Variable rate herbicide spray – economic case study, Tully region

Grower: Dore & Co.

Dore & Co. are trialling a variable rate of herbicide spray on their 590 hectare farm in Euramo and Bilyana, south of Tully. The Dore brothers currently apply a pre-emergent spray mix on ratoon cane at a constant rate to control their highest pressure weed, guinea grass. As guinea grass pressure areas are concentrated in relatively small areas within each block, they are trialling a variable spray system which enables them to apply a high rate of spray mix on high weed pressure zones, and a low rate on the rest of the block. The growers are interested in finding out whether the variable spray system will result in lower spray costs overall, and whether the cost savings will be sufficient to justify the setup costs.

The variable spray application is based on weed pressure maps that were created using a modified spot sprayer, which records a GPS location each time the spot spray trigger is pulled. A variable rate of pre-emergent herbicide is then applied, with a reduced rate applied to areas where no guinea grass was detected.

Key findings

- Results indicate that the variable spray would achieve a cost saving of $4.29 per hectare across the whole farm.
- When the cost of capital is taken into account, the new variable spray system appears worthwhile, with the investment amount being recovered in six years.
- The results were sensitive to the ratio of high weed pressure zones to low weed pressure zones, and the variable spray system would only be worthwhile if the low spray rate is applied to at least 67.5% of ratoons on average.

Trial description

The trial is being conducted on a 4.2 hectare block currently in third ratoon. The trial is non-replicated, and will continue into fourth ratoon. The trial's success will be evaluated through further spot spraying, which will track how the guinea grass pressure zones respond over time to the variable spray treatment.

The variable spray rate was a pre-emergent mix applied at the out of hand stage. The low rate consisted of Balance (80g/ha), Paraquat (1L/ha) and adjuvant (1L/ha) at a cost of $33.03/ha (product cost only). The high rate was Balance (150g/ha), Paraquat (1.7L/ha) and adjuvant (1.9L/ha) at a cost of $60.88/ha.

In the trial block, the high rate was applied to 23% of the trial area, while the low rate went on the remaining 77%. At this ratio the average product cost was $39.48/ha.

The variable spray replaced Dore & Co.'s conventional spray mix of Soccer (1L/ha), Paraquat (1L/ha) and adjuvant (1L/ha), costing $46.63/ha.

Table 1: Conventional and variable spray costs

Treatment	Cost ($/ha)
Conventional	**$46.63**
Low variable rate	$33.03
High variable rate	$60.88
Variable rate average	**$39.48**

In addition, the weed pressure map will also be used to apply a variable rate of Flame on some ratoon cane, which will result in additional minor cost savings. Currently Flame is applied to around half the farm immediately after harvest to control guinea grass.

There is an additional cost associated with preparing the weed pressure maps, which would need to be done each year based on the data collected from spot spraying. The agronomist estimated that preparing the maps would take around five hours for the entire farm, at a cost of $90 per hour, totalling $450.

Methodology

The following gross margin analysis models the effect of extending the variable spray treatment across all ratoons. The Farm Economic Analysis Tool (FEAT) was used to model Dore & Co.'s typical growing expenses such as fertiliser application costs, pesticides and other machinery operations. Yield and CCS are assumed to be the same for both systems, and are based on Dore & Co.'s previous production results.

Other parameters used in the analysis include: a sugar price of $430 per tonne;[1] a labour price of $30 per hour; and a fuel price of $1 per litre (net of the diesel rebate and GST).

Fertiliser and pesticide prices were sourced from local suppliers.

Results

Table 2 compares the gross margin[2] of the variable spray system with the gross margin of Dore & Co.'s conventional practice. As the variable spray is only applied to ratoon cane, plant cane gross margins are the same for both treatments. Gross margins are around $7 and $8 higher per hectare for the variable spray treatments.

Table 2: Gross margin by crop class: variable spray vs conventional, $/ha

	Variable spray ($/ha)	Conventional ($/ha)	Difference ($/ha)
Plant	$1,210	$1,210	$0
1R	$2,142	$2,135	$7
2R	$1,827	$1,819	$8
3R	$1,891	$1,883	$8
4R	$1,474	$1,466	$7
Fallow	-$819	-$819	$0

Investment analysis

The investment analysis parameters and results are presented in table 3.

[1] $430 per tonne is the 5 year average (2010-14) of QSL's seasonal and harvest pools.

[2] Gross margin equals revenue minus variable costs, which include chemical, fertiliser, machinery and harvesting costs.

Table 3: Investment analysis parameters and results

Number of hectares	592
Initial capital cost (total)	$10,115
Initial capital cost ($/ha)	$17.09
Variable cost saving ($/ha)	$4.29
Discount rate	7%
Investment life	10 yrs
Annualised equivalent benefit (AEB)[3] $/ha/yr)	$1.85
Discounted payback period	5 yrs

The initial capital investment of $10,115 includes the cost of purchasing and installing a GPS unit and setting up the switch on the spot sprayer, totalling $9,115. In addition, while the Dore brothers already owned a sprayer that was variable rate capable, they needed to purchase an unlock code to access the variable rate function, at a cost of $1000.

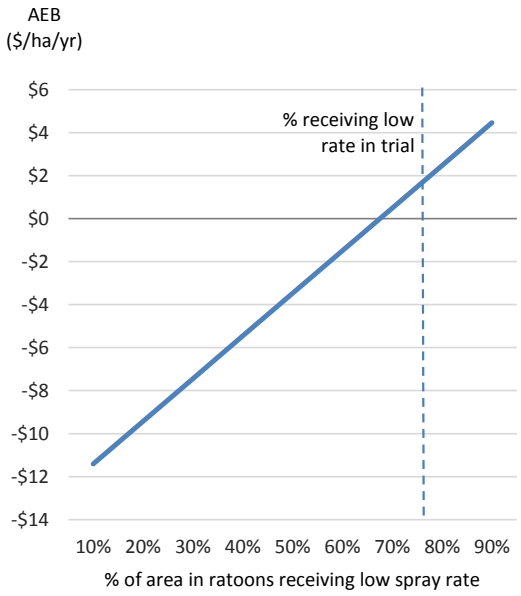
As table 3 shows, the average cost savings across the whole farm are $4.29 per hectare, including the cost of preparing the weed pressure maps. Results of the investment analysis show that the variable spray system was worthwhile. It would take five years to repay the capital costs of $10,115. Over a ten year investment horizon, the investment has added an additional $1.85/ha/yr to the bottom line (when the initial investment is taken into account), as indicated by the AEB.

The Dore brothers noted that they have since discovered that a similar system could be set up for around $2000. At this investment amount, the AEB would be $3.80 per hectare, and the cost would be recouped after the first year of operation.

Sensitivity analysis

The investment analysis presented above assumed the ratio of high to low spray zones that was used in the trial would apply to the whole farm. This is unlikely to be the case however, as the area of weed pressure will differ from block to block. A sensitivity analysis was conducted to determine the degree to which a change in the average ratio of high to low weed pressure zones would impact on the project's AEB. As figure 1 demonstrates, the variable sprayer would only be worthwhile if the low spray rate is applied to at least 67.5% of ratoons on average.

Figure 1: Sensitivity of AEB to the percentage of ratoons receiving the low spray rate

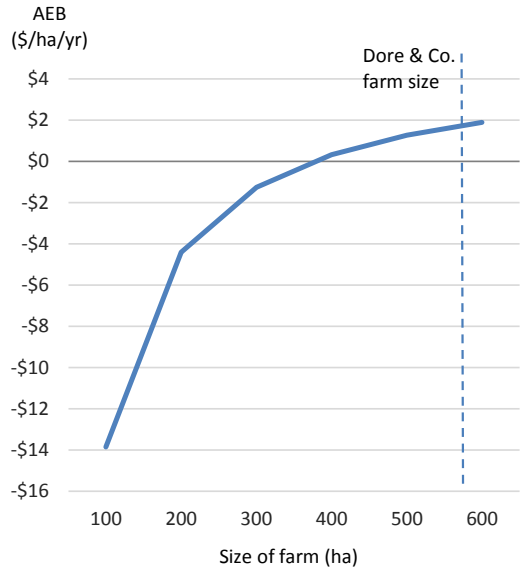


The positive AEB reported in the investment analysis is partly due to the fact that Dore & Co. will be able to utilise the sprayer over a relatively large area. However, growers operating smaller farms may not be able to achieve the same economies of scale, which would reduce the cost savings that could be achieved to offset the initial investment.

[3] AEB is a way of evaluating whether an investment is worthwhile from an economic perspective. The AEB is a transformation of the investment amount and the economic benefits it generates into a single annual cash flow. If the AEB is positive, the investment is performing better than the specified rate of return (the discount rate) and is thus considered worthwhile.

The following sensitivity analysis examines the impact of farm size on the profitability of the variable spray system tested in this trial. Figure 2 shows that the farm would need to be at least 375 hectares for the project to be profitable. Moreover, as farm size decreases, the sensitivity of the AEB increases (demonstrated by the steep slope of the line at smaller farm sizes).

Figure 2: Sensitivity analysis – size of farm



Conclusion

This study examined the profitability of using a variable rate application of herbicide spray on ratoon cane on a sugarcane farm in Tully.

Results indicate that the variable spray would achieve a cost saving of $4.29 per hectare. Investment analysis suggests that the initial outlay required to set up the variable spray system would be repaid in five years, and would result in an annualised equivalent benefit of $1.85 per hectare.

The results were found to be quite sensitive to the ratio of high weed pressure zones to low weed pressure zones. The variable spray system would only be worthwhile if the low spray rate is applied to at least 67.5% of ratoons on average. Farm size was also found to be an important factor in terms of profitability, with the investment breaking even at a farm size of 375 hectares. However, the possibility of setting up a similar system for the lower investment cost of $2000 would potentially make it viable for smaller farm sizes.

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