



Economic Evaluation of Banana BMPs - Key Findings

What was the aim of the project?

To provide banana growers in the Tully and Innisfail districts of the Wet Tropics with greater confidence as to the likely profitability and water quality benefits of adopting various Banana Best Management Practices (BMPs) and for industry stakeholders to gain a better appreciation of the opportunities and risks banana growers face in adopting those BMPs. Prior to this project being completed there was limited information published for growers to make informed decisions about adopting BMPs.

Key questions and project outcomes:

- What does the modelling (using data provided by growers and technical experts) suggest the economic and water quality outcomes will be for various practice adoption scenarios? (Technical Report)
- What do growers expect the economic outcomes and adoption barriers to be for adopting selected practices on their farms? (Adoption Report)
- Is investment in particular practice changes worthwhile (e.g. contouring, optimised fertiliser rates and regular fertigation, canola fallow crop, inter-row vegetation management, sediment traps and farm design)? (Three case studies)

Key findings:

- **Win-win:** Technical report findings indicate that adopting most BMPs evaluated may result in both economic and water quality benefits.
- **Research gaps:** There are few studies to define the production and profitability implications for adopting best management practices.
- **Risk:** Economic outcomes can be very sensitive to changes in production.
- **Variability & complexity:** Variation exists in farm sizes, soil types, slopes and in growers' perceptions of the characteristics of some BMPs. A range of non-economic or socio-economic factors can influence adoption decisions.
- **Continual innovation:** Many growers engage in continual innovation and work "in" the business and work "on" the business are often intertwined. As a result, time and money spent on evaluating BMP changes can be difficult to quantify.

Technical Report Summary

Key messages

The report found that, in general, growers adopting BMP were able to reduce *dissolved inorganic nitrogen (DIN)* and *total suspended sediment (TSS)* leaving banana farms, while at the same time *improving the profitability* of their farming businesses.

While the analysis is based on the assumption that yield is maintained after BMP adoption, the *economic outcomes can be very sensitive to changes in production*. It was identified that there are few studies to define the production and profitability implications for adopting best management practices.

How was the modelling completed?

Representative farm scenarios were developed to explore the economic and water quality implications of adopting stepwise management improvements.

- Data used in the modelling was based on the best information available at the time of the study, and collected from publications, industry sources, extension officers and workshops held with growers.
- Management practices were *modelled at three classes of B, C and D*.
- A range of scenarios were developed to represent typical banana growing farms in the Tully and Innisfail districts, with *variation in farm sizes, soil types and slopes*.

How did adopting BMP affect the environment?

The water quality modelling results found that:

- *Reducing fertiliser rates* was the single most important driver of DIN (dissolved inorganic nitrogen) abatement on all farms. For example, moving from D to B class rates was responsible for an 88 per cent reduction in total DIN losses from Ferrosol soils.
- *Increasing ground cover* on inter-rows and headlands was the most important practice in terms of reducing TSS (total suspended sediment) in runoff. For example, moving from D to B class ground cover was responsible for an 82 per cent reduction in total TSS losses from Ferrosol soils.

Technical Report Summary

How did adopting BMP affect farm profitability?

An investment analysis was conducted to measure the changes in farm profitability when making a practice change.

- In general, the transition to improved farming systems (e.g. all D class to all C class) showed a *positive impact on farm profitability*.
- The *highest economic benefit (annualised equivalent benefit, ABE) values* were associated with 'nutrient rate' and 'irrigation'.
- However, some individual practice changes showed a negative impact on farm profitability. For example, transitioning ground cover from D to C class resulted in a negative impact on farm profitability.
- Scenarios for a 40 hectare farm with Dermosol soils are shown in table 1. For example, moving from D level crop removal practices to B level is expected to have no effect on DIN or AEB, with a slightly positive effect in reducing TSS.

Table 1: Cost effectiveness examples, 40 hectare farm with Dermosol soil, modelled leaving other practices at D level but moving individual practice groups to B level

Practice Group	DIN (N/ha/yr)	TSS (t/ha/yr)	AEB (\$/ha/yr)
Crop removal	No effect	Slightly positive	No effect
Fallow management	No effect	Slightly positive	Slightly positive
Tillage	No effect	No effect	Slightly positive
Ground cover	No effect	Very positive	Very negative
Water control structures	No effect	Slightly positive	Slightly negative
Nutrient rate	Very positive	No effect	Very positive
Nutrient application	Slightly positive	No effect	Slightly negative
Irrigation	Slightly positive	No effect	Very positive

How much risk is there?

The adoption of BMP's is generally characterised as having a low risk of adverse production outcomes, however it was identified that *there is a limited number of studies to accurately define the production implications for some of these practices*. To analyse possible production implications, a risk analysis was undertaken which revealed that the economic outcomes can be very sensitive to changes in production.

Adoption Report Summary

Key messages

Survey results indicated:

- The practices were generally perceived by growers to have economic impacts that are *likely to encourage adoption* (refer to Table 2).
- The growers who were surveyed generally perceived that most practices *do not have characteristics that would be barriers to adoption* (refer to Table 3).
- Substantial variation in responses exists for some practices and, as described in the report, a range of additional matters may also influence adoption decisions. This highlights the *range of potential barriers to changing management practices* and that *individual circumstances and farming system complexities may result in a grower's perceptions differing from an average response*.

Further detail - perceived economic outcomes:

While it was perceived that *applying fertiliser fortnightly* ('fertiliser application frequency': Table 2) would increase production costs, it was also perceived that this practice would *increase production of bananas and enterprise profitability*.

Statistical analysis also indicates that using an annually revised fertiliser program based on recommended rates ('fertiliser rates') and using fertigation or a combination of fertigation and banded surface applications ('application method') are practices that are more likely to be viewed by adopters as profitable, suggesting that perceptions regarding "the bottom line" of a practice are critical in informing practice change decisions.

Further detail - perceived practice characteristics:

Growers generally perceived that planting into permanent beds, as well as using GPS and zonal tillage ('crop planting and tillage'), would require 'high capital investment' and 'new skills and information'. Adopting fertigation, or a combination of fertigation and banded surface applications ('fertiliser application method'), was generally perceived to require a 'high capital investment.' These perceptions buck the main trend in results (see above 'key messages') and may *discourage adoption of the practices relating to fertiliser application method and crop planting and tillage*.

How was the socioeconomics component completed?

A survey on the adoption of seven management practices was completed with forty six banana growers in the Innisfail and Tully districts. *Survey results were analysed and used to develop a report that highlighted the opportunities and constraints growers face in adopting the practices*.

Adoption Report Summary

Table 2: Average perceptions of practice adoption for perceived economic impacts (heat map)

		Perceived Economic Impacts				Adoption Rate
		Production costs	Production of bananas	Enterprise profitability	Variability of production	
Management Practices	Crop Removal Method	* 2.7	3.0	3.3	2.9	78%
	Grass or Planted Fallow Crop	* 2.9	4.1	3.9	2.3	83%
	Crop Planting and Tillage	2.6	3.6	* 3.9	2.5	76%
	Living Ground Cover	* 3.0	3.5	3.7	2.3	87%
	Fertiliser Rates	* 2.6	4.1	4.0	2.0	76%
	Fertiliser Application Method	* 3.0	4.0	3.8	1.9	74%
	Fertiliser Application Frequency	3.5	4.2	3.8	2.0	72%

Table 3: Average perceptions of practice adoption for perceived practice characteristics (heat map)

		Perceived Practice Characteristics						Adoption Rate
		High capital investment needed	Contractors needed to implement change	Does not fit with my current farming system	Not easy to trial	Requires new skills and information	Too much time required to look into	
Management Practices	Crop Removal Method	2.0	1.9	2.2	1.9	2.4	1.9	78%
	Grass or Planted Fallow Crop	* 2.3	2.0	2.0	1.9	* 2.5	1.8	83%
	Crop Planting and Tillage	3.9	* 3.0	* 2.5	* 2.6	3.6	* 2.5	76%
	Living Ground Cover	* 2.8	1.8	1.9	1.9	2.2	1.8	87%
	Fertiliser Rates	* 2.5	* 2.9	2.1	2.0	* 2.7	2.2	76%
	Fertiliser Application Method	4.0	* 2.8	2.3	* 2.6	* 3.2	* 2.4	74%
	Fertiliser Application Frequency	* 2.7	1.8	2.2	2.1	2.3	1.9	72%

How to interpret the socioeconomic results? - an example:

Using Table 2, Crop Removal Method, Perceived Impact on Production Costs.

- The practice is described in the report as “The banana crop is removed by treating with herbicide and plants are left to break down in the row area before cultivation.”
- The count of “2.7” indicates a perception that the practice will lead to decreased costs (individual responses are assigned values from 1 to 5, combined, then averaged). In this example, 1 equals a large decrease in costs, and 5 a large increase in costs (table 1 uses “decrease/increase” responses and table 2 uses “disagree/agree”).
- The result is colour coded to indicate whether the perception is likely to *encourage* or *constrain* adoption of the practice. In this example, the blue shading reflects that a perceived *decrease* in production costs is likely to *encourage* adoption. The shading becomes lighter the closer the averaged result is to “no impact” (or “neutral”).

Encourages adoption		No impact / Neutral		Constrains adoption
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- The asterisk “*” next to “2.7” indicates that there is notable variation within the average response. As in, 20% or more of the grower responses to the survey question were “small/large increase” (in costs) and 20% or more of the responses were “small/large decrease” (in costs).

Innovation and transaction costs

The adoption report also highlights that banana growers are engaging in continual innovation. This results in transaction costs (e.g. costs incurred and time spent on understanding and evaluating changes). These transaction costs vary between growers and can be difficult to estimate, as time spent by a grower 'working on their business' and time spent 'working in their business' is not always separable.

working *in* the business



working *on* the business
evaluation (transaction) costs

Case Studies

Case studies were also conducted on three growers who had adopted BMP practices. Detailed whole-farm economic analyses of their banana growing enterprises were developed.

Refer to the infographic and full cases studies to find answers for the following research questions:

1. What BMP changes were made on the farm?
2. Does the economic analysis show that the changes are worthwhile?
3. What about investment risk?

This project was funded through the Queensland Reef Water Quality Program. Assistance provided by participating growers and industry stakeholders is gratefully acknowledged. For further information please contact the Department of Agriculture and Fisheries on 13 25 23. Every business is unique and before adopting new practices it is important to seek expert advice in order to consider your own specific circumstances.

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