The Economics of Herbicide Management Practices on Sugarcane Farms – Mackay Region

Adopting progressive herbicide management practices as part of an integrated weed management program is an important step towards improving cane farm profitability and water quality. This report identifies the implications for profitability when adopting these progressive practices in the Mackay region. The findings are based on evaluations of farms that are representative of farming systems in the district using a legume fallow and practising low tillage.

Herbicide management options

The research evaluated three options involving various herbicide management practices for three farm sizes:

1) moving from conventional to best herbicide management practices (C-Class to B-Class);
2) moving from conventional to aspirational herbicide management practices (C-Class to A-Class); and,
3) moving from best to aspirational herbicide management practices (B-Class to A-Class).

A description of the practices within each herbicide management option is outlined in Table 1. Options are based on existing management practice guidelines and are classified on the potential to improve water quality on cane farms. Specific details of each option were developed through consultation with local experts including growers, agronomists, and extension officers on the basis that they each provide effective weed control within the product label and regulatory requirements.

Improvements to water quality

Changes to water quality were modelled and the benefits measured by annual changes in equivalent herbicide losses from the farm. It follows that a greater reduction in herbicide losses leaving the farm implies a larger improvement to water quality. Table 2 shows the annual reduction in grams per hectare when shifting from C- to B-Class, C- to A-Class, and B- to A-Class herbicide management as well as the percentage reduction in PSII-herbicide equivalent losses (PSII-HEq) from current levels.

Table 1: Practices within each herbicide management option

Conventional management practices (C-Class):
▪ Using herbicides at the high-recommended label rate across farm blocks ▪ Limited calibration ▪ Residual herbicides are not used strategically ▪ Incorporates the use of directed application and non-specific nozzles ▪ Consideration of crop stage, weed size and type.
Best management practices (B-Class):
▪ The herbicide rate is varied between blocks with consideration of weed type and pressure ▪ Regular calibration (for each application) ▪ Residual herbicides are used strategically ▪ Incorporates the use of directed application equipment with appropriate nozzles (includes Irvin legs, octopus bar and air-inducted nozzles) ▪ Consideration of crop stage, weed size and type, crop cycle, environmental conditions and irrigation.
Aspirational management practices (A-Class):
▪ Use of an Electronic Rate Controller ▪ The herbicide rate is varied between blocks with consideration of weed type and pressure ▪ Frequent calibration (for each block and automated) ▪ Residual herbicides are used strategically and a shift towards the increased usage of knockdown herbicides ▪ Incorporates the use of precision and directed application equipment with appropriate nozzles (includes a hooded-sprayer, two tanks and air-inducted nozzles) ▪ Nozzles changed regularly ▪ Consideration of crop stage, weed size and type, crop cycle, environmental conditions, climate forecasting and irrigation.

Table 2: Reduction in PSII herbicide-equivalent[1] losses

Class shift	Reduction in PSII-HEq losses (gr/ha/yr)	(%)
C- to B-Class	7	52%
C- to A-Class	11	85%
B- to A-Class	4	69%

How will improved herbicide management affect farm gross margin?

The Farm Gross Margin (FGM) is commonly used to evaluate the contribution of farm activities to profit. Table 3 shows an increase in the FGM when moving to improved herbicide management. The increase to FGM when moving to improved management practices is a result of cost savings through improved herbicide use efficiency, application methods and timing.

Table 3: Changes to farm gross margin when shifting to improved herbicide management ($/year)

Class shift	Farm size (hectares)		
	50ha	150ha	250ha
C- to B-Class	$1,240	$3,790	$5,870
C- to A-Class	$1,570	$5,045	$9,195
B- to A-Class	$330	$1,255	$3,325

How much will a grower need to invest to shift classes?

Table 4 provides the cost of equipment, obtained from local agribusiness, required to adopt improved herbicide management. A grower shifting from C or B to A-Class will need to spend up to six times more on equipment than when shifting from C- to B-Class. Equipment costs are higher for 250ha farms when larger machinery sizes are taken into consideration. Nevertheless, these costs fall on a per hectare basis in line with an increase in the farming area.

Table 4: Equipment cost

Class shift	Farm size (hectares)		
	50ha	150ha	250ha
C- to B-Class	$1,870	$1,870	$2,750
C- to A-Class	$11,575	$11,575	$13,768
B- to A-Class	$11,084	$11,084	$13,086

Will a progressive shift in herbicide management be profitable?

Table 5 presents the profitability of a change in herbicide management when taking into account the cost of equipment. It can be seen that moving from C- to B-Class is profitable for all farm sizes. On the other hand, the results indicate moving from C- to A-Class is profitable for 150ha and 250ha farms, but not for the relatively smaller 50ha farm, while moving from B- to A-Class is only profitable for 250ha farms. This is due to the amount of capital expenditure required relative to the sum of the future economic benefits, which is influenced by the size of the farm. Risk analysis illustrated the importance of ensuring production is maintained when progressing to A-Class herbicide management, which is based on practices under research and not thoroughly tested on a commercial scale.

Table 5: Annual Benefit or Cost ($/yr)

Class shift	Farm size (hectares)		
	50ha	150ha	250ha
C- to B-Class	$987	$3,536	$5,495
C- to A-Class	-$3	$3,471	$7,325
B- to A-Class	-$1,177	-$252	$1,548

*based on a required rate of return of 6%

What is the rate of return on the investment?

The rate of return on the investment represents the amount of money returned to the grower each year as a percentage of the initial money invested (i.e. cost of equipment). Individuals will require different rates of return depending on their perceptions about the risk of adopting each practice and how it will likely affect their farming business. The results presented in Table 6 show that moving from C- to B-Class has the highest annual rate of return, while a 50ha grower moving from B- to A-Class will lose 18% of the initial investment per year.

Table 6: Rate of Return

Class shift	Farm size (hectares)		
	50ha	150ha	250ha
C- to B-Class	66%	203%	213%
C- to A-Class	6%	42%	66%
B- to A-Class	-18%	2%	22%

[1] See full report for details of the methodology used.

How long does it take to recoup the initial investment?

The figures in Table 7 indicate the number of years it will take to recover the initial cost of the equipment as well as the annual return on investment required each year. Switching from C- to B-Class has the shortest payback period (1 to 2 years) followed by C- to A-Class (2 to 3 years on 250ha and 150ha farms). A 50ha farm takes longer to recoup the initial investment than 150ha and 250ha farms because the cost and future benefits are both spread over a smaller farming area.

Table 7: Payback period

Class shift	Farm size (hectares)		
	50ha	150ha	250ha
C- to B-Class	2	1	1
C- to A-Class	>10	3	2
B- to A-Class	>10	>10	5

What is the maximum investment that can be made before it is not profitable?

Table 8 shows the maximum amount of money that can be initially spent on equipment before it becomes unprofitable to adopt a management practice change. With the exception of a 50ha farm moving form C- to A-Class and a 50ha and 150ha farm moving from B- to A-Class, all other cases can accommodate a higher initial investment and still remain profitable.

Table 8: Maximum initial investment

Class shift	Farm size (hectares)		
	50ha	150ha	250ha
C- to B-Class	$9,135	$27,896	$43,202
C- to A-Class	$11,558	$37,121	$67,675
B- to A-Class	$2,424	$9,225	$24,472

The bottom line

The results of the economic analysis identify attractive opportunities to increase farm profitability whilst at the same time improving water quality. Moving from C- to B-Class is likely to produce the highest return on investment with the least amount of risk and also provide a substantial (52%) reduction in PSII-herbicide equivalent losses. Moving from C- to A Class on 150ha and 250ha farms is also likely to be profitable with considerable (85%) reductions in PSII-herbicide equivalent losses. However, moving to practices currently under research and not commonly practised exposes the grower to higher production risk. Interestingly, a risk analysis focussing on moving from B– to A Class indicated that a decrease in average yield of just one per cent (1%) or greater will result in a negative economic outcome.

In summary, several progressive changes were identified to be profitable, with the exception of a 50ha farm moving from C- to A-Class and a 50ha and 150ha farm moving from B- to A-Class. In many cases the progressive change in herbicide management is an important step toward increasing cane farm profitability and improved water quality.

This factsheet is a summary of information from the RP62C Cane research project, funded under the Reef Water Quality Science Program administered by the Department of Environment and Heritage Protection. For a full copy of the report, please refer to;

Poggio, M., Smith, M., van Grieken, M., Shaw, M. & Biggs, J. (2014). *The Economics of Pesticide Management Practices Leading to Water Quality Improvement on Sugarcane Farms*. Department of Agriculture, Fisheries and Forestry (DAFF).