

FutureCane



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**Sugar Research and
Development Corporation**

A CASE STUDY ON THE USE OF LEGUME CROP ROTATIONS IN SUGARCANE

April 2007

By

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"The Department of Primary Industries and Fisheries (DPI&F) seeks to maximise the economic potential of Queensland's primary industries on a sustainable basis.

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Introduction

Growing legume fallow crops has proven to be an important factor in reducing the yield decline effect in sugarcane production. Legumes can also provide a direct economic benefit to sugarcane farmers by providing a source of nitrogen. Further, in some instances, income can flow from the sale, of grain or seed. The following case study provides an insight into the changes made by Russell Young, a sugarcane farmer situated in the Rita Island area of the Burdekin district. The case study focuses on the economics of the old farming system versus a new farming system. The old farming system is based on the conventional farming practices previously used by the Young family in 2002 compared to the 2006 farming system which involves a reduction in tillage practices and use of a Soybean rotational crop for seed production.

A whole-of-farm economic analysis was used to assess the impact of the new farming system on farm profitability. A whole-of-farm economic analysis looks at the impact of a change in farming practice across the whole business, rather than focusing on one single component. This case study is specific to an individual grower's situation and is not representative of all situations. When evaluating a farming system change, it is important to have a detailed plan and an accurate assessment of benefits and costs involved for your own situation.

Farm description

The Young's family farm is situated in the Rita Island area, about 15 kilometres east of Ayr. The Young family has a long history in the sugar industry, with Russell's grandfather starting the sugarcane farming business in 1914. Russell currently farms on 60 hectares of sugarcane land on soils ranging from cracking clays to sandy loams. All of the sugarcane produced on Young's farm is grown under full irrigation using underground and channel water.

Investment

The machinery investment required to change to a new farming system will depend largely on the machinery ownership structure and the extent of change to the existing farming system. In this case study, the Young family were required to make no major changes to their machinery or equipment investment since the adoption of the new system. The Soybean crop is planted by a contractor and the minimal tillage practices require less use of equipment compared to the old system. Sugarcane planting and some of the cultivation operations is also completed using a contractor.

Farming Systems

Table 1 details the differences in farming practices between the old and new farming system. The major difference in the new system is the lower amount of tractor machinery operations and the addition of a Soybean fallow crop for seed production. Russell identified the need to grow a legume crop in order to improve soil health and farm productivity. Soybeans are only grown on the early plant cane area, which typically represents around 60 per cent of the total planted area each year.

Table 1. Characteristics of farming systems

Characteristics	Old System	New System
<i>Planting Width (m)</i>	1.5	1.5
<i>Planting Method</i>	Furrow opener stick planter	Furrow opener stick planter
<i>Planting Rate (tc/ha)</i>	5	5
<i>Row Configuration</i>	Single row	Single row
<i>Plant Cane Land Preparation</i>	4 x offsets 2 x ripper 1 x rotary hoe 1 x marking-out bar	<i>Soybean Land Preparation</i> 2 x offsets 1 x ripper 1 x rotary hoe 1 x marking-out bar 1 x hilling-up <i>Plant Cane Land Preparation</i> 1 x ripper (1 tine)
<i>Ratoon Cultivation</i>	3 x cultivation	2 x cultivation
<i>Burnt Cane harvesting</i>	Yes	Yes
<i>Controlled Traffic</i>	No	No
<i>Fertilizer</i>	Delta Mix at planting Top dress Urea	Delta Mix at planting No top dress
<i>Weed Control</i>	6 x cultivation 1 x grub control + fertiliser 1 x hilling-up 1 x chemical	2 x cultivation 1 x grub control + fertiliser 1 x hilling-up
<i>Insect Control</i>	suSCon Maxi	suSCon Maxi
<i>Disease Control</i>	Bumper	Bumper
<i>Irrigation</i>	Flood irrigation. Same costing used in old and new systems. Late plant has two less irrigations compared to early plant.	Flood irrigation. Same costing used in old and new systems. Late plant has two less irrigations compared to the early plant.

Whole Farm Economic Analysis – Old Vs New System

Economic analysis was conducted using the Farm Economic Analysis Tool (FEAT) developed by the DPI&F FutureCane initiative. FEAT is a computer based program designed specifically for cane farmers and allows growers to undertake a whole of farm economic analysis or to compare the economics of various components of a new farming system.

Variable costs are based on details such as rates of chemical, kilograms of fertilizer and machinery operations for a particular crop class. Machinery operating costs are based on the tractor size, fuel consumption, implement speed, width, field efficiency and repairs and maintenance. FEAT also calculates the tractor and irrigation labour required for each farming system based on the work rate for each operation. FEAT can be used to compare an historical farming system to the current farming system by applying current input prices to each scenario. The same commodity price is applied to both systems. This approach shows what the return on investment would be today, had the grower not made any changes.

Table 2 displays the economic performance of each farming system. The old system is based on Russell Young's farming practices in 2002 and the new system is his current farming practices with a Soybean fallow crop which is harvested for seed production. The Soybean rotational crop is only grown on his early plant cane area. The "old system" and "new system" both use the same productivity levels. The "new system and yield increase scenario" assumes a 10 per cent increase in plant cane yield across the area that previously had a legumes fallow.

In today's dollars, the old system provided a \$1 730/ha farm gross margin at a price of sugar at \$300/t. This is considerably less than the new system which provided a farm gross margin of \$1 858/ha. This represents an increase in whole of farm gross margin by \$7 680. If the soybean fallow crop improves the farm yields as anticipated, the new system would result in a farm gross margin of \$1 891/ha. This represents an increase in whole of farm gross margin by \$9 660. The lower farm gross margin in the old system is mainly due to the higher growing costs associated with more tractor operations in plant and ratoon cane.

The amount of money invested in the sugarcane farming business has stayed the same at today's market prices. Under the old system in 2002, the Young family would have had a 4.1 per cent return on investment using today's input costs. Using the new system, the return on investment has improved to 4.8 per cent and can be expected to increase to 5.0 per cent if an increase in plant cane yields is achieved.

The improvement in returns with the new system is a result of lower variable costs and additional revenue from the Soybean crop rotation. Table 3 shows the reduction in cane growing cost from \$887/ha to \$813/ha. The Soybean crop grown for seed production also provides additional income with a gross margin of \$539/ha (Table 4).

The number of hours spent on tractors in the cane operation has reduced from 4.99hrs/ha to 2.65hrs/ha. The reason for the decline in the tractor hours in cane is due to less cultivation operations and part of the tractor operation time being allocated to preparing the land for Soybeans. The total amount of time spent (including tractor and irrigation labour) has decreased in the new system even when

including the time taken to grow the Soybean crop (old system = 13.82hrs/ha, new system = 12.55hrs/ha).

Table 2. Economic comparison of two farming systems and tractor hours

	Old system	New system	*New system and yield increase
Price per tonne sugar	300	300	300
Average yield cane	122	122	124
Farm gross margin per hectare	1 730	1 858	1 891
Farm gross margin per tonne cane	16.03	17.21	17.26
Return on investment	4.1	4.8	5.0
Cane variable cost per tonne	13.35	12.75	12.65
Cane tractor labour h/ha	4.99	2.65	2.65
Cane irrigation labour h/ha	8.83	8.83	8.83
Soy's tractor & Irrigation labour h/ha	0	1.07	1.07

*Assumption of 10 per cent yield increase in plant cane crop as a result of Soybean rotation. Soybean rotation is only grown on early plant cane area.

Table 3. Cost of growing cane per hectare (whole farm)

	Old system	New system
	\$/ha	\$/ha
Land Preparation	89	49
Planting + Seed	105	105
Fertiliser & Soil Ameliorants	330	309
Weed Control	60	47
Insect Control	111	111
Disease Control	2	2
Irrigation	190	190
Total Growing Cost	887	813

Table 4. Soybean gross margin

Price	\$400/t
Payment Yield	2.85 t/ha
	\$/ha
Gross Income	1 140
Expenses	
Land preparation	244
Planting	131
Weed control	33
Insect control	22
Irrigation	61
Dessication	110
Harvesting	Included in price paid to grower
Total variable expenses	601
Gross margin per hectare	539

Benefits of new farming system

- Reduced number of cultivations before planting
- Reduced sediment, chemical and nutrient losses of farm
- No changes in farm machinery or equipment is required
- Lower chemical and fertilizer inputs because of a legume crop rotation
- Improvement in soil chemical, physical and biological components
- Legumes have show to improve sugarcane productivity
- Diversification of farm revenue
- Improved farm profitability
- Less time required to cover the same amount of sugarcane farming area
- Better timeliness of operations because of compacted wheel tracks



Conclusion

The use of legume crop rotations can present an opportunity to make additional income in a sugarcane farming system. Legumes also provide a synergy with sugarcane production by breaking the monoculture cycle and improving soil health. Since changing to the new farming system, the Young family does not need any additional machinery or equipment. In fact, the equipment needed and time taken has reduced in the sugarcane farming system because of less cultivation before cane planting and additional flow-on benefits from a Soybean crop (nutritional, weed control). The economic analysis indicates that the Young's family farm would be less profitable if they continued to grow cane using the old farming system.