Herbert demonstration farm update

Economic analysis case study
2015

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Introduction

The Herbert demonstration farm project compares two classes of management systems (conventional and improved) on adjacent blocks that have similar soils and environmental conditions. Since 2009, the project has gathered data from the fallow crop through to the third ratoon. The aim of the economic analysis is to compare the profitability of using conventional management practices to that of using improved management practices.

Unfortunately, results from the trial in 2011 were affected by Cyclone Yasi in conjunction with a prolonged wet season and heavy weed pressures, which contributed to historically low production figures in that year.

The farm management systems

The Herbert demonstration farm project compares two types of management systems. The characteristics of both systems are outlined below.

Conventional management system ("C Class" practices)

- Single cane rows at 1.62m spacing's
- Furrow planted
- Full cultivation
- Legume fallow
- Use of herbicides restricted under the reef protection regulations

Improved management system ("B Class" practices or BMPs)

- Wide cane rows at 1.83m spacing's
- Mound planted
- Reduced cultivation and zonal tillage
- Permanent mounds
- Controlled traffic
- Legume fallow with mulching
- Minimal use of herbicides restricted under the reef protection regulations:
    - Using Soccer and Dual Gold instead of Atradex and Velpar in plant cane
    - Using Flame instead of Diurex in first ratoon cane

Methodology

This economic analysis involves the use of the Department of Agriculture, Fisheries and Forestry's (DAFF) Farm Economic Analysis Tool (FEAT) to undertake a comprehensive evaluation of the implied revenues and costs of both management practices in isolation. From these results, a comparison between the gross margins and variable costs of each management system are examined. Revenues were calculated based on a 5-year average (between the 2008-9 and 2012-13 cane growing seasons) sugar price of $440 per tonne, which is assumed constant across the analysis to enable an objective assessment to be made regarding the costs for each treatment and the relative level of production. Furthermore, yields and Commercial Cane Sugar (CCS) levels were obtained from the grower's harvest data reported by the mill.

Information collected during the trial period was entered into FEAT growing expenses spreadsheets to calculate production costs. Variable costs for fallow, plant and ratoon cane were established by taking into consideration numerous farm-specific details including chemical and fertiliser usage, machinery operations and fallow crop practices. Chemical and

fertiliser prices were determined by averaging region-specific price lists obtained from local suppliers during July 2013. Machinery operating costs were calculated systematically by taking into account tractor size, fuel & oil consumption, repairs & maintenance as well as implement speed, width and field efficiency. The labour requirement for each farm management system was calculated using the work rate for each operation and costed at $30/hour. Cost and gross margin comparisons have been presented on a per hectare basis.

This economic analysis involves a partial farm analysis that focuses on the direct impact on farm gross margin due to the management practice changes. Accordingly, it does not take into consideration the fixed costs associated with the farming business or any capital costs associated with introducing the new practice.

Results

The Herbert demonstration farm has provided data from both the conventional and improved management systems since 2009. During 2009/10, 2010/11, 2011/12, 2012-13 and 2013-14, data was obtained for fallow, plant, first ratoon, second ratoon and third ratoon cane, respectively. The FEAT programme uses the data collected to calculate gross margins from each management system during each stage of the crop cycle (i.e. fallow, plant cane, etc). The results are examined in order of crop stage. An analysis that summarises all the presently available information is subsequently presented.

Fallow

Table 1 compares the fallow management costs associated with the trial site. Note that the two treatments have similar costs regarding land preparation and the use of ameliorants; with the difference between the two systems explained by the higher costs from utilising a mulcher to incorporate the legume fallow crop within the improved management system.

Table 1: Fallow cost comparison

	Conventional	Improved
Land preparation	$207/ha	$207/ha
Ameliorants	$233/ha	$233/ha
Legume crop	$219/ha	$297/ha
Total fallow cost	$659/ha	$736/ha

Plant cane

Table 2 compares the profitability of each management system in plant cane by analysing plant cane yields, CCS levels, growing and harvesting costs, and gross margins on a per hectare basis. The data for this analysis was collected from the same farm blocks as the fallow analysis.

The costs of growing the plant cane crop (inclusive of labour) for each treatment was initially calculated. Table 2 shows that the improved management system resulted in a total growing cost of $1,619/ha, which is $112/ha lower than the conventional management system. Similarly, once harvesting costs were included, the total variable costs of the improved management system were $181/ha less than those for the conventional management system. Nonetheless, despite having higher production costs, the conventional management system recorded a higher gross margin due to it producing a larger cane yield and CCS level. Figures 1 and 2 present the breakdowns for the plant cane variable costs of the conventional and improved management system, respectively.

Table 2: Plant cane comparison

	Conventional	Improved
Sugar ($/tonne) Average cane yield CCS	$440/t 61.09t/ha 15.9	$440/t 52.68 t/ha 15.54
Revenue (net of levies)	$2,875/ha	$2,404/ha
Growing costs breakdown: *Land preparation* *Planting and seed cane* *Fertiliser* *Weed and pest*	 $326/ha $776/ha $226/ha $405/ha	 $225/ha $769/ha $223/ha $399/ha
Total growing cost	$1,733/ha	$1,616/ha
Harvesting costs	$501/ha	$432/ha
Total variable costs	$2,234/ha	$2,048/ha
Gross margin	$641/ha	$356/ha

Figure 1: Conventional practices – plant cane variable costs ($/ha)

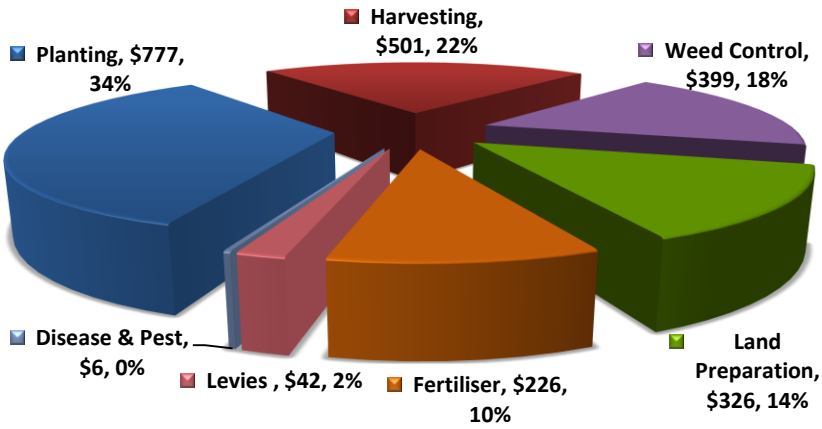
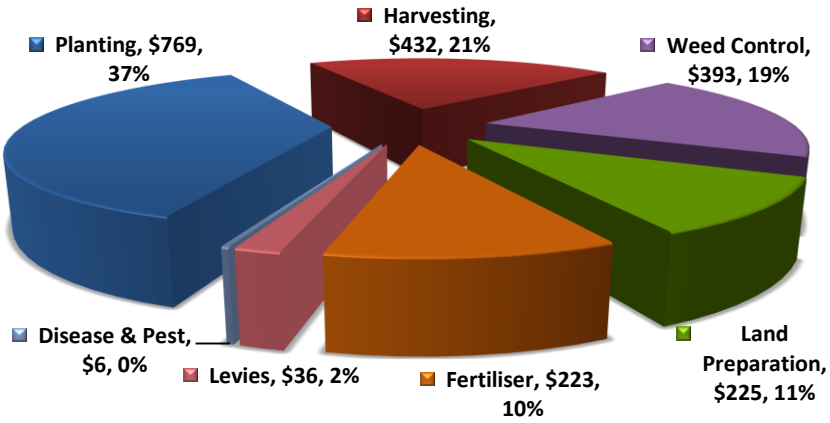


Figure 2: Improved practices – plant cane variable costs ($/ha)



Importantly, neither management system attained its full yield potential due to the impact of Cyclone Yasi. Additionally, the improved management system was affected by large weed pressures that may have reduced yields due to increased competition for nutrients within the

soil. In particular, it is thought that the environmental conditions did not favour the herbicides chosen, therefore reducing their efficacy. This consequently lowered revenue and, in turn, the gross margin.

First ratoon

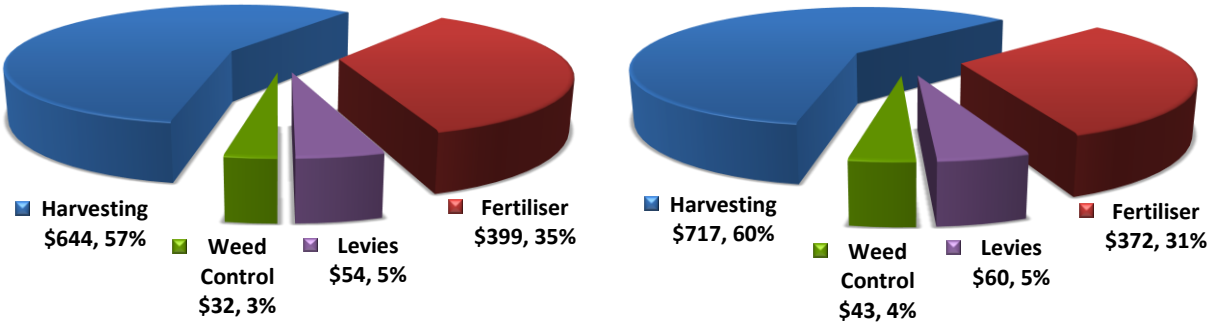
Table 3 expands on the previous analysis to compare the profitability of each management system during the first ratoon crop stage of the demonstration farm. The data for this examination was collected from the same blocks used for the fallow and plant cane trials.

Both trial blocks recorded similar growing costs with only $16/ha difference between the two management systems (see Table 3). Interestingly, the saving in fertiliser costs realised within the improved management system was offset by higher herbicide costs from using a more expensive substitute for Diurex (Flame), which is now under restricted use in the wet tropics. The total variable costs were higher for the improved practice treatment as a consequence of increased harvesting costs associated with the higher yield. Overall, the improved system generated a significantly higher gross margin per hectare ($365/ha) due to the higher yield and CCS level. The first ratoon variable costs for both management systems are presented in Table 3 and depicted graphically in Figure 3.

Table 3: First ratoon comparison

	Conventional	Improved
Sugar ($/tonne) Average cane yield CCS	$440/t 78.48 t/ha 14	$440/t 87.38 t/ha 14.2
Revenue (net of levies)	$3,103/ha	$3,525/ha
Growing costs breakdown: *Fertiliser* *Weed and pest*	 $399/ha $31/ha	 $372/ha $42/ha
Total growing cost	$430/ha	$414/ha
Harvesting costs	$644/ha	$717/ha
Total variable costs	$1,074/ha	$1,131/ha
Gross margin	$2,029/ha	$2,394/ha

Figure 3: First ratoon variable costs ($/ha) – conventional (left), improved (right)



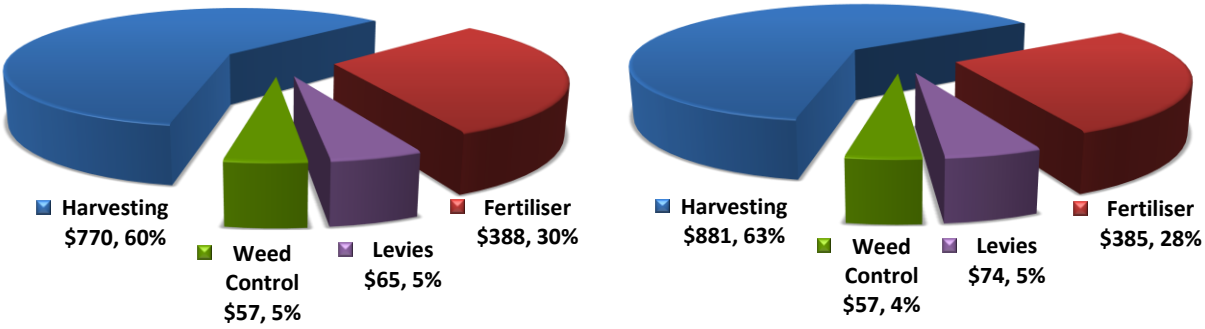
Second ratoon

Overall, the improved system generated a higher gross margin per hectare than the conventional management system (i.e. $308/ha) in the second ratoon crop due to a considerably higher yield; this is despite the improved management system producing a relatively lower CCS. Although both systems had similar growing costs, the total variable costs were higher for the improved practice treatment due to the higher harvesting costs associated with the higher yield. Table 4 compares the profitability of each management system during the second ratoon crop stage, while a breakdown of the variable costs for both management systems are displayed in Figure 4.

Table 4: Second ratoon comparison

	Conventional	Improved
Sugar ($/tonne) Average cane yield CCS	$440/t 93.88 t/ha 13	$440/t 107.39 t/ha 12.85
Revenue (net of levies)	$3,341/ha	$3,758/ha
Growing costs breakdown: *Fertiliser* *Weed and pest*	 $388/ha $57/ha	 $386/ha $57/ha
Total growing cost	$445/ha	$443/ha
Harvesting costs	$770/ha	$881/ha
Total variable costs	$1,215/ha	$1,323/ha
Gross margin	$2,126/ha	$2,434/ha

Figure 4: Second ratoon variable costs ($/ha) – conventional (left), improved (right)



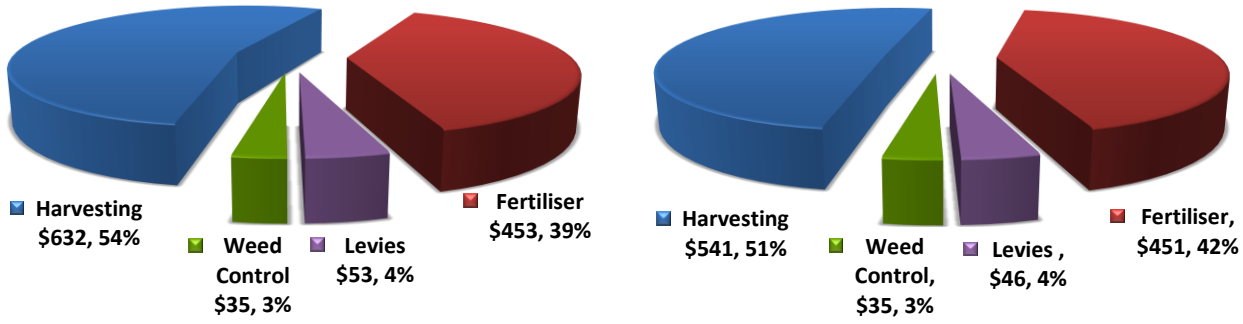
Third ratoon

The conventional management system produced both a higher yield and CCS in the third ratoon crop. Due to the resulting higher revenues, the conventional management system realised a considerably higher gross margin per hectare than the improved system (i.e. $306/ha). Even though both systems had similar growing costs, the total variable costs were higher for the conventional management treatment due to higher harvesting costs associated with the higher yield. Table 5 compares the profitability of each treatment, while each system's variable costs are itemised in Figure 5.

Table 5: Third ratoon comparison

	Conventional	Improved
Sugar ($/tonne) Average cane yield CCS	$440/t 77.04 t/ha 12.3	$440/t 65.97 t/ha 11.75
Revenue (net of levies)	$2,528/ha	$2,021/ha
Growing costs breakdown: *Fertiliser* *Weed and pest*	 $452/ha $35/ha	 $450/ha $35/ha
Total growing cost	$487/ha	$485/ha
Harvesting costs	$632/ha	$541/ha
Total variable costs	$1,119/ha	$1,026/ha
Gross margin	$1,409/ha	$995/ha

Figure 5: Third ratoon variable costs ($/ha) – conventional (left), improved (right)



The analysis so far

A comparison of the average sugar yield over the life of the trial provides an indication of the relative productivity of each management system. While relative production costs can be measured by comparing the total variable costs of each system. However, analysing the average gross margins for each system allows for a more meaningful comparison to be made about each farming system as this takes both factors into account. These indicators are examined as follows.

Figures 6, 7 and 8 illustrate the cane yield, CCS and sugar yield for both treatments during plant, first ratoon, second ratoon and third ratoon cane as well as an average value. A comparison of the conventional and improved systems finds that cane and sugar yield has been mixed through the crop stages, while CCS has been analogous. Taking into account the whole crop cycle, the improved system produced a comparatively higher average cane yield. However, the conventional system grew cane with a relatively higher average CCS, and generated a sugar yield slightly higher than the improved system (see Figures 7 and 8). Overall, there has only been only a marginal difference in productivity between the two systems.

Figure 6: Cane yield comparison (t/ha)

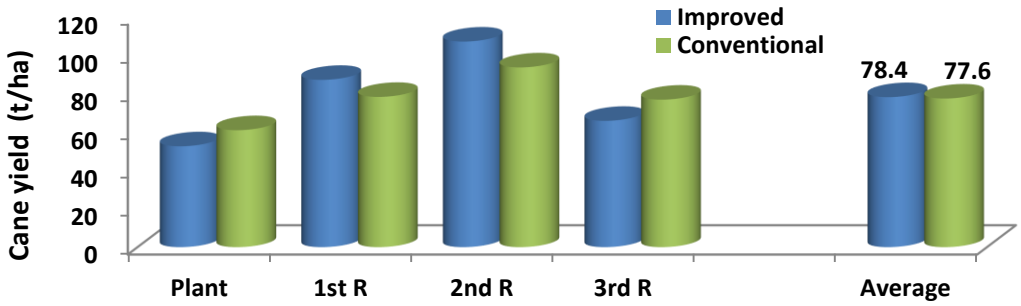


Figure 7: CCS comparison

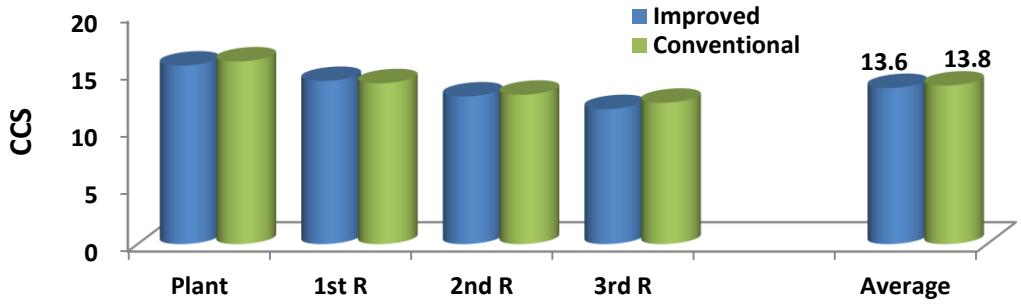
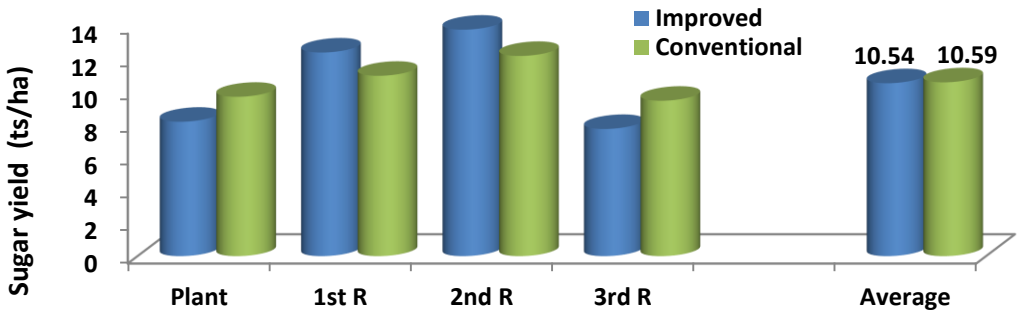


Figure 8: Sugar yield comparison (ts/ha)



An analysis of growing costs, harvesting costs and total variable costs for both treatments during each crop stage are compared in Figures 9, 10 and 11. Growing costs for the

improved system were comparatively higher in the fallow due the use of a mulcher, and lower in plant cane mostly because of reduced cultivation.

On average, the conventional system demanded relatively higher growing costs. Harvesting costs are directly based on yield, which explains why this graph is almost a direct replication of the cane yield graph. Because the improved system produced a higher average cane yield, it also generated relatively higher average harvesting costs. Total variable costs are calculated by summing growing costs with harvesting costs. Overall, the improved system's lower growing costs cancelled out higher harvesting costs to generate slightly lower total variable costs than the conventional system.

Figure 9: Growing cost comparison ($/ha)

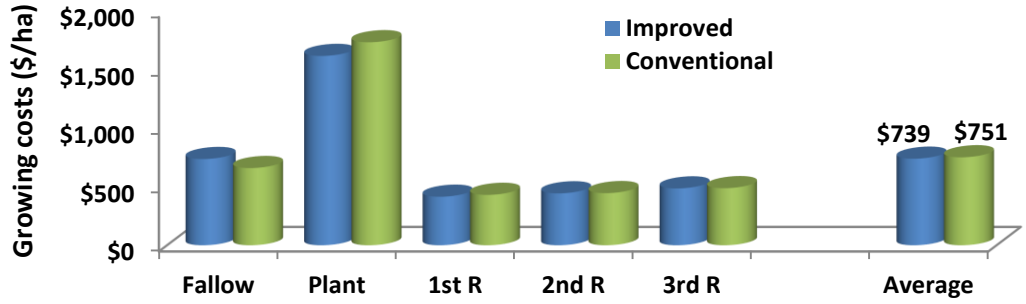


Figure 10: Harvesting cost comparison ($/ha)

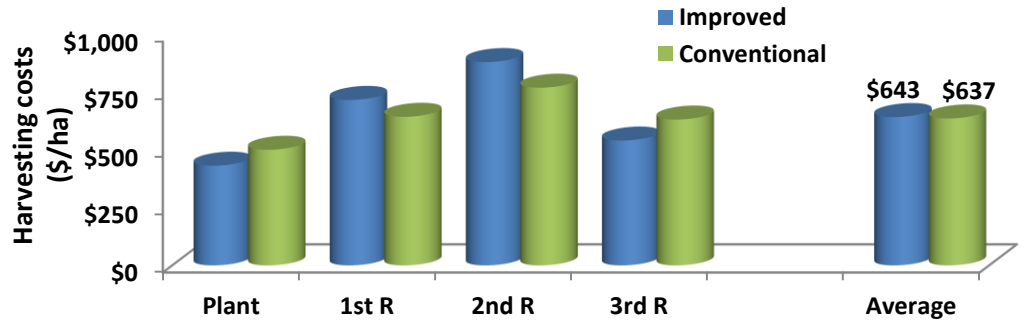
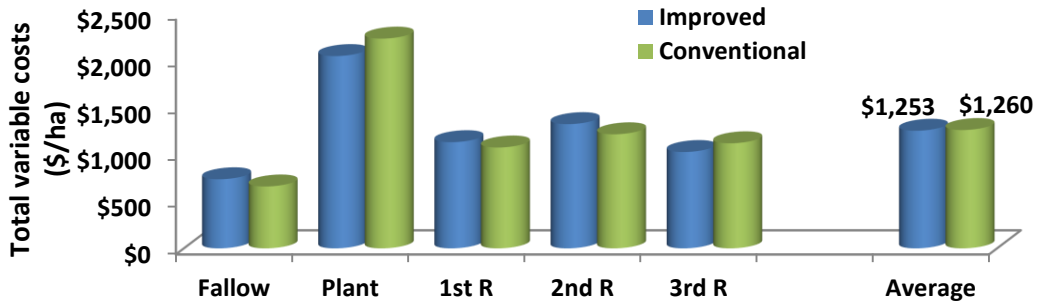
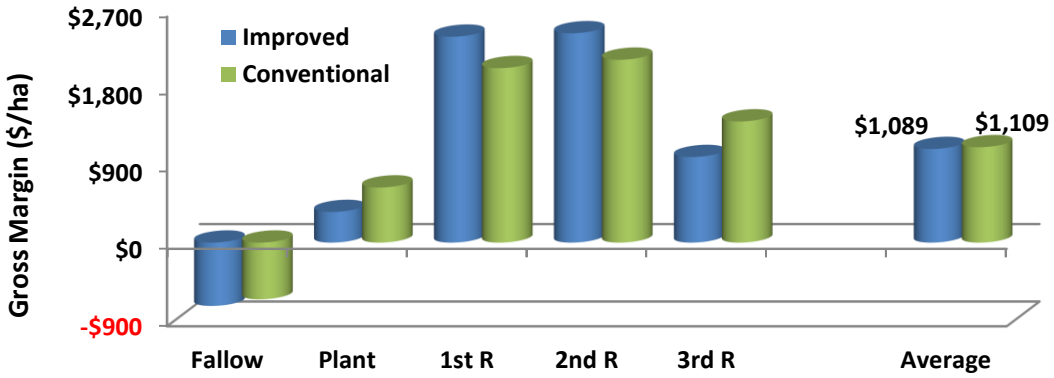


Figure 11: Total variable cost comparison ($/ha)



The incremental gross margins for each crop stage as well as the average over the four years are depicted in Figure 12. While the improved management system accrued relatively higher fallow costs as well as a lower gross margin in plant cane, it generated a substantially higher gross margin in both the first and second ratoon crops. However, the improved system produced a considerably lower gross margin in the third ratoon, which in turn eroded all preceding gains. Consequently, the conventional management system has realised a marginally higher gross margin on average ($20/ha or 1.8% higher) over the trial period so far.

Figure 12: Gross margin comparison – conventional versus improved system ($/ha)



Conclusion

This report provides an update to the results of the economic analysis for two different farm management systems currently being trialled at the Herbert demonstration farm. The trial involves comparing conventional management practices to improved practices, which include reduced tillage, mound planting, and using alternatives to traditional Photosystem II (PSII) chemicals. The results of the analysis indicate that the conventional management system benefited from lower legume fallow crop costs and a higher sugar yield in plant and third ratoon cane. On the other hand, the improved management system incurred lower plant cane growing costs and a higher first and second ratoon sugar yield.

On the whole, the improved system's lower growing costs cancelled out comparatively higher harvesting costs, due to greater cane yields, to generate relatively lower total variable costs than the conventional system. However, the conventional system has so far generated higher revenues by growing cane with a relatively higher CCS to achieve an average gross margin that is slightly higher than the improved system. Overall, the results to date indicate that the conventional and improved management systems are very similar in economic terms (average gross margin).

It is important to note the limitations of these results; this analysis involves a single-replicate trial where both treatments produced historically low plant cane yields (t/ha) due to adverse effects from Cyclone Yasi. Additionally, the improved management system's plant cane yields were thought to be reduced by heavy weed pressure resulting from suspected herbicide treatment failure due to environmental conditions.

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