

Development and implementation of harvest management planning tools for the maximisation of CCS in the Tully district

CGT001 - Final Report

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Executive Summary:

Issue:

The Tully Sugar Limited milling district is characterised by large geographical, varietal, and seasonal differences in sugar yield. Growers are increasingly looking for ways to increase profitability by capitalising on these differences. This is a multifaceted task as there are several variables such as variety, crop class, crop age, CCS, cane yield, and soil type to consider simultaneously when planning the harvest. Adding to the complexity of the harvest planning task in the Tully district is influence of large harvesting groups, high mill crushing rates, and a wet tropical environment.

A study of Tully Sugar Industry productivity data by Lawes *et al.* 2004 indicated that, weather effects excluded, the time of harvest and crop age at harvest had the biggest effect on CCS and biomass accumulation. The harvest planning decision making process identified by the growers in the SRDC funded “Working Together For Our Future” Action Group working on Low CCS indicated the key drivers considered by growers when planning a harvest schedule are:

- time of harvest in the previous season,
- agronomic factors,
- block topography,
- group rotation,
- the growers view of the climate forecast.

Using these factors growers formulate a harvest schedule for their cane blocks - “Harvest Plan”. Typically growers then vary this plan to taking account of the weather and transport logistics at the time of harvest. This complex decision making process can be simplified if growers had the ability to produce a number of management scenarios using decision support tools.

A review of harvest planning decision support tools revealed that there were no “off the shelf” decision support tools available for users. However the CSIRO SugarMax models could be adapted for use in harvest planning. The SugarMax tool was developed through previous SRDC projects CSE003 (SRDC, 2005) and CSE005 (SRDC, 2006) to provide increased capacity for growers to learn from and adopt improved time-of-harvest schedules.

R&D Methodology:

The project operated within a participatory action research framework. Within this frame work the key activities undertaken to ensure the development and adoption of the harvest planning tools were:

- Formation of a “Pilot Group” of growers to guide the process of customising harvest planning tools for local requirements.
- The Pilot Group was surveyed to provide a better understanding of how growers currently undertake their harvest and planting planning prior to and during the season.

- Group sessions were held with the Pilot Group to ground truth the key findings of the Lawes *et al.* 2004 study and the SugarMax model outputs. Through this process the task of facilitating the identification of the key decisions for harvest planning, the information needed, and the process was identified and documented.
- The CCS trending information and the and appropriate tools for growers harvest planning scenarios were modelled and developed by CSIRO and reviewed by the Pilot Group.
- The success of the harvest planning outcomes was measured against Key Performance Indicators (KPIs) as determined by the Pilot Group. Harvest plans were developed for Pilot Group members before the 2007 and 2008 seasons and tested against the actual decisions made.

Outputs - Skills/Processes/Practices:

The key output from the project was the development of and use by growers of web based harvest planning tools to improve harvest plan decision making.

- The SugarMax and web based harvest planning tools, developed by CSIRO and contract web programmers respectively, were calibrated and customised for use in the Tully District.
- The project provided participants with SugarMax and web based decision support tools that assist them to plan their harvest to maximise their individual CCS and tonnes sugar per hectare.
- The SugarMax and web based decision support tools were used by the Pilot Group members to develop plans for the 2007, 2008 and 2009 harvest seasons.
- KPIs were developed in conjunction with the Pilot Group to measure the performance of harvest planning outcomes. The KPIs identified were:
 - An increase in CCS for the pilot group growers of 0.5 CCS units for the 2008 and 2009 season over a measured benchmark (average CCS) from the pilot growers' 2005 and 2006 CCS results.
 - Improved purity of harvested cane >86%
 - Comparison between planned harvest schedules and actual harvest schedules. Whether the harvest plans developed followed and if there were variation what were the reasons for the variation.

Outcomes:

The outcomes of the project:

- improved understanding of factors influencing harvest planning among 50% of the 209 production units in the Tully industry, and among the harvest and milling sectors of the industry,
- improved decision making process implemented by 50% of Tully growers when harvest planning,
- implementation of improved harvest planning by 20 growers in 2007, by 50 growers in 2008, and by 100 growers in 2009,
- an increase of 0.5 CCS units by growers participating in the project over the period 2006 to 2009.

Background:

The Tully area sugar milling region is spread across several varying geographic and climate zones. Across these regions and within regional districts varietal differences in cane yield and CCS vary throughout a harvest season. Research by McDonald *et al.* 1999 showed the importance of time of harvest and crop age on crop productivity and profitability. Lawes *et al.*, 2004 analyses suggested that exploitation of regional spatial variation would improve productivity. Sugarcane growers have a lot of issues to consider simultaneously when planning harvest times for individual blocks on farms including variety, crop class, crop age, CCS, cane yield, soil type and micro-climates. Each block's location within the farm also comes into the time of harvest decision due flood risk and attractiveness to pests. Therefore growers have been searching for a tool to help manage these complex decisions. Regional management differences such as varieties, group rotations and mill throughput means that harvest planning processes also vary across regions, therefore an industry-wide method is not appropriate. Regions can use a harvest planning tool to better manage: variety selection; crop age and crop class management; harvester migration and trafficability in wet weather; risk management of harvest; and to plan for better accommodation of climate forecasting indicators. Previous research has shown that improved time of harvest decisions have the potential to increase industry-wide profitability by an average of \$1.00 per tonne of cane (Higgins & Muchow, 2003). This benefit can vary quite substantially across growers, as growers with multiple farms or varieties will usually have a higher potential benefit.

A review by a group of growers and industry staff as part of the CG007 Tully Sugar Industry Project "Working Together For Our Future" identified that time of harvest decisions were not always optimal and that better management decisions would result in more profitable outcomes. This group flagged the need for some type of harvest planning tool that would allow growers to better assess the affect of harvest management decisions on economic returns. The Tully industry furthered this by outlining the goal of a five year average CCS of 13.5 in the productivity plan.

The Tully Sugar Industry operates an efficient cane harvest and transport system. Daily cane allotments are large and farm size can vary within harvest groups. There is a view held within the industry that the operating parameters adversely influence harvest management at the block level.

The concept of harvest planning for improved outcomes is not a new idea. Area such as Maryborough, Mackay and Mosman have investigated the use of harvest planning tools both for optimising sugar make and transport scheduling. A review of the harvest planning decision support tools available revealed that there were no "off the shelf" decision support tools available for users, however the CSIRO SugarMax models could be adapted for use in harvest planning. The SugarMax tool was developed through previous SRDC projects CSE003 (SRDC, 2005) and CSE005 (SRDC, 2006) to provide increased capacity for growers to learn from and adopt improved time-of-harvest schedules.

Objectives:

This project aimed to improve harvest management in the Tully district. The project is aligned with an action plan in the Tully Productivity Plan - TT95135.

The objectives of this project were:

- to improve understanding among growers, harvesters and millers in the Tully district of the benefits of improved harvest planning decision making. This will be achieved by benchmarking current management decisions and determining the benefits of improving harvest management.
- to calibrate the sugar Max and Variety Max tools developed by CSIRO for the Tully District. To do this successfully Tully growers, who have expressed interest in harvest planning and CCS maximisation, will collaborate with researchers to ensure that a usable harvest management tool is developed.
- to develop an internet/web based harvest management tool that can be implemented to improve the decision making process and maximise CCS and yield
- to identify aspects of harvest planning which impact on the value chain via the utilisation of Sugar Max and Harvest Max tools.

The above objectives were achieved via:

- the project fostered an improved understanding of the benefits of the harvest planning process. This was achieved by implementing the project plan based on participatory action research framework action learning via pilot group made up of growers and industry stakeholders. Initially the Pilot Group benchmarked current practice and knowledge levels for harvest planning and management decisions. This benchmarking process produced baseline data for harvest planning performance and facilitated the development of harvest planning KPIs. The pilot group then participated in harvest planning process. The harvest plans developed were then implemented in the 2007, 2008 and 2009 harvest seasons. The outcomes and outputs of this process were measured against the baseline data and the KPIs to determine the success, results and/or efficacy of the harvest plans. These measured outputs and outcomes were reported to the Tully industry.
- The SugarMax and Variety Max tools were calibrated for the Tully District. This was achieved by ground truthing the outputs of the planning tools with the Pilot Group. The Pilot Group reviewed the harvest planning tools both the methodology used to develop a harvest plan and the harvest plan developed. The review process highlighted some changes that the Pilot Group thought
- Internet/web based harvest management tools, based on SugarMax were developed and implemented to improve the decision making process and maximise CCS and yield.
- Aspects of harvest planning impacting on the value chain were identified by the project participants and the pilot group. This was achieved via group facilitation process.

Methodology:

Project management and work plan:

The project was split into three phases to allow efficient project management and minimise the risk of the project developing tools that were ineffective or unsuitable.

Phase 1:

The first phase of the project 2006 – 2007 (pre season 2007) focused on education within the local region to build capacity for grower adoption during the 2007 harvest. To achieve this goal a grower pilot group was formed. The purpose group was to:

- test the harvest planing tools produced
- provide feedback on the project progress and input on project direction.

These workshops and the subsequent directions provided by the group were the cornerstone of the project.

The other important element of Phase 1 was the customisation, development and validation of the CSIRO SugarMax model. The CSIRO model, SugarMax, was adapted to the Tully region. Productivity data as well as grower pilot group input was collected and used to validated the model. This lead to the development of robust harvest planning tools. The process also provided valuable feedback to project management on the efficiency and format of delivery platform options for harvest planning tools - eg internet based vs installation on participant personal computers vs one on one participant interaction with trained harvest planning tool users. It was resolved to use an internet based system to deliver the harvest planning tools. To provide easy access to the harvest planning tools the Sugar Max was to be adapted for Tully Sugar website.

The pilot group and the process participatory action research framework functioned well building grower confidence in the outputs of the harvest planing tools and ownership of the project.

Phase 2:

The second part of the project (2007 season) was an application, review, and extension phase. The harvest management tools were applied, tested, and reviewed by the pilot group. This review formed the base for:

- Measurement of project KPIs performance.
- Promotion of the project and the results so far and extension the industry to from a “harvest tools user group”. This group was the original pilot group plus other new growers to the process.
- The project management committee reviewed the project performance to date against the criteria of KPIs and risk realisation and subsequent management to determine if the project should proceed to phase 3 or cease in June 2008.

Phase 3:

The third part of the project (2008 season onwards) was a continuation of the application, review, and extension Phase 2. The harvest planing tools were applied,

tested, and reviewed by the pilot group and user group during the 2008 season. An extension program based around the results obtained by the growers using the tools over the 2007 and 2008 seasons was used to get as many users as possible for the 2009 season.

As planned harvest planning tools based on the CSIRO SugarMax tools were developed. These tools featured an internet based delivery system that was integrated into the Tully Sugar Web Site. The development of these tools was delayed due to technical issues with interfacing and internet licensing for solver software. The obstacles were overcome and the harvest planning tools “on line version” was operational in April 2009.

Project activity summary:

The project operated within a participatory action research framework. Within this framework the key activities undertaken to ensure the development and adoption of the harvest planning tools were:

- Formation of a “Pilot Group” of growers to guide the process of customising harvest planning tool for local requirements.
- The Pilot Group was surveyed to provide a better understanding of how growers currently undertake their harvest and planting planning prior to and during the season.
- Pilot group sessions to test the findings of the Lawes *et al.* 2004 study and the SugarMax models with a view to identifying and agreeing on the key decisions for harvest planning, the information needed, and appropriate tools for growers. Harvest planning scenarios were modelled by CSIRO and reviewed by the Pilot Group.
- The success of the harvest planning outcomes was measured against Key Performance Indicators (KPIs) as determined by the Pilot group. Harvest plans were developed for Pilot Group members before the 2007 and 2008 seasons and tested against the actual decisions made.
- The Tully industry periodically reviewed the outcomes/outputs of the project at key milestones.

Tully sugar industry and CSIRO staff worked with a pilot group of growers (18 initially and 34 in total) to create harvest plans for the 2007 and 2008 seasons using the CSIRO SugarMax model. Web based harvest planning tools were used to develop harvest plans for the 2009 season. The aim of the project was to assist growers develop harvest plans that maximises CCS of sugarcane harvested on their farm. Pilot growers and members of the Tully sugar industry were involved in the development of the harvest planner and provided feedback on content and design. The SugarMax and web based decision support tools were used by the pilot group members to develop harvest plans for the 2007, 2008 and 2009 harvest seasons. The Harvest Planning Tools were promoted to growers at the 2008 Productivity Awards on March 27th and the preseason shed information meetings held in April. At these meetings a short presentation on the harvest planning tools was given and interested growers registered for Training. Eight new grower users nominated for training after

BLOCK Details																	
FARM	BLOCK	Original	Selected	CLASS	Lock Block to Round:-	Tonnes Estimate	Area (ha)	Yield (t/ha)	Cut Age	Cut Date	District Variety	%	Round Age (mth)				
		VARIETY	VARIETY										1	2	3	4	5
2663	12B	Q117	Q117	1R	2	37	0.5	78	18	22/09/2008	2-Q117	100%	10	11	13	13	
2663	04A		Q152	R5R	2	369	5.3	70	16	26/10/2008	2-Q152	100%	8	10	11	12	
2663	11B		Q158	R7R	4	51	0.8	65	14	26/10/2008	2-Q158	19%	8	10	11	12	
2663	11A		Q158	R7R	2	221	3.4	65	14	29/10/2008	2-Q158	81%	8	10	11	12	
2663	04D		Q186	2R	2	75	0.9	85	14	26/10/2008	2-Q186	100%	8	10	11	12	
2663	06C	Q216	Q172	1R	3	94	1.2	80	18	21/09/2008	2-Q172	30%	10	11	13	13	
2663	12A	MIXE	Q172	3R	2	219	2.9	75	14	25/10/2008	2-Q172	70%	9	10	12	12	
2663	06E	Q204	Q186	1R	2	57	0.8	75	18	7/08/2008	2-Q186	2%	11	13	14	15	
2663	09D	MIXE	Q186	2R	2	85	1.1	75	0	8/12/2008	2-Q186	3%	7	9	10	11	
2663	02D		Q186	3R	2	423	5.3	80	14	17/11/2008	2-Q186	17%	8	9	11	12	
2663	06A		Q186	4R	1	580	8.3	70	16	8/08/2008	2-Q186	23%	11	13	14	15	
2663	04F		Q186	4R	1	727	10.4	70	16	8/09/2008	2-Q186	28%	10	12	13	14	

see the presentation at the shed meeting or the Productivity Awards. This number as disappointing however smaller numbers of users allows for better training in the use of the tools and improves overall outcomes and user experience with the harvest planning website. The aim is to build on the number of users each year.

Training of the pilot group and other interested growers in the use of the web based tools via small group training utilising the Tully Sate School computer lab. The computer lab facilities enabled all users to access to the TSL and harvest planning websites. The training session were held on the 14th, 15th, 16th of April 2009. These sessions were attended by 12 of the pilot group growers. The training consisted of:

- Familiarising growers with the harvest planning tools,
- Running a simulated harvest planning exercises,
- Providing the growers with a procedures and help manual,
- Harvest Planning Tools users will be supported on an ongoing basis by local extension staff. The development of a harvest plan consists of three major stages.

The harvest planning process:

The harvest planning process of the pilot group members was documented. Typically this was a three stage process as outlined below.

Stage 1 – Review information entered into the harvest planner.

The growers from the pilot group reviewed the block and harvesting rotation details to ensure the information put into the plan is correct (see Fig. 1). The growers then select variety CCS trends for every variety grown on the farm (example of CCS trends shown in Fig. 4). The nomination of a dominant variety in a mixed block must be completed for the appropriate selection of variety CCS trends. This is an important component of the model since the harvest plan optimisation is based on these trends. Historical variety CCS data is used to develop maturity trends for each of the seven districts and the Tully mill area. This enables growers to select a variety CCS trend for the varieties grown on their farm from their respective district or an alternative district. This information enables the model to determine the optimal harvest time for each variety grown on a farm given the current variety mix and given the percentage of cane that is to be cut in each round.

. 1 - An example of a list of growers block information showing 'Round Age' – the crop age in months at each harvest round. This also shows how growers are able to 'lock' blocks to rounds. Where there is not a trend available for the "original" variety, an alternate 'selected' variety is chosen. The 'District-Variety' shows the unique trend chosen for each district and variety. 'Cut Age' is the age in months at which the crop was cut in the previous season.

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

Stage 2 - Generation of optimal harvest schedule.

The optimised harvest schedule is generated using Solver, a licensed machine-specific Microsoft Excel add-in module. The web based harvest planning tools use algorithm developed by contract programmers to determine the optimum harvest scheduled. Figure 2 shows an example of an optimal harvest schedule generated by SugarMax/ web based harvest planning tools showing the optimal tonnes per variety to harvest in optimal harvesting rounds. Using the information entered in Stage 1, it provides the grower with details on the varieties and tonnage to harvest each round relative to the harvesting rotation. Blocks that need to be harvested in a specific round (because of replanting, pest damage or flooding) can be nominated before the optimal harvest schedule is run. If the grower has blocks that need to be harvested in a specific round the optimal harvest schedule will be generated around these blocks.

Stage 3 - Lock blocks into harvesting rounds and generate final harvest plan.

This is made easier for the grower as the SugarMax model calculates the approximate length and anticipated starting date of each round to determine the age of every block for each round. Growers select which blocks to harvest in each round using information from the optimal harvest schedule (recommended harvest time for each variety and tonnage per round) and block age. The optimisation process is re-run once all the blocks have been allocated into a harvesting round and a final harvest plan is generated. The final harvest plan is presented in two formats; a table with blocks listed in harvest sequence and a farm map colour coded to indicate harvest rounds (see example in Fig. 3). The grower can decide to give this plan to the harvester operator and/or cane inspector.

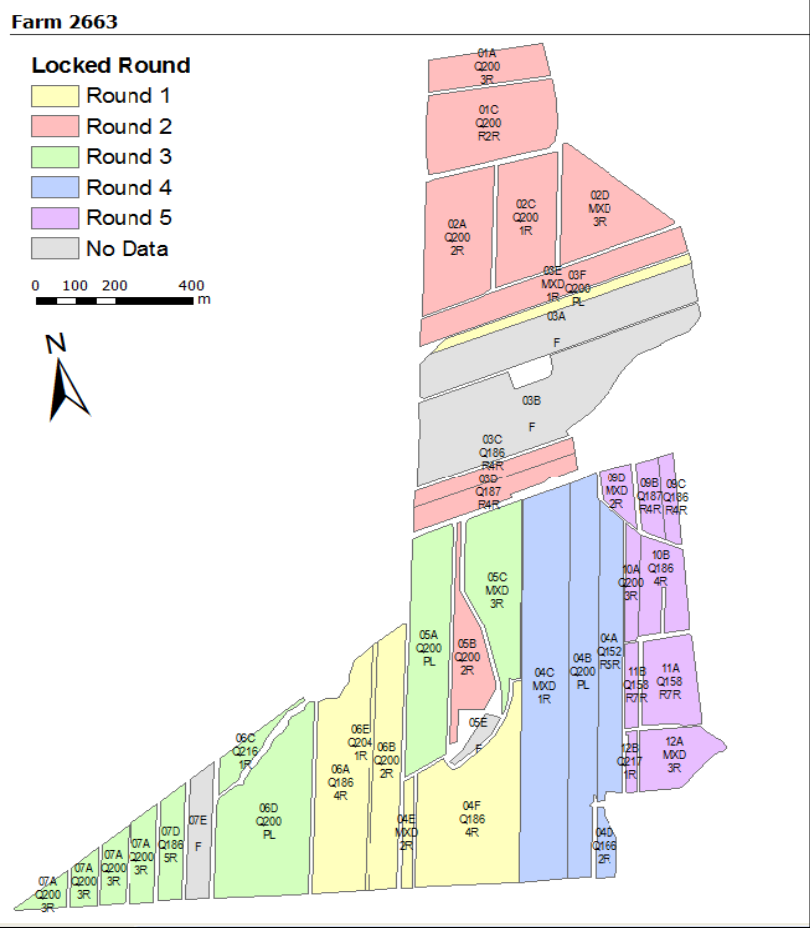
The majority of growers surveyed in the Tully region said the benefits of the harvest planner included:

- Ability to schedule single farm, multiple farms or farms across different districts
- Ability to generate more than one plan, which allows a harvest schedule to be developed for wet and dry seasons
- Calculation of crop age per round for each block allows 12 month old cane to be easily identified
- Ability to sort by variety, block number or class when locking blocks to rounds
- Provides a running total of the amount of cane locked into each round
- Colour coded harvest plan on farm map, which allows for quick reference and easy interpretation.

SugarMax											
Harvest PLAN			Season: 2007		Rounds: 4		Season Length: 22 weeks				
FARM: 2663											
Harvest											
	Block:	District/Variety:	Class:	Tonnes	Area:	Age(m)	Harvested?	Date	Tonne	CCS	Comments
ROUND:1	01A	2-Q200	3R	237	3	13	<input type="checkbox"/>				
	03F	2-Q200	PL	153	2	11	<input type="checkbox"/>				
	04B	2-Q200	PL	654	8	11	<input type="checkbox"/>				
	04F	2-Q186	4R	727	10	10	<input type="checkbox"/>				
	06A	2-Q186	4R	580	8	11	<input type="checkbox"/>				
	06B	2-Q200	2R	372	5	12	<input type="checkbox"/>				
	10A	2-Q200	3R	77	1	11	<input type="checkbox"/>				
				Total:	2,800						
ROUND:2	11A	2-Q158	R7R	221	3	9	<input type="checkbox"/>				
	04D	2-Q166	2R	75	1	10	<input type="checkbox"/>				
	12A	2-Q172	3R	219	3	10	<input type="checkbox"/>				
	04A	2-Q152	R5R	369	5	10	<input type="checkbox"/>				
	09D	2-Q186	2R	85	1	8	<input type="checkbox"/>				
	12B	2-Q117	1R	37	0	11	<input type="checkbox"/>				
	10B	2-Q186	4R	222	3	8	<input type="checkbox"/>				
	07D	2-Q186	5R	140	2	11	<input type="checkbox"/>				
	06F	2-Q186	PL	116	1	12	<input type="checkbox"/>				
	03C	2-Q186	R4R	138	2	8	<input type="checkbox"/>				
	04E	2-Q187	2R	70	1	12	<input type="checkbox"/>				
	09C	2-Q186	R4R	74	1	8	<input type="checkbox"/>				
	09B	2-Q187	R4R	94	1	8	<input type="checkbox"/>				

. 2 - Example of a harvest schedule generated by SugarMax, showing the tonnes per variety to harvest at optimal harvesting rounds.

Fig. 3 – Above: An example of a final harvest plan for a farm.



Below:
Coloured
showing
harvest in
round.

Q200^Q CCS Maturity Curve for the Tully Mill Area

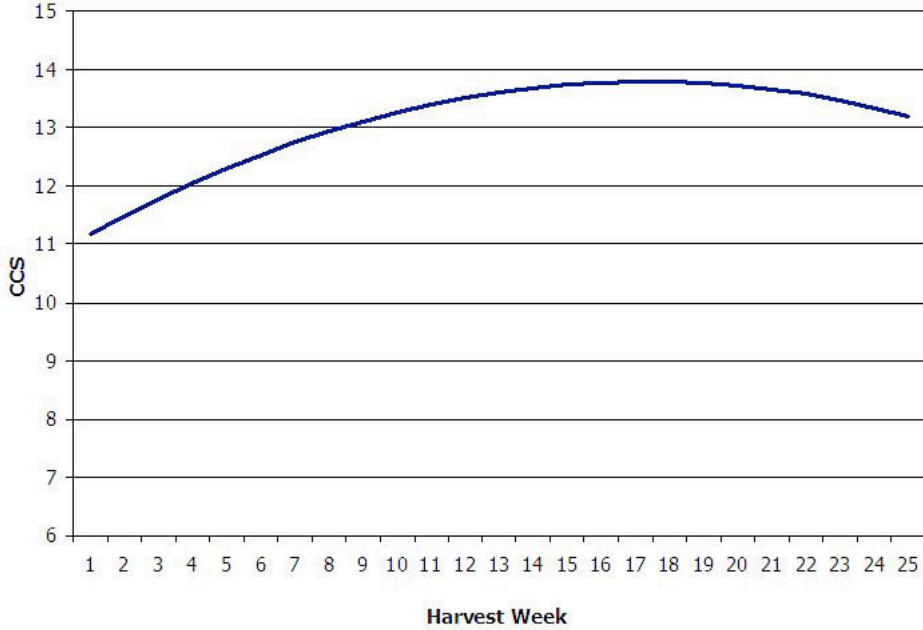


Fig. 4 - Q200^A CCS curve for the Tully area.

Outputs:

Outputs - Skills/Processes/Practices:

The key output from the project was the development and use by growers of personal computer - internet based harvest planning tools to improve harvest plan decision making.

Internet based harvest planning tool website

The Harvest Planning Tools website was completed in early April 2009. Completion of the Harvest Planning Tools website was delayed due to some technical difficulties around the interface of the harvest planning website and the new Tully Sugar Limited (TSL) web site. These difficulties were eventually overcome and the website was ready for training grower users in mid April 2009.

The project provided the pilot grower and/or user group with the means to produce harvest plans SugarMax and web based decision support tools that assist them to plan their harvest to maximise their individual CCS and tonnes sugar per hectare.

Outputs - Knowledge:

The project aimed to build on existing and develop further knowledge and skills in harvest planning.

Key areas of knowledge development were:

- Documented harvest plans for the pilot group for the 2008 and 2009 seasons. These plans will include planned and actual components. A review and improvement process was also an outcome of the pilot group activities.
- The value of harvest planning was determined and validated via benchmarking performance and review comparisons.
- The internet/web based tools have the potential to improve logistic management. Documented harvest plans, stored electronically, within the Tully Sugar IT system provide the opportunity to improve logistics management. Tully Sugar staff can then access these stored harvest plans to use the information to best manage the logistical task.

Intellectual Property and Confidentiality:

The project did not generate any confidential or sensitive intellectual property.

All programming work undertaken by the contract programmers to develop the internet based harvest planning tools remains the property of the Tully Sugar Industry. This programming code can be made available to other stakeholders in the sugar industry for the purposes of developing/customising harvest planning tools in other production areas/situations.

Environmental and Social Impacts:

Environmental impacts:

The project had no adverse or unexpected environmental impacts.

Social Impacts:

The project built capacity in the Tully Sugary Industry via exposure to methodology used - “participatory action research framework”. This approach allowed participants:

- full interaction in the process of achieving the project outputs. Participating in the project under this methodology has promoted improved understanding of harvest planning
- Participants also gained greater knowledge of the complex interactions of the variables that influence harvest planning and the effect of these variables on other element of the value chain.

Expected Outcomes:

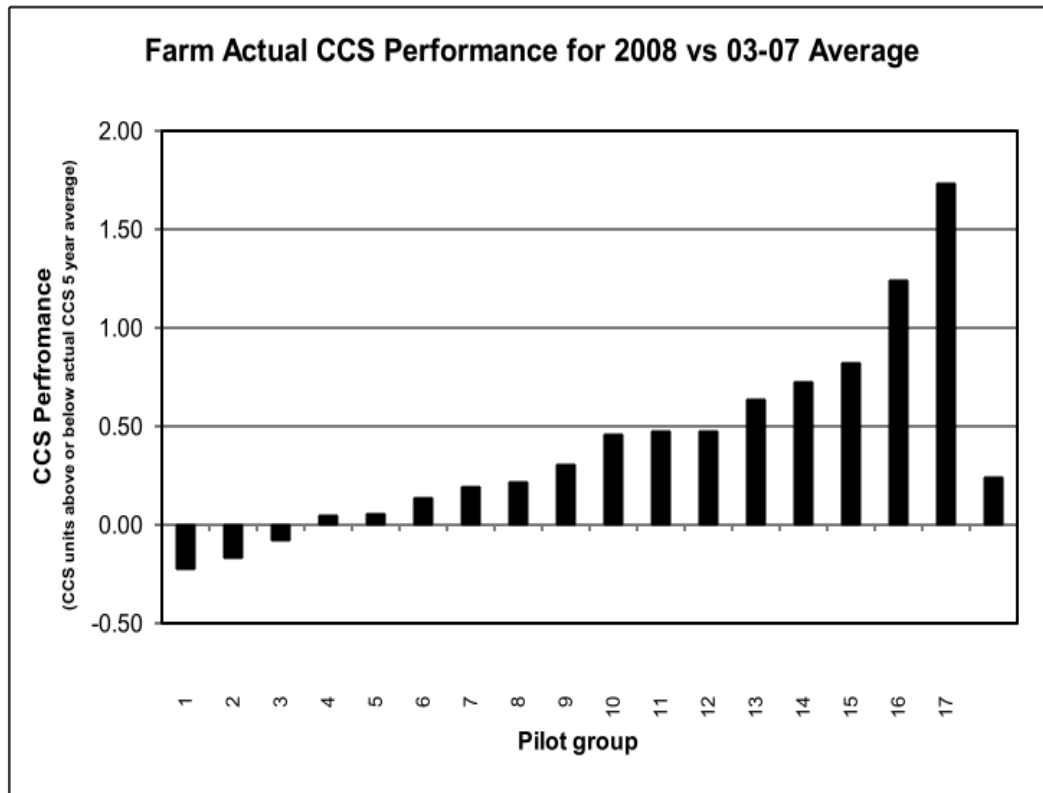
The expected outcomes of this project were:

- improved understanding of factors influencing harvest planning among 50% of the 209 production units in the Tully industry, and among the harvest and milling sectors of the industry.
- improved decision making process implemented by 50% of Tully growers when harvest planning,
- implementation of improved harvest planning by 20 growers in 2007, by 50 growers in 2008, and by 100 growers in 2009,
- an increase of 0.5 CCS units by growers participating in the project over the period 2006 to 2009.

The project failed to achieve the target adoption rate 50% of productions units. This was due to a number of factors namely:

- Development of the personal computer - internet/web based harvest planning tool was delayed until April 2009. The delayed development web based tools meant that the planning process in the 2008 season was still based on the personal computer based CSIRO Sugar Max tools. This system, whilst reliable, is reliant on a trained user / harvest planning participant interaction. This “one on one” interaction requirement slows the planning process thus limiting the number of participants than can be serviced with the project resources at hand. This experience only served to highlight the requirement for harvest planning tools to be personal computer - internet/web based format. This functionality allows users to work through the process at their own pace and at a time that is suitable to them.
- The project did however cover a large portion of the mill area. This reflects the participation of growers farming large areas. Typically these growers had multiple farms spread geographically over the mill area. These factors make harvest planning inherently hard and the adoption of harvest planning tools attractive. Comments from the pilot group participants typically were “I have too many blocks to remember exactly what needs cutting when and where”

Key performance indicators (KPIs) were developed in conjunction with the pilot group to measure the performance of the harvest planning outcomes. The project set



out to focus on CCS improvement as a KPI. However the pilot group indicated that other measures of harvest plan performance should be used eg:

- An increase in CCS for the pilot group growers of 0.5 CCS units for the 2008 and 2009 season over a measured benchmark (average CCS) from the pilot growers' 2005 and 2006 CCS results.
- Harvest plan users have the ability to compare their developed harvest plan against a theoretical harvest plan developed by the harvest planning tools. Eg the theoretical harvest plan may yield a “best plan indicator score” of 100. The user plan, after taking into account constraints such as siding availability, rotational issues, and harvest shifts, may yield a “plan indicator score” of 85. This “plan indicator score” functionality could be improved on to included a monetary value based on sugar process and yields. The indicator score could also be used to compare different rotation configuration with in the group.
- Comparison between planned harvest schedules and actual harvest schedules. Eg were the harvest plans developed followed and if there were variation what were the reasons for the variation.
- Purity of cane supply < or > 86.5%

Harvest Planning Performance:

Harvest plan vs actual and performance as measured against KPIs was collated and circulated back to pilot group members at the completion of the 2007 and 2008 harvesting seasons.

The individual participants received a report on their performance in the key areas bench marked against their 5 year average or the Tully area average.

Production Unit: Burrakin										Harvest Plan v Actual				
Cut Date	Farm	Block	Variety	Class	Tonnes	CCS	Purity	Actual	Planned	Cut Date 07	Age (days)	Plan Y/N	Purity < 87	12 month
10/07/2008	2663	03F	Q200	1R	196	14.91	91.79	1	1	14/07/2007	363	Cut to plan	Ok	Optimum
12/07/2008	2663	05D	Q186	OR	745	13.50	89.64	1	1	23/07/2007	356	Cut to plan	Ok	Optimum
21/08/2008	2663	01B	Q200	R3R	586	15.58	90.91	2	2	26/08/2007	361	Cut to plan	Ok	Optimum
21/08/2008	2663	02A	Q200	3R	413	15.79	61.15	2	2	26/08/2007	362	Cut to plan	Low purity	Optimum
21/08/2008	2663	02B	Q200	2R	400	15.16	91.41	2	2	27/08/2007	361	Cut to plan	Ok	Optimum
24/08/2008	2663	03B	Q200	PL	1289	15.33	92.17	2	2	17/07/2007	405	Cut to plan	Ok	Optimum
28/09/2008	2663	03A	Q200	PL	840	13.98	90.00	3	1	14/07/2007	443	Not cut to plan	Ok	Old
29/09/2008	2663	05A	Q200	1R	561	15.51	89.79	3	3	28/08/2007	399	Cut to plan	Ok	Optimum
29/09/2008	2663	06C	Q200	3R	189	16.96	93.47	3	2	28/08/2007	399	Not cut to plan	Ok	Optimum
29/09/2008	2663	06C	Q216	2R	97	15.35	91.82	3	3	24/09/2007	372	Cut to plan	Ok	Optimum
30/09/2008	2663	06B	Q200	1R	783	16.75	91.19	3	3	26/09/2007	371	Cut to plan	Ok	Optimum
31/10/2008	2663	04D	Q166	3R	72	13.54	88.24	4	4	17/10/2007	380	Cut to plan	Ok	Optimum
31/10/2008	2663	05G	Q200	1R	635	15.70	91.87	4	4	19/10/2007	378	Cut to plan	Ok	Optimum
1/11/2008	2663	01A	Q200	OR	253	14.15	90.11	4	4	23/08/2007	436	Cut to plan	Ok	Old
13/11/2008	2663	06A	Q200	3R	415	12.85	87.35	5	5	21/07/2007	481	Cut to plan	Ok	Old
13/11/2008	2663	06E	Q204	2R	112	12.19	80.40	5	5	21/07/2007	482	Cut to plan	Low purity	Old
14/11/2008	2663	07A	Q200	OR	343	13.98	87.24	5	3	25/09/2007	416	Not cut to plan	Ok	Optimum
14/11/2008	2663	06D	Q186	OR	790	10.45	84.75	5	5	22/07/2007	482	Cut to plan	Low purity	Old
Total / Ave						8679	14.55	88.55						

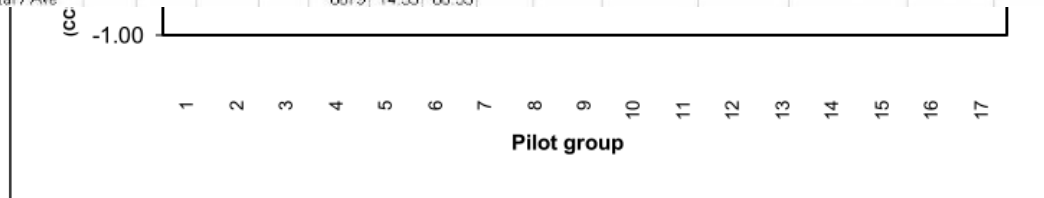


Figure 5: CCS vs previous 5 year average.

Figure 6: Individual CCS performance relative to the mill and actual

Harvest Plan Performance	2008 Season Performance			2007 Season Performance		
	Block s	Tonne s	% Group (Tonnes)	Block s	Tonne s	% Group (Tonnes)
Not harvested to plan	205	94,079	24%	246	87,357	35%
Harvested < 86.5 purity	207	92,500	23%	141	43,356	17%
Not harvested to plan & < 86.5 purity	49	21,015	5%	47	15,675	6%
Harvested to plan & < 86.5 purity	158	71,485	18%	94	2,7681	11%
Blocks harvested < 9 month > 14 months	121	60,711	15%	33	7,822	3%
Not harvested to plan < 9 month > 14 months	38	19,192	5%	20	4,847	2%

Harvested to plan < 9 month > 14 months	83	41,520	10%	13	2,975	1%
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Figure 7: 2008 pilot group performance: purity result, planned vs actual harvest time, age of cane at harvest for the 2008 and 2007 season

Future Research Needs:

The pilot group recommend the inclusion of a function called “best plan indicator score”. This function allows users have the ability to compare their developed harvest plan against a theoretical harvest plan developed by the harvest planning tools. This “plan indicator score” functionality could be improved on to included a monetary value based on sugar process and yields. The indicator score could also be used to compare different rotation configuration with in the group, or optimum farm variety suites for given mill areas or districts.

Recommendations:

(Including activities or other steps to further develop, disseminate or exploit the Project Outputs, and/or to achieve benefits)

The key recommendation from the project participants were:

- linking of the harvest planning tools with other web based tools would provide some efficiency and improve user functionality. The most likely linkage would be with the internet based version of BSES Limited's QCANE Select tool. Incorporating the the harvest planning tool into QCANE Select would place all the variety data, recommendations, farm planning and harvest planning in the one location for users. There are also efficiencies to be gained in a shared location via shared data set and website/decision support tool maintenance.

List of Publications:

(Copies of substantive publications from the project should be included as Appendices. Where the project involves a student and the thesis is relevant to the project this should be referred to in the report and an electronic copy of the thesis sent with the report or as soon as it is available.)

I need some help here.

These are the publications I can think of but there maybe be more.

ASSCT papper

Canegrowers magazine article

Local newsletter articles

Also Promoted at:

pre season shed meetings 2007, 2008, 2009

TCPSL AGM 2007, 2008, 2009

Productivity awards nights 2007, 2008, 2009

Norther Field officers meeting 2009 (in Mareeba)

