured.
- Optimum for Bambaroo growers different to Abergowrie.
- Agreements to be at least two seasons in advance.
- Optimum for mill different to growers.
- Reliance wholly/solely on CCS to determining value to growers

Risk – Profits Ownership

- Financial loss to individuals.
- Risk of standover – who's last?
- Understanding and believing the risks.
- How to share profits equally.
- Risk sharing mechanisms.
- Ego/shirt in decision making.
- If season is longer than 23 weeks it cost big money – I need compensation.
- Loss of income caused by a longer season.
- Profits margins.
- Cost sharing from charges incurred.
- Some sectors may gain an advantage.
- For profitability we need shorter season 22-23 weeks.
- World sugar price.
- $ Returns.
- Low profits.
- The "do-nothing" scenario is preferred – risk adversity.
- Risk – Impossible to quantify the full range of risks and benefits to each player in the chain.
- Profit sharing.
- Focus on share rather than size of cake.
- The risk that someone might gain $$ at your expense.
- Ownership of reward share of risks.
- Equity manager as a Risk manager tool = How effective is it?
- Lack of risk sharing for new ways of operation.
- Share of extra income from change.
- Understanding the effects on all parties.
- Risk management sharing between stakeholders.
- Not sharing in any benefits of change.
- Profit and risk sharing.

Value Adding

- Government regulation e.g. ethanol mandates.
- Policies.
- Public perception on GMOs.
- More than one product going through our sugar terminals (keep them maintained).
- Government policy on renewable energy.
- Season length to suit maximum profit for whole district and stakeholders.
- Ethanol – Varieties, income ratoonability longer season to maximize profits.
- Environmental issues.
- EPA.
- Labour force acceptance.
- Skills base to move into other crops.
- Need for greater vertical integration in local industry.
- Resources/new incomes left in district.
- Focus on crystal sugar.

- Each party trying to get a bigger share of pie.
- Lack of profit sharing from new practices between sectors.
- Barrier – Funding for capital investment to change.
- Research into value adding plastics/co-generation, etc.
- Understanding value adding.
- Avoiding volatility impacts.
- Depends on products being produced.

Mill Performance Issues

- A performance guarantee.
- Mill reliability.
- Mill capability.
- Logistics and mill capacity to meet season length.
- 22 week optimum mill crushing capacity inefficient t/port system.
- Mill capacity.
- Mill transport.
- Infrastructure.
- Mill.
- Sugar needs better mill capacity and transport system that stands in road of optimal season length.
- Mill capacity.
- Mill reliability.
- Mill maintenance.
- Mill arrogance.
- Crushing capacity in the barrier.
- Mill, transport and crushing capacity.
- A guarantee by mill on performance.
- Less mill performance, less maintenance.
- Mill breakdowns too often.
- Mill performance and reliability.
- Run down mill.
- CSR upgrade mill and infrastructure.
- Infrastructure constraints.
- Mill efficiency.
- May create mill and harvest inefficiencies.
- Mill reliability.
- No money spent on mill infrastructure if there is a long season.
- Reliable millers more so.
- Milling capacity.
- CSR will not invest in milling capacity.
- Mill will adopt less production regium.
- Upgrade run-down mill.
- Mill reliability.
- CSR reliability.

Mill Transport

- Rail capacity.
- Number of trains to one subdistrict and sidings.
- Need for staggered bin deliveries and sidings.
- Transport.
- Transport system (more efficiency).
- Transport reliability.
- Bin capacity.
- Better loco maintenance.
- Larger Harvesting groups without a strategy.
- Efficiency of bin supply.
- Mill transport system.
- Logistics.
- Gluts and sidings.
- Mill transport not reliable or flexible.
- Siding capacity.
- Assuming crystal sugar – mill transport is the barrier.
- Limitations – siding capacities.

Labour Issues

- Labour force.
- Workplace health and safety.
- Fatigue management harvesting.
- Season length for workers earnings and what to remain.
- Labour.
- Employment duration.

Ratooning

- Group – equity, ratooning, rotation.
- Late ratoons.
- Ratooning capability.
- Yields.
- Loss of ratooning capacity for next year's crop.
- Ratooning.
- Poor ratoons.
- Ratoons for crops following years.
- Late finish poor ratoons no chances for plough out or alternate crops.
- No point ratoons won't grow.
- 30 week optimum ratooning problems CCS declines hot weather fire threats.
- CCS and poor ratoon.

Harvesting issues

- Longer season haulout and field workers work longer season for the same money.
- Research change in cane pay to suit geographic harvesting.
- Harvester shirtings all over district.
- Flexible harvest and transport system.

- Harvesting system.

Cane Production Issues

- BSES to monitor farms (CCS, tonnes etc) paid through service agreement.
- Containing input costs – chemicals and fertilizers.
- Access to CSIRO research tools – operationalism.
- Cane varieties.
- Compaction – loss of production.
- Match good early sugar varieties with soil types/weather.
- Performance of varieties.
- Lower production effect to be addressed.
- Varieties suit season length.
- Long season – poor soil structure.
- Agronomics and variety management to meet season length.
- Better CCS varieties.
- Longer fallow.
- Long season – poor fallow crops.
- Variety- CCSs.
- Soil nutrition.

CCS Issues

- CCS levels.
- CCS content.
- Late finish.
- Loss of CCS season to finish by mid November.
- CCS.
- CCS for profit.
- CCS underwriting.
- Loss of sugar content.
- Loss of CCS and productivity for the following year.
- Crop size.
- Low sugar content.
- Longer season.
- Less cane.

Weather

- Crop not harvested due to weather.
- No wet weather insurance scheme.
- Climatic variability.
- Wet weather risks to be renumerated.
- Rainfall also effects season length.
- Wet weather.
- Weather.
- Wet weather risk, sharing, arrangements.
- No weather.
- Adverse weather district wide.

- Weather short season needed.
- Large variation in weather wet – too dry.
- Greater risks caused by weather – when season is extended.
- Yearly changes in weather pattern.
- Weather risk is larger than that which was stated today.
- Crop size and weather conditions.
- Climate variability – minimise the risk – how?
- Rainfall diversity across region.
- Managing adverse weather conditions.
- Grower equity due to weather.
- Late harvest/standover cane and impact on following year.
- Weather restriction.
- Contingency to manage risks due climate.
- Fear of a disastrous wet weather event.
- Farm damage due to wet weather.
- Unseasonal circumstances.
- Early wet weather or late.
- Weather risks.
- Managing wet weather at harvest.

Non-specific Issues

- Conservative leadership.
- Sack all the academics.
- Unachievable.
- Insanity, I will grow cows.
- End of sugar industry in Ingham.

APPENDIX 12 - Individual responses under specific categories pertaining to- "What are the knowledge gaps – what should the industry focus on?"

Knowledge Gaps	Votes	
	No	%
Value adding.	**55**	**24.3%**
Bio-factory the cane plant. Economic Analysis of Alternative Products across value chain. What is known about all the products that can be produced from cane? Value adding with totally new products/crops. Repositioning/selling ourselves better Do we know what our client(s) want? – Quality, amount, type, characteristics Herbert industry/community does its own markets research Value adding: chocolate etc Economic Analysis of alternative product or by product		
Value Chain	**55**	**24.3%**
Value chain impacts – what each sector does, and know it affects downstream $/environments **systems approach**. Mill production cost to be available to growers (trust). Understand value chain. Economic evaluation needed on the effect on Mill, Growers and Harvesters – each section of losses Vs gains on CCS, crop yield, over 5 yrs when season extends beyond 22 weeks. Do we know what our clients want? Research harvest system to maximise returns Harvest losses- ratoon damage, harvest speed. Hours of harvesting – humidity/temperature, sugar loss Price projection – Predictive models Research payment formula options Mill info disclosure: Growers always open at forums workshop. Whole Industry Economic Model to demonstrate impact of changes. Cost of tonne cane to be crushed. Mill profits for all products and production costs. How to make a win – win situation for both millers and growers. Marketing. Value change analysis		
Crop management and varieties	**42**	**18.6%**
Varieties Research Varieties GM Costs of traditional soil management. The sugar cane plant physiology -Water tolerance, ratooning . Chemical ripeners- Varieties Research Control traffic systems Early CCS Varieties to suit season length Soil health		
Risk Management	**23**	**10.2%**
How do we manage the risk of extending the season length? Understanding risk – transparent. Women into positions leadership and employment (Harvest Haul out)		
Improved negotiations skills for growers.	**13**	**5.8%**
Improved negotiation skills for growers. Encouraging new young industry participants Negotiating skills – or 'professional' negotiator Skilling the next generation of farmer		
CSR investments made by board with lack of knowledge of cane faming.	**13**	**5.8%**
Profit advantages for participants to start early	**8**	**3.5%**

Profit advantage for differing start times – payment system		
Whole of industry BSES funding.	**8**	**3.5%**
BSES agreement fee for service/monitoring farms		
Seasonal forecasting	**4**	**1.8%**
Seasonal climate forecasting		
Dealing with diverse nature of Herbert.	**3**	**1.3%**
Implementation of research.	**2**	**0.9%**
Implementation of Research- communication, education, access to research.		
TOTAL	**226**	**100.0%**

APPENDIX 8 – Di Bella et al. (2008)

APPENDIX 9 – Poggio et al. (2006)

HERBERT FARMING SYSTEM TRIAL REPORT

November 2006

By

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[2,3,4 & 5]BSES Limited

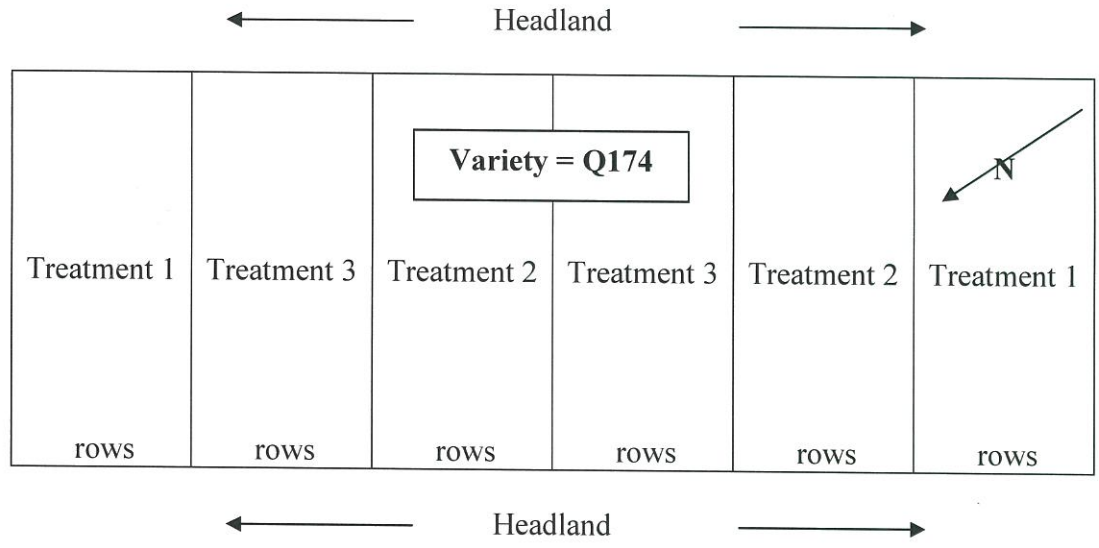
1.0 Introduction

This paper is based on a farming system trial that was conducted at the Herbert BSES station during December 2004 – October 2006. The aim of the trial is to evaluate the agronomy and economics of different farming systems in the Herbert region. The treatments are based on a conventional farming system versus a new farming system. The new farming system incorporates the main principles promoted by the Sugar Yield Decline Joint Venture. This report is based on the information and data collected for a legume fallow and a plant cane crop.

2.0 Trial Location and Design

The trial was established at the Herbert BSES Station (Fairford Road, Ingham) in 2004 on a 3.6ha fallow block with a silty clay soil. The trial consisted of three treatments and two replications. All treatments were planted with the variety Q174. Figure 1 displays the trial design and treatments

Figure 1. Trial Design



Treatment 1 = conventional system @ 1.6m single row, furrow opener planting
Treatment 2 = pre-formed mounds @ 1.6m single row, double disc planter
Treatment 3 = pre-formed mounds @ 1.8m dual row, double disc planter

3.0 Planting Systems

The trial site was established in a plough-out block in December 2004. The block was cultivated in early December to remove the old cane stool and provide an adequate soil tilth for treatment preparation and lazer levelling. The three treatments consisted of a conventional planting system at 1.6m row spacing versus pre-formed beds planted with a double disc opener planter at 1.6m single row and 1.8m dual row configuration. The BSES Limited bed former was used to make to beds in December 2004. Following the trial site preparation the block was planted with a crop of Soybeans on the 24th December 2004 to improve soil health and provide nitrogen for the plant cane crop. Weed control in the Soybean crop was achieved by using a pre-emergent herbicide after planting and then two spray-out herbicide applications prior to planting the cane crop in May 2005. Prior to planting the cane crop on the 5th of July 2005, the conventional treatments were strategically tilled using a rotary hoe and ripper to provide sufficient soil tilth for a standard planter (furrow opener). The pre-formed bed treatments were not cultivated prior to planting with a double disc opener planter. An equal amount of fertilizer was applied to each treatment before the out-of-hand stage. No fertilizer was applied during planting. Table 2 shows the nutrients applied to the plant cane crop. Weeds were controlled in the plant cane crop using a mixture of cultivation and herbicides. The conventional system required additional cultivation because of the need to fill in the planting furrow and hill up. The characteristics of each system are outlined in Table 1. Figures 2, 3, 4 & 5 display the trial site through the different stages of site preparation.

Table 1. Characteristics of planting systems

Characteristics	Treatment 1	Treatment 2	Treatment 3
Planting Width	1.6m	1.6m	1.8m
Planting Method	Furrow Opener	Double Disc Opener	Double Disc Opener
Planting Rate (tc/ha)	3.5	3.5	5
Row Configuration	Single	Single	Dual Row (500mm)
Land Preperation	2 x discing 1 x ripping 1 x ripping (strategic) 2 x rotary (strategic)	2 x discing 1 x ripping 1 x mounding	2 x discing 1 x ripping 1 x mounding
Fallow Crop	50kg/ha Liechardt Soybean 1 x planting 22nd Dec. 2004 3 x Chemical	50kg/ha Liechardt Soybean Planted 22nd Dec. 2004 3 x Chemical	50kg/ha Liechardt Soybean Planted 22nd Dec. 2004 3 x Chemical
Cane Planting Date	5/07/05	5/07/05	5/07/05
Germination Date	29/07/05 – 16/08/05	10/08/05 – 16/08/05	10/08/05 – 16/08/05
Controlled Traffic	No	No	Yes
Fertilizer	Soil Test 20/12/04 Blend 3 @ 0.75t/acre Planting – No fertilizer Top Dress – Sulphate of Ammonia + Potash	Soil Test 20/12/04 Blend 3 @ 0.75t/acre Planting – No fertilizer Top Dress – Sulphate of Ammonia + Potash	Soil Test 20/12/04 Blend 3 @ 0.75t/acre Planting – No fertilizer Top Dress – Sulphate of Ammonia + Potash
Weed Control	2 x chemical 3 x Grubber	2 x chemical 1 x rolling rake	2 x chemical 1 x rolling rake
Insect Control	Lorsban	Lorsban	Lorsban
Disease Control	Bumper	Bumper	Bumper

Table 2. Nutrient Comparison of Treatments

Kg/ha of element						
Treatment	**N**	**P**	**K**	**S**	**Ca**	**Mg**
Treatment 1*	50	0	100	60	643	58
Treatment 2*	50	0	100	60	643	58
Treatment 3*	50	0	100	60	643	58

*A moderate Soybean crop was grown in the fallow

Figure 2. Bed forming

Figure 3. Soybean spray-out

Figure 4. Pre-formed beds post planting

Figure 5. Conventional Vs beds

4.0 Results

Information was collected from the trial site during December 2004 to August 2006. The information collected included weed counts, soil temperature, rainfall, trial productivity and economics. All treatments were assessed using the same methods.

4.1 Weed Counts

Dominant weed species were Blue Top, Sicklepod, Convolvulus and Sedge. Four weed count assessments were conducted after planting from the 29th of July 2005 to the 19th of August 2005. The assessments were taken in an un-sprayed section of the trial to determine the weed pressure in the various treatments. The number of weeds present in each treatment was counted in a randomly placed quadrat of 0.25m2. Three sub-samples were taken from each treatment and then averaged to determine the overall weed pressure. The weed count results are displayed in figures 6, 7, 8 and 9. The trial results indicate that weed pressure was a lot higher in the conventional treatments compared to the minimal tillage treatments.

4.2 Soil Temperature and Rainfall

The soil temperature at seeding depth was also recorded for each treatment from the 13th of July 2005 to the 19th of September 2005. Low soil temperatures can effect germination and cause a slower cane emergence after planting. Figures 10 and 11 show the soil temperatures during the July to September period. The soil temperature results indicate that the pre-formed beds had higher maximum temperatures and lower minimum temperatures. This might suggest that the mounds heat up more during the day and cool down more at night because of the soil profile characteristics. Rainfall was also recorded at the BSES weather station during the trial period (Figure 12). A considerable amount of rainfall was received in the months following planting, with 78mm in July and 83mm in August. Figure 13 displays the trial following heavy rainfall in July. The cane planted on pre-formed beds was less prone to water logging around the cane sets compared to the conventional treatments which were water logged.

Figure 6. Average weed population on the 29/07/05

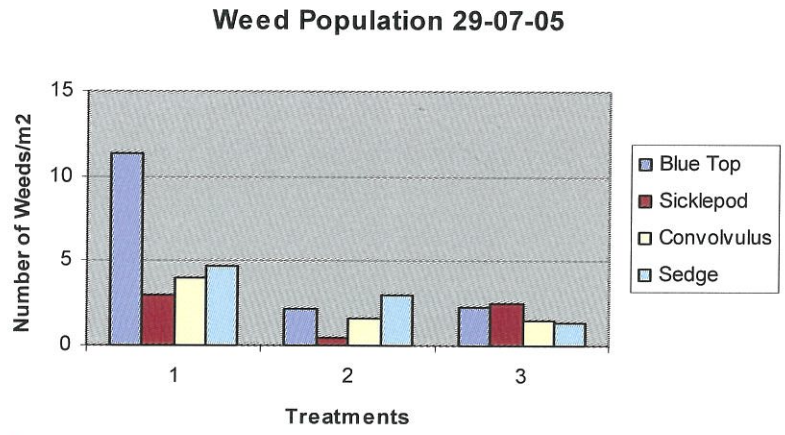


Figure 7. Average weed population on the 5/08/05

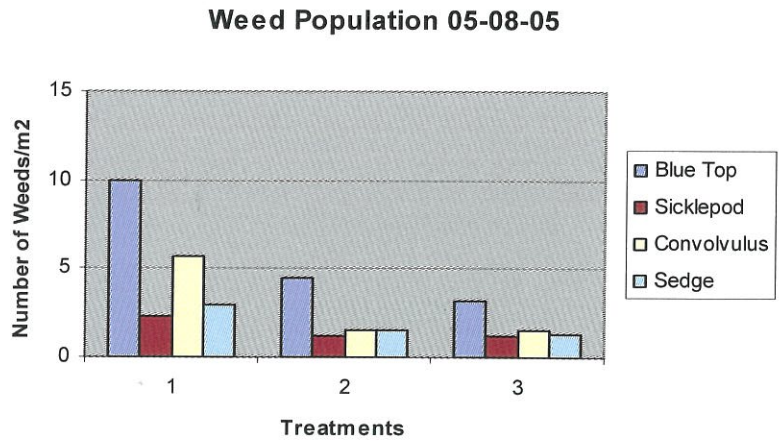


Figure 8. Average weed population on the 12/08/05

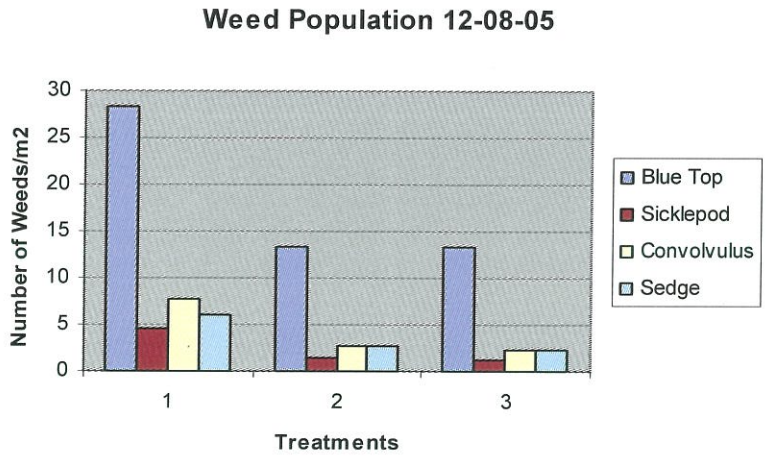


Figure 9. Average weed population on the 19/08/05

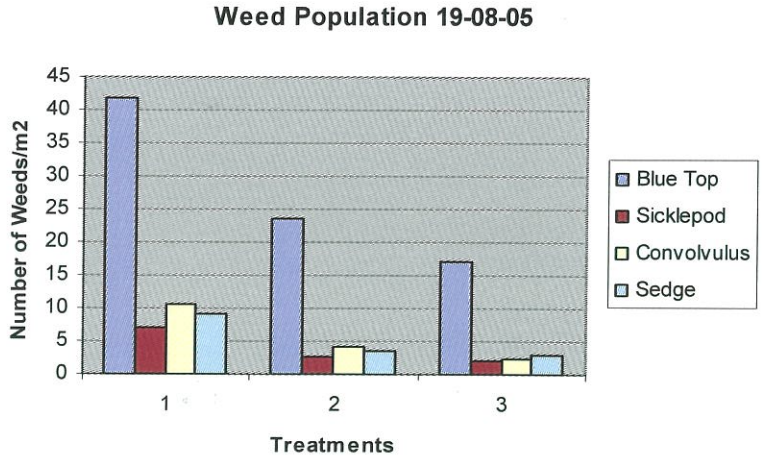


Figure 10. Maximum Temperature 13/07/05 – 19/09/05

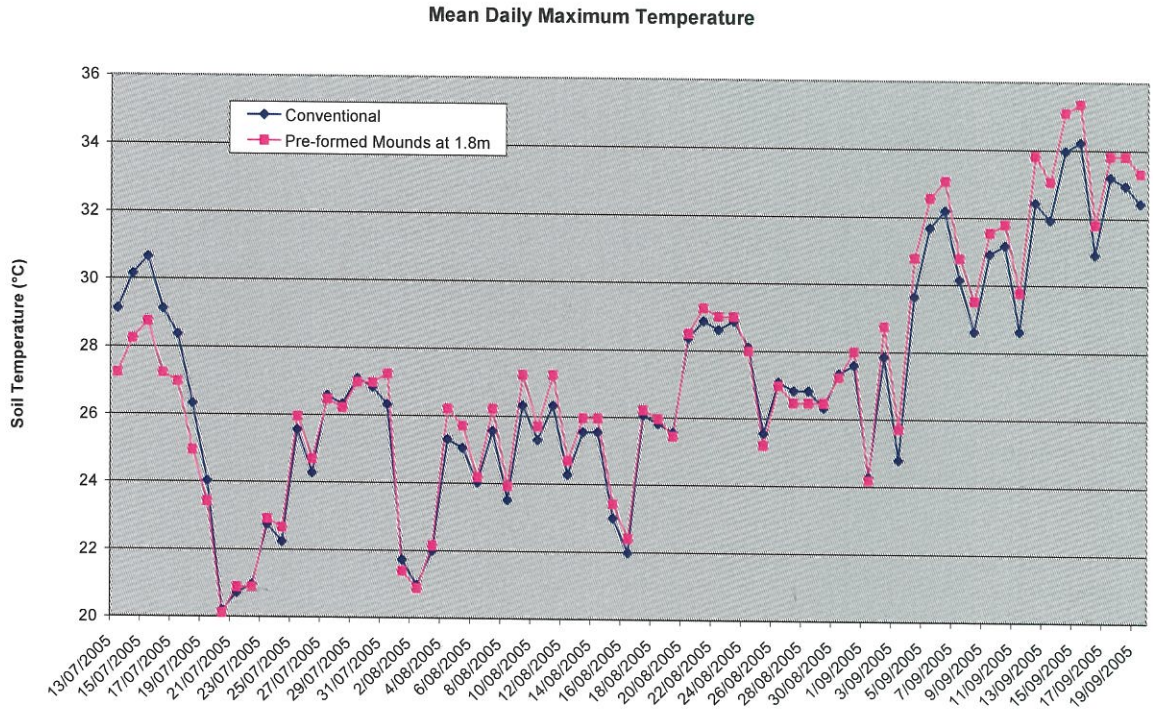


Figure 11. Minimum Temperature 13/07/05 – 19/09/05

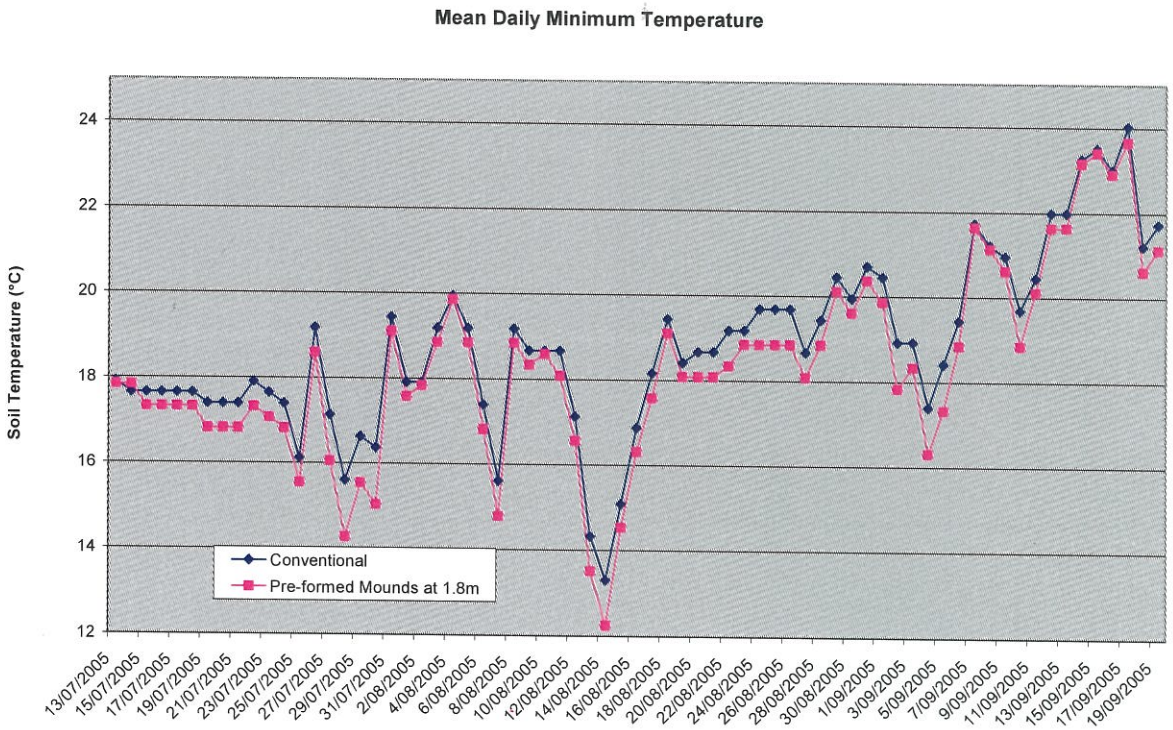


Figure 12. Ingham Rainfall in 2005

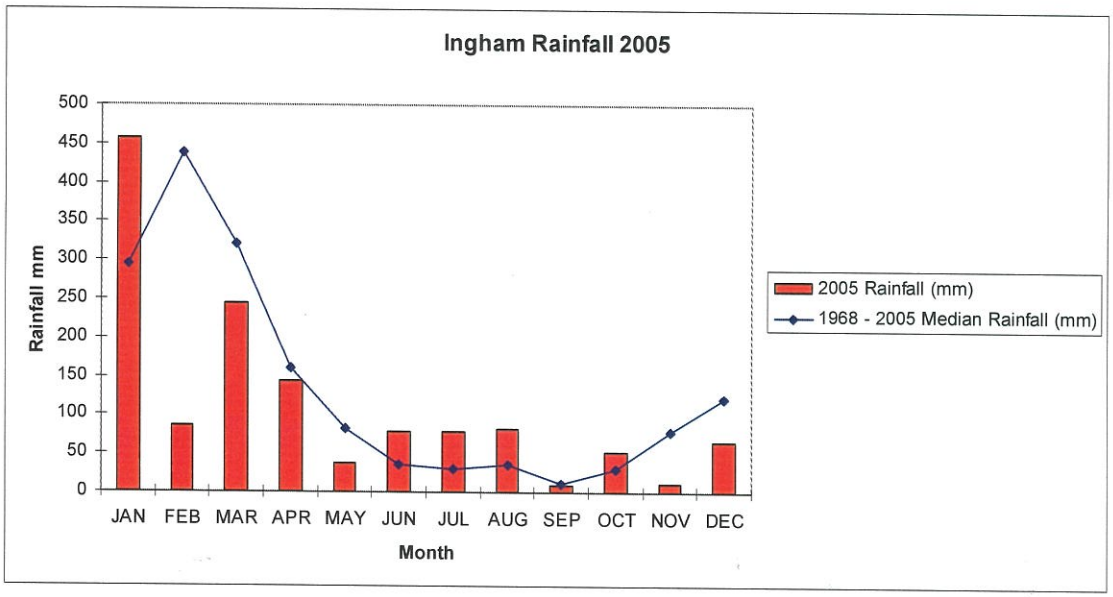


Figure 13. Trial site following rain in July – Beds are not water logged

4.3 Trial Yield & CCS

The trial was harvested on the 22nd of August 2006. Yield and CCS data was collected from each treatment. Figure 8 displays the trial yield and CCS levels and Figure 9 shows the tonnes sugar per hectare. Treatment 3 (1.8m dual row disc opener planted) had the highest yield and lowest CCS, followed by Treatment 2 (1.6m single row disc opener planted) and then Treatment 1 (1.6m conventional system), which had the lowest yield and highest CCS. The 1.8m dual row bed treatment produced 11.95 ts/ha compared to 10.12 ts/ha in the 1.6m conventional treatment.

Figure 8. Trial Productivity

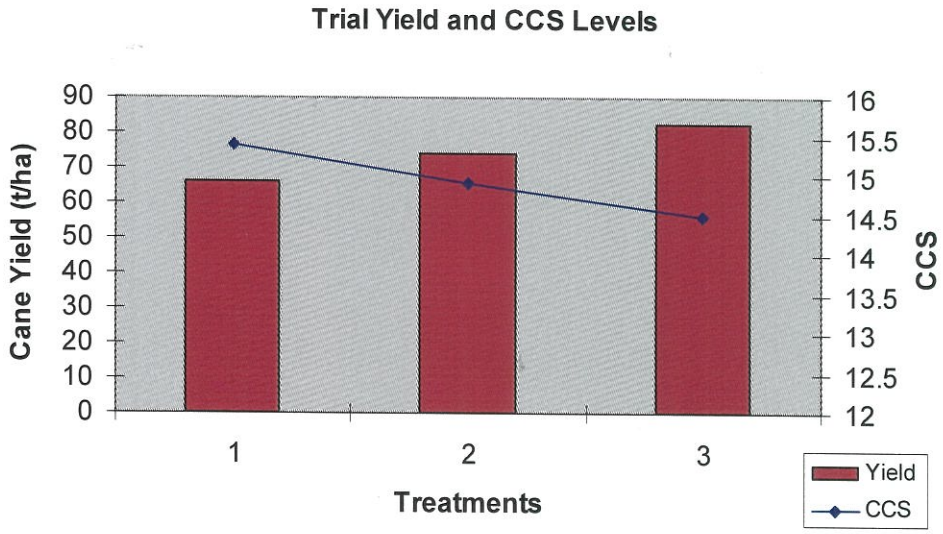
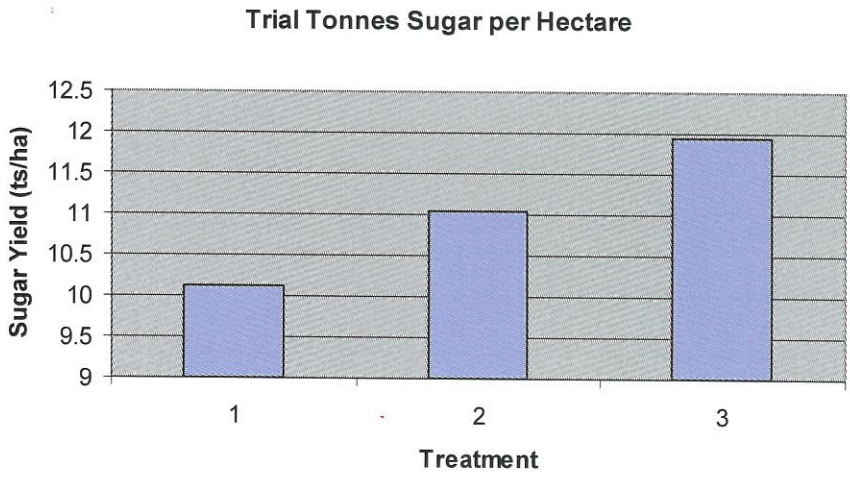


Figure 9. Trial Productivity



4.4 Economics

The majority of the economic analysis was conducted using the Farm Economic Analysis Tool (FEAT) developed by the DPI&F FutureCane initiative. Planting costs are based on the information collected during the trial period and were calculated using a planting cost calculator spreadsheet.

This analysis investigates the variable costs based on details such as rates of chemical, kilograms of fertilizer and machinery operations for a plant cane crop. Machinery operating costs are based on the tractor size, fuel consumption, implement speed, width, field efficiency and repairs and maintenance. The labour required for each planting system is based on the work rate for each operation. The cost comparisons are provided on a per hectare basis. This is a partial analysis only and does not represent the change to the whole farming business.

Table 2 displays the cost of growing the plant cane crop for each farming system. The cost analysis includes the planting of a legume crop in the fallow prior to the wet season. The calculated planting costs are inclusive of labour. The remaining operations do not include tractor labour costs however the time taken is detailed on the bottom row of Table 2. Treatment 2 (1.6m single row disc opener planted) had the lowest variable costs at $1585/ha, representing a $145/ha saving versus Treatment 1 (1.6m conventional system) and $110/ha saving versus Treatment 3 (1.8m dual row disc opener planter). The increased costs in Treatment 3 are related to the higher seeding and planting costs per hectare. Table 2 also shows that the number of hours spent on farm planting operations has decreased by over 40% with the new planting system (Treatment 2 and Treatment 3).

Table 4 displays the profitability of each system by evaluating the economics at a gross margin level. The gross margins are based on the income produced from each treatment less the variable expenses. Two gross margins were developed, the first excludes tractor labour costs and the second includes tractor labour costs. Treatment 3 had the highest gross margin overall, with a figure of $607/ha excluding tractor labour costs and $484/ha including tractor labour costs. Treatment 3 provided an improvement of $389/ha including tractor labour costs against Treatment 1. Only a marginal difference of $18/ha occurred between Treatment 2 and Treatment 3.

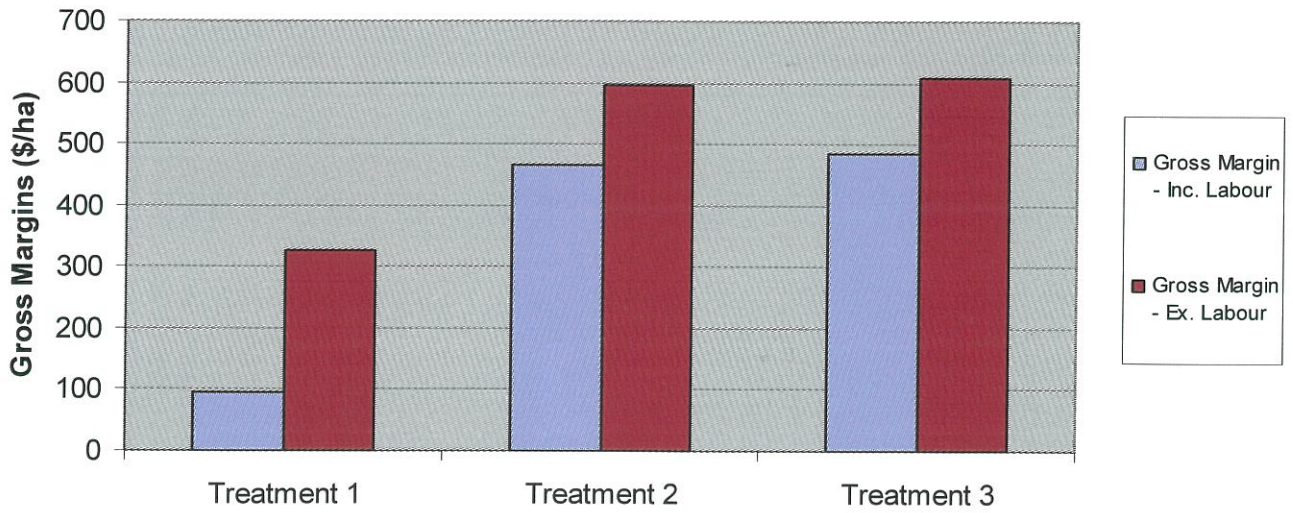
Table 3. Cost of growing plant cane per ha

	Treatment 1 Conventional System	**Treatment 2 New System 1.6m**	**Treatment 3 New System 1.8m**
	$/ha	$/ha	$/ha
	Variable Costs	Variable Costs	Variable Costs
Legume Crop	207	207	206
Land Preparation	245	119	117
Planting	346	346	408
Seed	105	105	150
Fertilizer & Soil Ameliorants	406	406	405
Weed Control	253	234	232
Insect Control	17	17	26
Disease Control	6	6	6
Total Growing Cost	1585	1440	1550
Tractor labour hrs/ha	11.59	6.51	6.16

Table 4. Economic comparison of plant cane treatments

	Treatment 1 Conventional System	Treatment 2 New System 1.6m	Treatment 3 New System 1.8m
Price per tonne sugar	$350/t	$350	$350
Average yield cane	65.9t/ha	74.2t/ha	82.4t/ha
CCS	15.4	14.9	14.5
Revenue per hectare	$2367/ha	$2548/ha	$2726/ha
Growing costs per hectare (ex. labour)	$1585/ha	$1440/ha	$1550/ha
Harvesting costs per hectare	$455/ha	$512/ha	$569/ha
Gross margin per hectare (ex. labour)	$327/ha	$596/ha	$607/ha
Tractor labour at $20/hr	$232/ha	$130/ha	$123/ha
Gross margin per hectare (inc. labour)	$95/ha	$466/ha	$484/ha

Figure 10. Gross margins for the plant cane crop



5.0 Conclusion

The BSES farming system trial provided some valuable information on the agronomy and economics of different farming systems in the Herbert region. The trial displayed that the two new farming system treatments are a viable option in the Herbert region and can provide significant agronomic, economic and social benefits. The new farming system treatments incorporated some or all of the three principles advocated by the Sugar Yield Decline Joint Venture project: 1) legume fallow 2) minimal tillage and 3) controlled traffic.

Weed population measurements indicated that the conventional treatments had higher weed pressure compared to the pre-formed bed disc opener planted cane. This effect is most likely related to tillage in the conventional treatment causing additional weed seed germination following planting. This can cause additional weed control expenses through the need for more cultivation and/or chemical applications.

The disc opener planted treatments germinated 7 – 14 days slower than the conventional treatment. This difference may be related to several factors including soil temperature. Soil temperature records indicated that the pre-formed beds had lower minimum and higher maximum temperatures. A greater fluctuation in temperature and a lower minimum may have caused the slower germination in the pre-formed bed treatments. This effect is probably attributed to the soil profile having a greater surface area exposed to sunlight during the day and then subject to more heat loss during the night surrounding the set area. Heavy rain following the planting of the trial displayed the advantages of pre-formed mounds in reducing the likelihood of water logging around the set. The wet conditions caused a failure of germination in some areas of the conventional treatment.

Yield and CCS records indicated that Treatment 3 (1.8m dual row disc opener planted) had the highest tonnes sugar per hectare, followed by the Treatment 2 (1.6m single row disc opener planted) and Treatment 1 (1.6m conventional system). Improved productivity combined with a considerable reduction in labour and other variable costs resulted in the new farming system treatments being more profitable compared to the conventional system. Including tractor labour costs, Treatment 3 (1.8m dual row disc opener planted)

had the highest gross margin of $484/ha, followed by Treatment 2 (1.6m single row disc opener planted) at $466/ha and Treatment 1 (1.6m conventional system) at $95/ha. Treatment 3 (1.8m dual row disc opener planted) provided an improvement of $389/ha compared to Treatment 1 (1.6m conventional system). The number of hours spent on farm planting operations decreased by over 40% with the new planting system (Treatment 2 and Treatment 3). On a whole of farm basis this would represent a considerable improvement in the plant cane gross margin and overall farm profitability.

The new farming system is progressively evolving and when fully developed will have the potential to reduce planting operation costs even further and improve farm profitability. The economic analysis does not take into consideration the fixed costs associated with a farming business. It can be expected that fixed costs will also decrease considerably because of the reduction in machinery, implements and time required to carry out the operations in the new farming system.

APPENDIX 10 – Prestwidge et al. (2008)