Department of **Employment, Economic Development and Innovation**

Paddock to Reef Monitoring & Evaluation

Economic analysis of ABCD cane management practices for the Tully Region

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1.0 Background

1.1 ABCD Framework

The economic analysis is based on the A, B, C and D management practice framework for water quality improvement developed in 2007/2008 by the respective natural resource management region. This document focuses on the economic implications of these management practices in the Tully region. A review of the management practices is currently being undertaken to clarify some issues and incorporate new knowledge since the earlier version of the framework. However, this updated version is not yet complete and so the Paddock to Reef project has used the most current available version of the framework for the modelling and economics.

The ABCD framework used in this economic work is based on the ABCD framework as at 2007-2008. Therefore, some of the mechanical operations, chemical use and fertiliser use may not necessarily link up with what growers may think should be in each management class today. The project utilised expert agronomist advice to prepare an initial draft of the operations that may be practiced by growers in each class, and then these were validated and modified with a group of Tully growers to obtain a consensus. The final list of machinery operations, chemical application and fertiliser applications used for the modelling and economic analysis are detailed in the CSIRO MTSRF project 3.7.5.

It must be acknowledged that the machinery operations, chemical applications and fertiliser applications modelled in this project are only one of a myriad of possible scenarios that could equally suit each management class. It is recommended that each individual grower undertake their own research and economic analysis before implementing a change in management practice on their own farming business. From a policy perspective, it is important to note that the results in this report are not prescriptive of every landholder. Some landholders will have higher/lower costs of transitioning to improved practices, and some landholders will end up with higher/lower gross margins that those provided here even if similar operations are practiced.

1.2 APSIM

As part of the project specification, sugarcane crop production data for the Tully region was provided by the APSIM model. Fertiliser application rates detailed in MTSRF project 3.7.5 are not fully supported by growers for the A and B class management categories. For A class management, this project has used the Nitrogen Replacement Theory developed by CSIRO. This method of calculating fertiliser application rates is not yet accepted by industry and has not yet been proven both scientifically or economically sound, although further scientific work is on-going. For B class management, fertiliser application rates are based on the 6 Easy Steps programme which is widely accepted by industry. For modelling and economic purposes a specific fertiliser application rate had to be chosen, whereas in reality the application rate is determined using 6 Easy Steps after relevant soil tests.

1.3 Economic Analysis

The economic analysis focuses on the implications of changing from D to C, C to B and B to A class management practices. It is recognised that these management practices have certain limitations and in many cases the grouping of practices may not be reflective of the real situation. This aim of this report is to provide a guide to the economic impact that may be expected when undertaking a particular change in farming practices and will ultimately lead to more informed decisions being made by key industry stakeholders.

Because of the complexity involved in the economic calculations, a combination of the FEAT, PiRisk and a custom made spreadsheet was used for the economic analysis. FEAT, developed by the DPI&F FutureCane initiative, is a computer based economic analysis tool designed specifically for the sugar industry. Figures calculated in the FEAT program were transferred to the custom made spreadsheet to develop a discounted cash flow analysis. The marginal cash flow differences for each farming system were simulated over a 5-year and 10-year planning horizon to determine the Net Present Value of changing across different management practices. Net present value is a profitability indicator and aids in making a decision as to whether a change in management practice is worthwhile from an economic perspective.

PiRisk is a risk analysis tool that can be added into an Excel Workbook and includes macros and distributions that give spreadsheets the ability to conduct stochastic simulations to evaluate risk. The process of risk analysis allows us to test uncertain parameters in an economic analysis and determine the potential risk associated with a change in value. In this economic analysis, a PiRisk analysis was completed for sugarcane price and sugarcane yield to determine its impact on farm gross margin for each management practice class.

2.0 Economic Analysis Parameters

- 120 hectare farm: representing a typical farm size for the region.
- Net sugar price: $349.30. This is the 5 year average price from 2005 to 2009.
- CCS: 12.86. This is the 5 year average CCS for the Tully Sugar Mill.
- Sugarcane yields provided by APSIM.
- APSIM S4 soil type.
- Contractors used for harvesting, planting and some spraying operations.
- Contract harvest cost: $7.50/tonne without GPS guidance for D, C and B class management, and $7.80/t with GPS guidance for A class management.
- Contract planting cost: $360/ha without GPS guidance for D and C class management, $370/ha with GPS guidance for B class management and $400/ha (Mizzi Planter) with GPS guidance for A class management.
- Contract spraying cost: $30/ha.
- Fuel price without GST and after rebate: $0.85/L.
- Labour cost: $30/hour.
- Soil tests are $130 each and leaf test are $50 each.
- Figures are exclusive of GST where applicable.
- Green cane trash blanketing is used in all management class practices.
- Crop cycle consists of fallow, plant and four ratoon cane crops. Each part of the crop cycle has an equal proportion of land area.
- Bare fallow used in D and C class management.
- Cowpea fallow crop grown for green manure in half of the fallow area in B and A class management, with the remainder of area in bare fallow.
- Lime is applied in the fallow area of all management classes.
- All chemical and fertiliser prices are based on April 2010 figures.
- Grower changes from narrow rows (1.5m) to wider rows (1.8m) in the process of implementing controlled traffic as the move is made from C class to B class management practice.
- Detailed machinery operations, fertiliser application rates and chemical application rates are contained in the MTSRF project 3.7.5 document.
- The information presented on A class management practices is based on practices under research, scientifically sound but commercial viability not yet proven and caution must be taken with the interpretation of the actual numbers presented.

- Transaction costs are not included in this analysis. Examples of transaction costs include the time spent purchasing and learning about the new equipment purchased.
- The economic analysis is a steady state analysis for a representative property operating exclusively in each management class. This analysis assumes that the transition to a new management practice occurs in the first year.

Each farming business is unique in its circumstances and therefore the parameters and assumptions used in this economic analysis do not reflect each individual situation. Consideration of individual circumstances must be made in order to make an informed investment decision.

3.0 Gross Margins

The main objective of this section is to identify the gross margin of fallow, plant and ratoon cane crops (Table 1) in a sugarcane farming business. The economic analysis focuses on two types of fallow management, bare fallow and cowpea fallow grown for green manure. Legume crops (eg. cowpeas) are typically grown for green manure in the Tully region due to the very wet climatic conditions making it difficult to harvest for grain. It is assumed that no revenue is received from these green manure crops. It is assumed that a cowpea fallow crop is grown for green manure in half of the total fallow area for A and B practices, with the remainder of area in bare fallow. A bare fallow is used in C and D management practices. Labour has been treated as a variable cost ($30/hr) in the gross margin analysis to allow for a more accurate comparison between management practices. It should be noted that as cultivation decreases when transitioning from D class practices to A class practices, the additional labour savings contribute to the higher gross margin.

Table 1 shows a trend of increasing farm gross margin per hectare as practices change from D class through to A class management. This trend is largely associated with savings in tillage, fertiliser, weed control and labour costs in the plant and ratoon cane crops. A cowpea legume crop is grown in A and B class practices, providing soil health benefits and nitrogen to the fallowing plant cane crop. The fallow gross margin is negative for A,B,C&D management practices due no revenue generated from a Cowpea green manure crop. As anticipated, the gross margin for plant cane crops is lower than ratoon cane crops because of the higher input costs associated with plant cane operations (eg. tillage and planting).

Table 1. Gross Margins

Scenario Name	Plant Cane GM/ha	Ratoon 1 GM/ha	Ratoon 2 GM/ha	Ratoon 3 GM/ha	Ratoon 4 GM/ha	Bare Fallow GM/ha	Cowpea Fallow GM/ha	Farm GM/ha
A Class	$843	$1,419	$1,487	$1,546	$1,774	-$245	-$405	$1,124
B Class	$717	$1,402	$1,510	$1,544	$1,815	-$330	-$490	$1,096
C Class	$484	$1,226	$1,334	$1,413	$1,677	-$477	NA	$943
D Class	$243	$1,148	$1,260	$1,321	$1,589	-$425	NA	$856

4.0 Characteristics of Management Class Change

It has been assumed that all growers have already adopted Green Cane Trash Blanketing, even in D class, and no longer burn cane before harvest. It has also been assumed that the grower changes from narrow rows (1.5m) to wider rows (1.8-2.0m) in the process of implementing controlled traffic as the move is made from C class to B class.

Table 2 shows the potential practice changes that a grower may undertake in the transition from one management class to another management class. The changes listed will vary for each farming business and largely depend on soil type, farm size, machinery, access to contractors and individual circumstances.

Table 2. Potential practice changes

D class to C class
Slight reduction in the number of soil preparation passes before cane planting Reduction in cultivation in ratoon cane Reduction in fertiliser application rates More flexible chemical strategy across the farm (eg. use of spray out in fallow) Slightly better record keeping Limited soil tests taken Decrease in farm labour requirements
C class to B class
GPS used for planting Controlled traffic at 1.8m row spacing Further reduction in tillage passes before cane planting No tillage in ratoon cane Soil tests undertaken in each fallow block before planting Fertiliser application rates based on soil tests Use of legume crops in half of the fallow area Spray-out of fallow area Increased chemical use – but targeted to each blocks requirements Development of a soil management plan Development of computer skills Much better record keeping Use of climate and weather forecasts Decrease in farm labour requirements
B class to A class
All major machinery controlled by GPS guidance Increase in contract harvesting cost to accommodate for the GPS on harvester and haul-outs Further reduction in tillage passes before cane planting, zero tillage after planting. EM mapping of farm Soil test taken in each fallow block and selected leaf tests undertaken Fertiliser & soil ameliorant rates application rates based on soil and leaf tests and EM mapping Use of legume crops in half of the fallow area Spray-out of fallow area Variable chemical application using maps and GPS Knockdown chemicals used more and residual chemicals used less Zonal spraying with a hooded sprayer Continued development of computer skills Decrease in farm labour requirements

5 Capital Costs

The capital costs incurred by a grower transitioning from one management class to another will vary substantially and largely depend on individual circumstances. The capital costs that have been included in this economic analysis are shown in Table 3.

Table 3. Capital Costs

Capital Item	**Cost**
D Class to C Class	
No capital investment	$0
Total	$0
C Class to B Class	
Stool splitter fertiliser box	$40,000
Sprayer modifications	$5,000
Harvester modifications	$12,500
Farm tractor modifications	$1,500
Total	$59,000
B Class to A Class	
GPS on farm tractor	$40,000
Shielded sprayer	$28,000
Ripper/Rotary Hoe mods	$20,000
Total	$88,000

In addition to the capital costs in Table 3, there are annual costs associated with changing management classes. These annual costs are associated with improvements in fertiliser application rates in B class and A class nutrient management. Annual costs associated with changing management classes include:

- Soil tests: 2 soil tests per annum for B class management and 4 soil tests per annum for A class management; and
- Leaf tests: 2 leaf tests per annum for A class management.

6.0 Investment Analysis

An investment analysis was undertaken using the net present value (NPV) technique to determine if the investment in capital is worthwhile and creating value for the farming business. The investment analysis framework implicitly accounts for the opportunity cost of the extra capital investment involved. Given the economic parameters used in the analysis, an investment should be accepted if the net present value is positive and rejected if it is negative. A discount rate of 7% has been used to convert the future cash flows of the cane business to their present values (value in today's dollar terms).

Table 4 below shows the net present values associated with changing from one class to another class over both a 5 year and 10 year investment period. The NPV's are greater for the 10 year investment period due to the fact that the large capital costs are incurred at the beginning of the investment, but the smaller improvements in cash flow are received annually. Thus the longer the investment time period, the more years of increased cash flow to offset the initial capital investment.

Table 4. Net Present Values

Change in management practice class	Net Capital Investment	NPV (10 year analysis)	NPV (5 year analysis)
D class to C class	$0	$73,020	$42,627
C class to B class	$59,000	$70,538	$16,621
B class to A class	$88,000	-$64,748	-$74,426

Changing from D to C requires no additional capital outlays and earns a positive NPV (5years) of $42,627 and $73,020 (10 years). The results indicate that a change in management practices from D to C is clearly a worthwhile proposition.

Changing from C to B requires an additional capital outlay of $59,000 and earns a positive NPV of $16,621 over a 5 year investment horizon. The 10 year investment horizon revealed a positive NPV of $70,538. Both scenarios indicate that the investment required to change management practices (C – B) is worthwhile from an economic perspective.

Changing from B to A requires an additional capital outlay of $88 000 and is likely to produce a negative NPV of -$64,748 (5years) and -$74,426 (10 years). The negative NPV indicates that the transition from B to A class management practices is not a worthwhile investment.

7.0 Risk Analysis

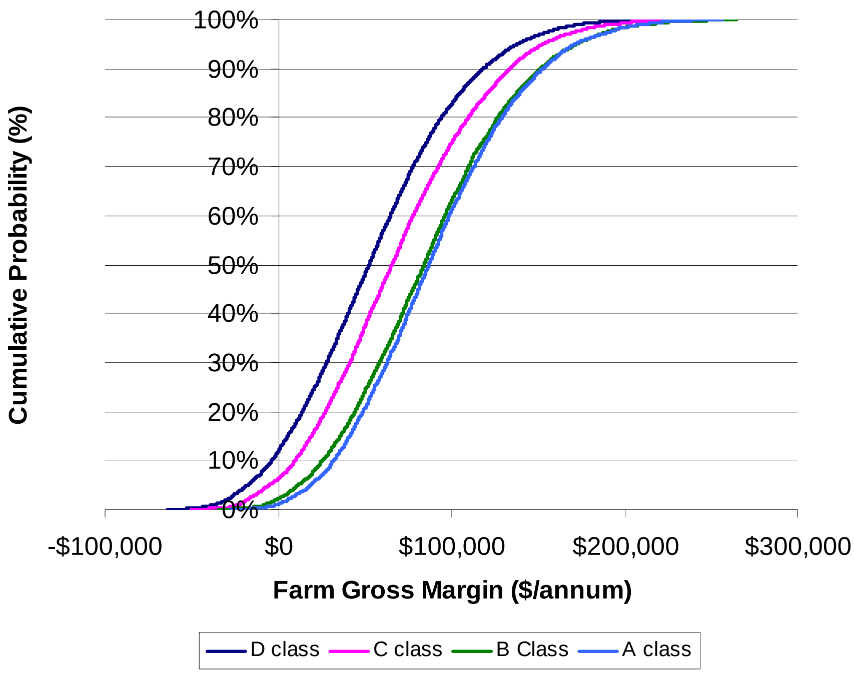
Risk analysis has been undertaken due to the uncertainty that surrounds future cash flows. These future cash flows can vary due to the variability in prices received and yields obtained from sugarcane crops.

PiRisk was used to introduce stochastic properties (variability) into the analysis by specifying probabilistic distributions for the variables that are considered most important. The outcomes for the risk analysis are arranged as cumulative probability distribution curves. The risk analysis focuses on variability in sugarcane price and yields

In the last 10 years, the sugar price has varied between $230 and $450 per tonne, while the average of the last 5 years is $349.30 which is the base sugar price used for the analysis. For the risk analysis, the minimum price has been set at $230/tonne and the maximum price at $450/tonne. The base case cane yields for the plant and ratoon crops were obtained from the APSIM crop model that uses approximately 100 years of weather information for a particular site and the relevant soil type to calculate expected yields.

PiRisk was used to conduct 10,000 simulations of the farm gross margin with random values being chosen from the probability distributions for sugarcane price and yield. The farm gross margin for each of the simulations is plotted on the cumulative probability graph in Figure 1.

Figure 1. Distribution of farm gross margin



The key observations from the PiRisk analysis is that the D and C class management practices have a higher probability of making a negative farm gross margin compared with A and B class management practices. This suggests that farms using A and B class management practices will be stronger financially than those persevering with D and C class management practices, all else being equal, in any given year. The results also indicate that the maximum negative gross margin is substantially higher for D and C class management practices. The graph emphasises the superiority of A and B class management practices over the other options, however this does not take into account fixed costs and capital investment required to make the transition. Therefore, the interpretation of this graph should be carried out in conjunction with the NPV figures outlined in section 6 of this report.

8.0 Conclusions

This economic analysis is based on APSIM modelled cane yields, the assumptions discussed in Section 2 and the costs associated with transitioning discussed in Section 4.   The net present value results indicate that the transition from D to C and C to B class management practices is a worthwhile proposition from an economic perspective. However, a grower currently operating in B class management practices will not be better off transitioning to A class management practices. Changing from C to B class management practices displayed the greatest benefit with a more resilient farm gross margin and a positive net present value with either a five year or ten year investment period.

The risk analysis showed that in any specific year, a grower will receive a higher farm gross margin when operating with an improved class of management practices, although the difference is small between B and A class management practices. This indicates that the likelihood of A and B class management practices making a negative farm operating return is lower compared to C and D class management practices.

The results of this economic analysis have shown that there are expected economic benefits when moving from D to C and C to B class management practices. The benefits will vary for each individual grower depending on their starting point and their individual circumstance. However, a grower currently operating with B class management practices will not be better off by moving towards A class management practices. The outcome of this transition will strongly depend on factors such as capital investment, length of the investment period and the ability to successfully implement these commercially unproven practices. As previously noted, the costs and benefits associated with a transition will be different for each individual grower and therefore each circumstance needs to be carefully considered before making a change in management practice.