The impact of Smartcane BMPs on business and the environment in the Wet Tropics

Case Study 1: Salmec

This case study is the first in a series that evaluates the economic and environmental impact of Smartcane Best Management Practice (BMP) adoption by a number of sugarcane growers in the Wet Tropics of North Queensland. Economic, biophysical and farm management data before and after BMP adoption was supplied by the grower and the Farm Economic Analysis Tool (FEAT)[1] and CaneLCA Eco-efficiency Calculator (CaneLCA)[2] were used to determine the impact of these changes on business performance and the environment. The findings of these case studies are specific to the individual businesses evaluated and are not intended to represent the impact of Smartcane adoption more broadly.

Key Findings of the Salmec case study

The transition to BMP, which began in 2008, has resulted in:

- Annual improvement in farm operating return of $150/ha ($124,500/yr total)
- 124kg less pesticide active ingredients and 1 tonne less nitrogen lost to waterways annually
- Annual fossil fuel use reduced by 15 per cent (or 25 tonnes of fuel over the cane life cycle)
- Greenhouse gas emissions reduced by 19 per cent annually (equivalent to taking 47 cars off the road each year).

About the farm

Salmec, owned and operated by Mark Savina and Mick Andrejic, manages 12 cane farms with a total area of 830 hectares north of Cairns. As part of their farming operations, Salmec plants and harvests its own cane. Over the past eight years, Salmec has implemented a range of changes to improve the profitability and reduce the environmental impact of their farms. Today, Salmec is a Smartcane BMP accredited business.

Image 1: Mark Savina

What changes were made?

Salmec has made big changes to nutrient, soil health and pest management (Table 1).

To reduce compaction and improve soil health, Salmec changed their row spacing to match the wheel tracks on their harvester. This meant moving from 1.52m to 1.8m row spacing using GPS guidance. Flipper-rollers were put on their harvesters to keep haulouts to the controlled traffic lanes. It took five years to make these changes across all blocks on each farm.

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[1] FEAT is a Microsoft Excel® based tool that models sugarcane farm production from an economic perspective, allowing users to record and analyse revenues and costs associated with their sugarcane production systems. *https://www.daf.qld.gov.au/plants/field-crops-and-pastures/sugar/farm-economic-analysis-tool.*

[2] CaneLCA is a Microsoft Excel® based tool that calculates 'eco-efficiency' indicators for sugarcane growing based on the life cycle assessment (LCA) method. It streamlines the complex LCA process to make it more accessible to researchers, agricultural advisors, policy makers and farmers. *https://eshop.uniquest.com.au/canelca/*

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To improve nutrient management, Salmec adopted the Six-Easy-Steps guidelines. Nitrogen rates recommended by Six-Easy-Steps were 50kg/ha less nitrogen in plant and ratoon cane than Salmec's standard practice.

Salmec made minor modifications to their chemical store and adopted Farmworks for electronic farm record keeping.

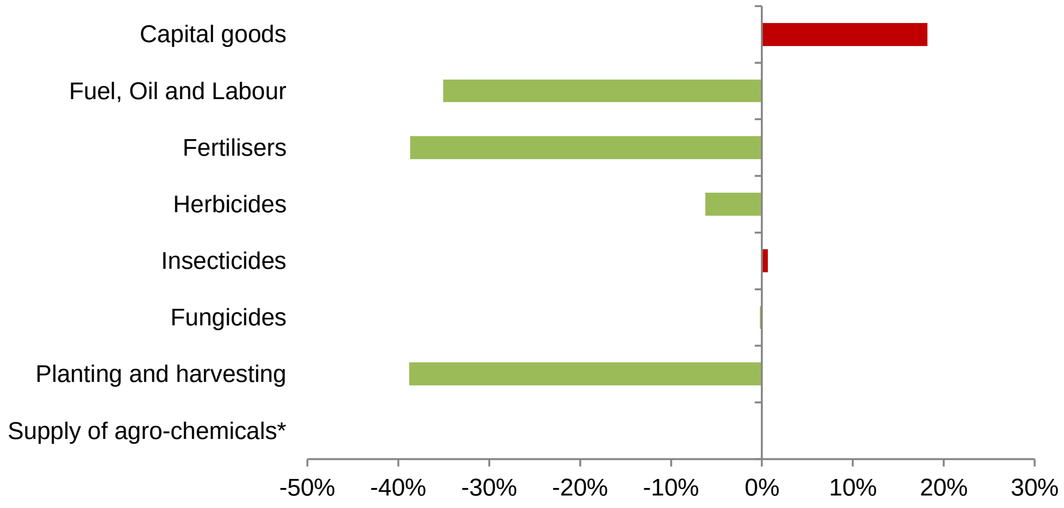
Table 1: Main changes to the new farming system

	Before	After
Weed, Pest and Disease Management	• 3kg/ha Velpar K4 (468g/kg Diuron and 132g/kg Hexazinone) in plant and ratoon cane • No insecticide	• Banded spraying in plant cane (30 per cent of time) • No Diuron in plant and reduced Diuron in ratoon cane • Reduced 2,4-D in plant and ratoon cane • Insecticide - Talstar
Soil Health	• Heavy tillage • 1.52m row spacing • Legume fallow (50 per cent of fallow area)	• Reduced tillage (zonal ripping and tillage) • 1.8m single row spacing • GPS guidance • Legume fallow with preformed mounds (50 per cent of fallow area)
Nutrient Management	• Grower determined nutrient rate	• Six-Easy-Steps nutrient rate

What does this mean for the business?

Economic analysis indicates that Salmec's operating return has increased by $150/ha/yr ($124,500/yr total) under the new BMP farming system. This is the result of lower operating costs after BMP adoption. The biggest contributors to change in operating costs were; fertiliser costs (-38 per cent, -$58/ha); fuel, oil and labour (-35 per cent, -$52/ha); planting and harvesting costs (-39 per cent, -$58/ha); and capital goods costs (+18 per cent, $27/ha) (Figure 1).

Figure 1: Contribution to change in farm operating costs (%)



*Cost to supply agro-chemicals is embodied in fertilisers /herbicide /insecticide /fungicide cost.

In terms of cost savings from BMP adoption, the $52/ha reduction in money spent on fuel, oil and labour was mainly due to the wider row spacing, which reduces tractor hours through the reduction of the total number of rows and therefore distance travelled. For the same reason, fuel and labour used in harvesting was also reduced after BMP adoption. In addition, through adoption of Six-Easy-Steps nutrient program, money spent on fertiliser was reduced by $58/ha.

Capital goods (Figure 1) refer to the cost of repairs, maintenance and depreciation of machinery and equipment. After BMP adoption repairs and maintenance costs decreased as a result of reduced tractor hours and zonal ripping. However, depreciation increased due to new machinery and equipment purchased to implement BMP.

How much did it cost to make the change?

To move to a controlled traffic system with 1.8m single row spacing, Salmec installed a GPS base station and purchased six GPS units. Modifications were made to widen implements, two flipper rollers were purchased for Salmec's harvesters and earthworks were undertaken to widen drains. Salmec also purchased a stool splitter, mound planter and spray boom. Chemical store modifications and the purchase of Farmworks software were relatively minor expenses.

The total cost of implementation was $408/ha or $338,700 across all 12 farms.

Was the investment profitable?

Results of an investment analysis show that BMP adoption was a worthwhile investment for Salmec. It would take five years to repay the $338,700 invested. Over a ten year investment horizon, Salmec's investment has added an additional $101/ha/yr to the bottom line (when the initial investment is taken into account) (Table 2). This analysis is based on the assumption that yield is maintained after BMP adoption, which is Salmec's experience.

Table 2: Total cost change, capital investment and value of investment

Cost of Implementation ($/ha)	$408
Discounted Payback Period	5 years
Annual Benefit ($/ha/yr)	$101
Internal Rate of Return	29 %
Investment Capacity ($/ha)	$1,204

Investment capacity is the maximum amount of money that can be spent before an investment becomes unprofitable. Salmec could have invested up to $999,320 ($1,204/ha), or three times their actual investment, before the cost savings made by adopting BMP would be insufficient to provide the required (7 per cent) return on investment.

What does this mean for the environment?

The environmental impacts of Salmec's farming system before and after BMP adoption are shown in Figure 2.

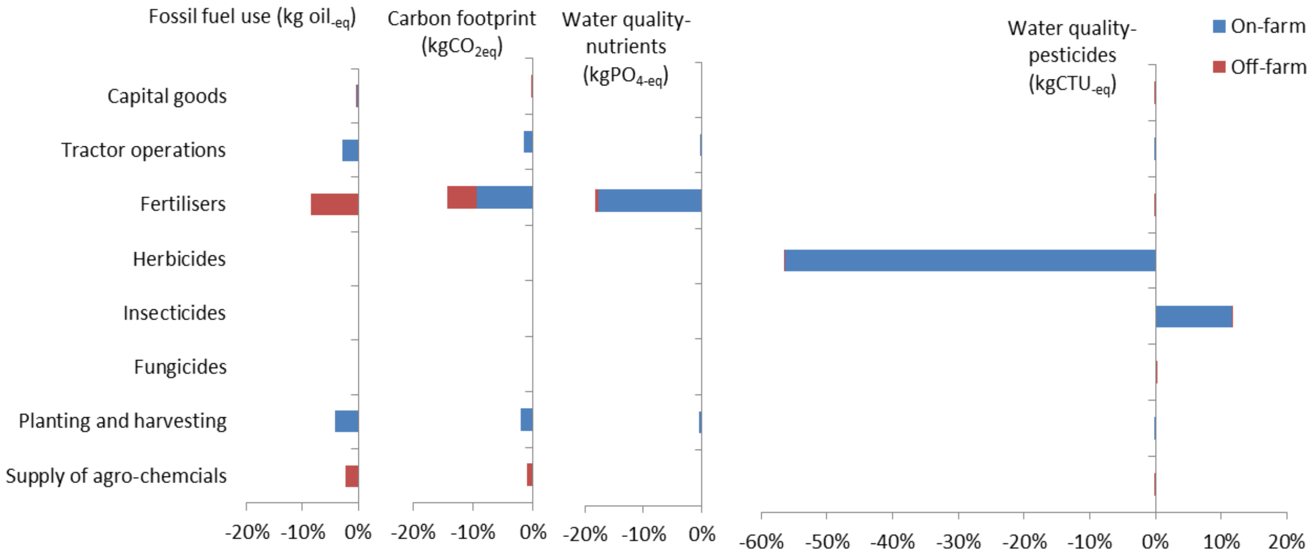
After BMP adoption, annual fossil-fuel use was reduced by 15 per cent overall. This means avoiding around 25 tonnes of fossil fuel use per year for the whole life cycle of the farming operation[3]. More than half of this occurs off-farm, due to less fertiliser being produced at the factory and supplied to the farm. Avoided urea production is the biggest energy-saver because it's an energy-intensive fertiliser, but there are also some savings from other fertiliser ingredients (DAP, KCl, Gran-am). The remainder is due to Salmec's own on-farm reduction in fuel use for tractor operations, planting and harvesting as a result of wider row spacing.

The carbon footprint (greenhouse gas emissions) of cane production reduced by 19 per cent overall after BMP adoption. This means avoiding around 188 tonnes of carbon dioxide per year across the whole farming operation, the equivalent of taking 47 cars off the road for a year. Most of the carbon

[3] Life cycle fossil fuel use includes not just to the diesel consumed directly on the farm but also the fossil fuels used in the production the fertilisers, pesticides, lime, electricity etc. used on the farm.

footprint reduction (77 per cent) is due to less on-farm emissions of nitrous oxide[4] (a strong greenhouse gas) due to Salmec reducing the use of nitrogen fertiliser. The rest (23 per cent) are due to the avoidance of off-farm production and supply of fertilisers (mostly urea), as well as less tractor and harvester fuel from the wider row spacing.

Figure 2: Increase / decrease in environmental impacts after adoption of BMP (per ha)[5]



The potential for water eutrophication from losses of nutrients to the environment was estimated to reduce by 20 per cent overall. This means the avoidance of around 1 tonne of eutrophying substances being lost to water per year across the whole farming operation. This is all due to a reduced potential for nitrogen loss to surface water runoff and groundwater infiltration, because less nitrogen has been applied.

The potential for aquatic eco-toxicity impacts from losses of pesticides to water was estimated to reduce by 45 per cent overall. This resulted from an avoided loss of around 124kg of pesticide active ingredients to water per year. Reduced herbicide application rates for active ingredients with higher toxicity potential (atrazine, diuron, hexazinone, paraquat and pendimethalin) contributed to a 56 per cent impact reduction, but there is a potential increase in impact (11 per cent) due to the introduction of the insecticide Talstar (bifenthrin) in Salmec's new farming system.

What about risk?

When adopting any management practice change there is always a risk that things may not go as planned (e.g. yield loss, financial risk). The adoption of management practices that have been

[4] The assessment assumes a generic nitrous oxide (N_2O) emission factor of 1.99% of applied N lost as nitrous oxide N, which is based on the latest Australian greenhouse gas inventory methodology. The global warming potential for nitrous oxide is 298 kg CO2-e / kg N_2O.

[5] A negative value is a decrease in environmental impact, and a positive value is an increase in impacts.

kg oil_{-eq} = kilograms of oil equivalent, the reference substance for measuring fossil-fuel resource depletion

kg $CO_{2\text{-}eq}$ = kilograms of carbon dioxide equivalent, the reference substance for measuring greenhouse gases

kg $PO_{4\text{-}eq}$ = kilograms of phosphate equivalent, the reference substance for measuring eutrophication of water due to releases of nutrients (N, P) and sugar

kg CTU_{-eq} = kilogram of equivalent critical toxicity units, a measure of eco-toxicity in freshwater due to releases of pesticides scientifically validated, such as BMP, means that an adverse impact on production is unlikely.

Results of a production risk analysis show that yield across plant and ratoon cane would need to decline by more than 7 per cent before investing in BMP adoption is unprofitable for Salmec (Figure 3).

From an environmental perspective, the yields across plant and ratoon canes would need to decline by between 20 per cent and 25 per cent for there to be no net gains in life cycle fossil fuel use, carbon footprint, and nutrient-related water quality impacts; and by 45 per cent for there to be no net gains in pesticide-related water quality impacts (Figure 4).

What's the bottom line?

This case study has evaluated the business and environmental impact of Smartcane BMP adoption for a farm in the Wet Tropics.

Results indicate that BMP adoption has resulted in a large cost saving for Salmec by reducing the amount spent on fertiliser, fuel and labour. Salmec made a significant investment in new machinery and equipment to implement BMP and this has proved to be a worthwhile investment.

The most significant environmental benefit for Salmec is the reduced potential for water quality impacts from a transition to pesticide with lower toxicity, residuals not applied in the wheel tracks and reduced application rates, and a reduction in the amount of N fertiliser applied. There are also fossil-fuel conservation and greenhouse gas mitigation gains from a combination of increased row spacing and reduced urea demand.

Each farming business is unique in its circumstances and therefore the parameters and assumptions used in this case study reflect Salmec's situation only. Consideration of individual circumstances must be made before applying this case study to another situation.

Figure 3: Annual benefit of investment ($/ha/yr) sensitivity to yield

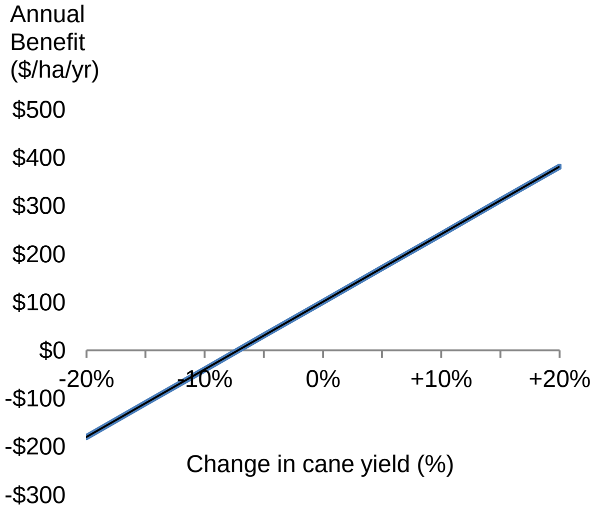
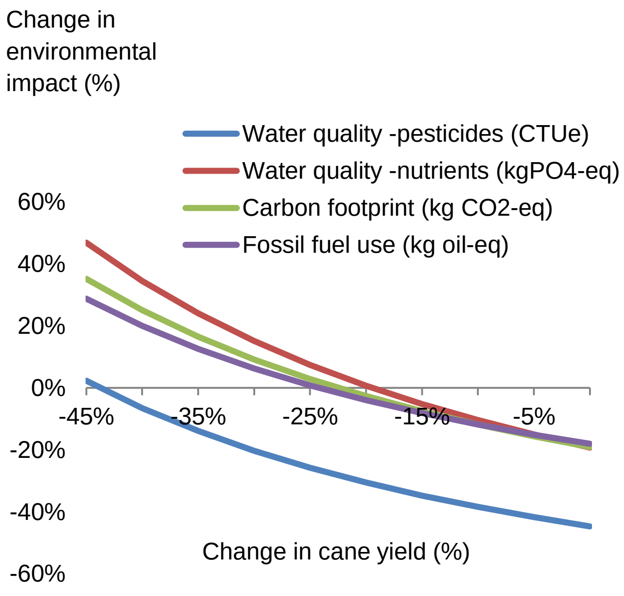


Figure 4: Environmental impact sensitivity to yield



This case study forms a component of SRA Project 2014/15 (Measuring the profitability and environmental implications when growers transition to Best Management Practices). For further information contact the Townsville DAF office on (07) 3330 4560

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