

The Economic Advantage of Reduced Tillage Planting of Sugarcane in Australia

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Abstract: Land preparation for planting sugarcane is a major cost to growers. Currently growers may undertake up to eight tillage passes to prepare a seedbed for planting. However, this number of passes is considerably less than that practiced thirty years ago. Good crop establishment is necessary to ensure yield and ratoon longevity for the next crop cycle. However, it was hypothesised that the number of tillage passes could be reduced without compromising crop performance and would offer considerable savings in crop establishment costs.

A field trial was undertaken to compare conventional land preparation for planting sugarcane with reduced tillage strategies for planting sugarcane. The reduced tillage strategies involved cultivating the old crop row only and not disturbing the inter-row zone. Treatments included ploughing-out the old stool followed by a fallow period, spraying-out the old stool followed by a fallow period and then cultivating the row prior to planting and ploughing-out the old stool and replanting with no fallow period.

An instrumented tractor was used for all operations to enable energy use and time taken for each cultural operation to be determined. Parameters monitored included engine speed, fuel flow, engine temperature and true ground speed.

Results demonstrate that cost savings in the order of 50% can be achieved through the adoption of reduced tillage land preparation for planting sugarcane compared with conventional practice. The cost of conventional land preparation was \$400 per hectare; in contrast, reduced tillage costs were in the order of \$200 per hectare. The time taken to prepare land for planting was considerably less using reduced tillage compared with conventional practice. The overall effect was that reduced tillage land preparation resulted in greater cost margin benefit up to 7% to the grower in the year of planting.

INTRODUCTION

Land preparation is one of the major costs in establishing a crop of sugarcane. Good crop establishment is essential for ensuring yield and ratoon length of the next crop cycle. Cane growers have already begun to reduce the cost of production by the adoption of green cane harvesting and trash blanketing and by not cultivating during the ratoon cycle. However, it is necessary to replant the crop at the end of its useful ratoon period, and there are potential cost savings to be made at this time.

Compared with thirty years ago, the sugar industry has reduced the number of cultural operations during land preparation for planting. The question remains unanswered, however, as to how effective are the individual operations in achieving the desired results of destroying the old stool, removing soil compaction, controlling weeds and preparing seedbeds?

Currently growers undertake up to eight tillage operations to prepare an area for planting. Each cultivation is a cost and can potentially cause problems requiring further tillage passes in an attempt to rectify the situation. For example, the first cultivation may generate cloddy conditions, requiring further operations to generate a tilth suitable for planting. Each subsequent tillage pass is a further

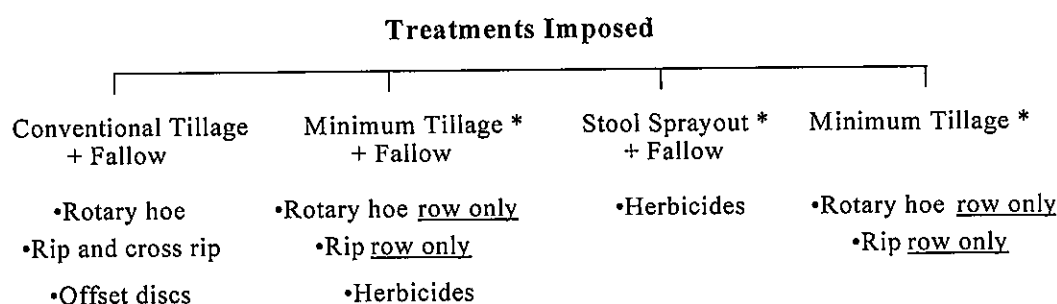
cost, reducing productivity from both excess energy and time usage, plus there is extra wear and tear on equipment.

Particularly in times of poor sugar prices is it possible to reduce the cost of production? The answer is most certainly yes.

This paper presents the results of a trial to determine the effectiveness and cost of alternative tillage strategies in land preparation for planting sugarcane.

MATERIALS AND METHODS

A field trial was conducted at Bundaberg in south east Queensland, Australia to compare conventional land preparation practices with minimum tillage methods of stool removal, where only the previous cane row was cultivated. The soil was a yellow podsollic. There were four treatments which will be designated as T1, T2, T3 and T4 in the paper for the conventional+fallow, minimum tillage+fallow, stool sprayout+fallow and minimum tillage, respectively (Figure 1).



* Interrow left uncultivated – Traffic Zone

Figure 1. Treatments imposed at Bundaberg

An instrumented tractor (John Deere 2250) was used for all field operations to allow energy use and time taken for each tillage operation to be determined.

Two varieties were grown, Q138 and Q155, which are tolerant and susceptible, respectively to the soil-borne disease *Pachymetra chaunorhiza*. Varieties were selected to determine the effectiveness of varietal rotation since the cane was planted directly back into the old row in treatments T2 to T4. Rows were also maintained as close as possible to the previous row in T1 as well.

Instrumentation of the tractor enabled wheel slip, fuel flow, and exhaust temperature and engine revolutions to be logged for each tillage operation. This enabled fuel usage and time taken for each cultural operation to be determined. The economics of each strategy was based on the actual plot yield and sugar content and the price of sugar at the time of the experiment.

RESULTS AND DISCUSSION

Details of the economic benefits of strategic tillage for land preparation compared with conventional tillage are given in Table 1. These are based on the price of fuel being 35 cents/litre (all monetary figures are in Australian dollars), Roundup® at \$7.25/litre, 2,4-D at \$6.20/litre and labour costed at \$12/hour. It can be seen that where several cultural operations were part of the system that labour was the dominant component of the cost, compared with a spraying or fewer tillage operations. It is evident that the cost of land preparation for planting sugarcane can be reduced by 50 percent. Similar

results have been observed in other agricultural industries (Richardson, 1977). These trials were conducted within the constraint of the current cane farming system; hence harvesting traffic will affect ratoon performance due to the mismatch between crop row spacing and equipment track widths.

Table 1. Cost of land preparation for each tillage strategy at Bundaberg

Treatment	\$/ha				
	Fuel	Roundup	2,4- D	Labour	Total
T1*	63.14			410.40	473.54
T2	15.58	87.00	18.60	111.60	232.78
T3	0.94	58.00	18.60	199.20	277.00
T4	14.74			97.20	111.94

*Treatments are as indicated in Materials and Methods

Fuel use and the time taken for each tillage operation are shown in Figures 2 and 3, respectively.

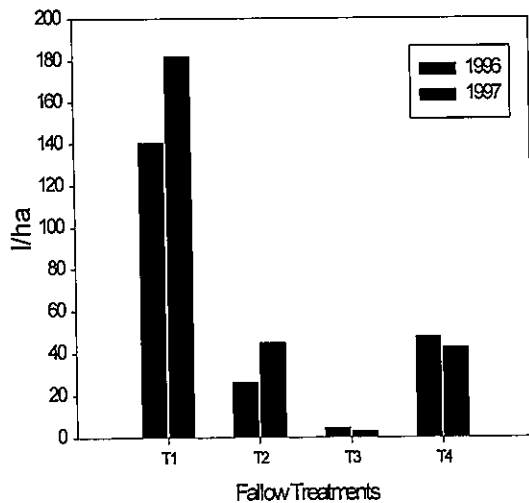


Figure 2. Fuel use for each tillage treatment

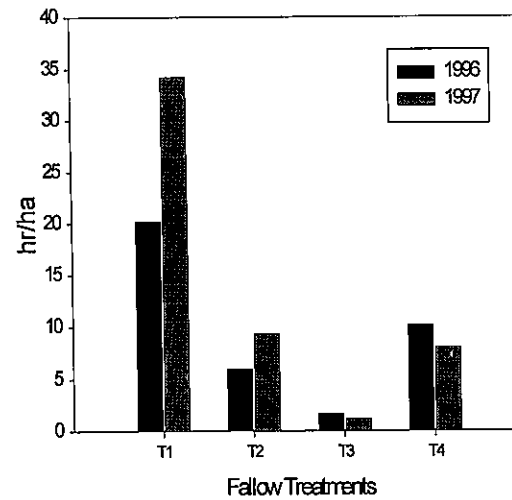


Figure 3. Time taken for land preparation for each tillage treatment

Seasonal differences due to changes in environmental conditions will result in different soil moistures at time of planting and these will affect the type and number of operations undertaken in any one season. However, considerable savings of up to 50 percent in fuel and time taken for land preparation can be observed. This is due to the practice under strategic tillage of only cultivation of the crop row and not disturbing the compacted inter-row. Similar energy savings have been obtained under controlled traffic management systems (Tullberg and Victor-Gordon, 1998).

The gross returns for each tillage strategy are given in Table 2 and Table 3 for the two varieties grown at Bundaberg. These results are based on cane yield and sugar level obtained from each treatment and the price of sugar at the time of the experiment. Differences reflect yield and sugar content variation between treatments and varieties. However, the relative differences between treatments should remain no matter what seasonal conditions are experienced.

Table 2. Gross margin (\$ per hectare) for Q138

Treatment	Cane Yld (tcph)	Price (\$/T)	Gross Income (\$)	Land preparation cost (\$)	Difference	Relative to T1
T1	117.9	23.27	2743	473.54	2270	0.0 %
T2	121.2	20.93	2535	232.78	2303	1.4 %
T3	118.7	22.61	2684	292.00	2392	5.4 %
T4	108.6	21.47	2333	111.94	2221	-2.2 %

Commercial sugar content (CCS) = T1 14.1, T2 13.0, T3 13.8, T4 13.3, tcph = tonnes cane per hectare

Table 3. Gross margin (\$ per hectare) for Q155

Treatment	Cane Yld (tcph)	Price (\$/T)	Gross Income (\$)	Land preparation Cost (\$)	Difference	Relative to T1
T1	97.4	24.26	2363	473.54	1889	0.0 %
T2	92.2	24.50	2257	232.78	2025	7.2 %
T3	93.1	23.58	2196	184.99	2011	6.5 %
T4	74.6	23.08	1721	111.94	1609	-14.8 %

CCS = T1 14.4, T2 14.6, T3 14.2, T4 14.0

The cost of land preparation is the same for both varieties and it can be reduced from \$470 (Table 1) under conventional practice to \$230 (Table 1) per hectare under strategic tillage practices. This equates to a 50 per cent saving in cultivation cost. Further saving will depend on the number and type of operations undertaken.

If conventional land preparation (T1) is taken as the base, stool ploughout (T2) results in a 1.4 and 7.2 percent better return for the varieties Q138 and Q155, respectively. Similarly stool sprayout (T3) with minimum tillage for planting results in an even better return compared with conventional land preparation for Q138 and approximately the same return as stool ploughout for Q155. Ploughout-replant (T4) resulted in a reduced return compared with conventional land preparation for both varieties. This is largely due to the reduced yield and possibly because there was no fallow period under this system. All other strategies had a fallow period of between six to ten months. The benefit of a break from sugarcane, compared with growing cane continuously, has been demonstrated by Garside *et al.* (1997) where increased cane yield was measured after a fallow break compared with ploughout-replant.

Yield of cane and sugar content has not been compromised by a reduction in tillage operations during land preparation for planting. Ideally the system should be implemented after the establishment of a system of controlled traffic. This would minimise the effect of harvesting traffic encroaching on the crop row as in the current system due to the mismatch between crop row spacing and equipment track widths.

CONCLUSIONS

Economic benefits are to be gained by a reduction in the number of tillage operations for land preparation for planting sugarcane. There is potential to reduce the cost of production and improve profitability in the year of planting if reduced tillage principles are followed.

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References

- Garside, A.L., J.E. Berthelsen and C.L. Richards. Effect of fallowing history on cane and sugar yield of a following cane crop, *Proceedings Australian Society Sugar Cane Technologists* 19, 80-86, 1997.
- Richardson, J. H. Minimum cultivation systems-economic considerations. *Proceedings Minimum Cultivation Convention, Sheraton Hotel, Perth, Western Australia, ICI Rural Division*, p 9-1-9-4, 1997.
- Tullberg, J.N. and L. Victor-Gordon. Wheel effects on tillage energy, *Proceedings Second National Controlled Traffic Conference, 26-27 August, University of Queensland, Gatton*. Eds Tullberg, J. N. and Yule, D. F., pp. 59-64, 1998.