GREEN CANE HARVESTING AT MKWASINE ESTATE, ZIMBABWE

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Abstract

The advantages and disadvantages of green cane harvesting as observed at Mkwasine Estate are discussed. Harvesting costs increased, but were offset by savings in weed control. The trash blanket slowed tiller emergence, made flood irrigation and fertiliser application more difficult and complicated subsequent harvesting. However, greater moisture retention from the trash blanket resulted in water savings when water supplies were limited, and higher cane yields were recorded from fields with a trash blanket than those without.

Keywords: green cane harvesting, trash blanket, weed control, yield, Zimbabwe

Introduction

Mkwasine Estate is situated in the south-east lowveld of Zimbabwe and has 4 700 hectares planted to cane. Manual harvesting is practised and cane is normally burnt before harvest. However, since 1994, Mkwasine Estate has experimented with green cane harvesting. The main objective was to conserve as much moisture as possible in the soil, and was in response to the recent increase in the occurrence of droughts in Zimbabwe. Another factor was the possibility of restrictions on burning for environmental reasons.

Trends in Australia and elsewhere are towards an increase in green cane harvesting. Smith *et al.* (1984) referred to the advantages from green cane harvesting, which include moisture and soil conservation and the build-up of organic matter. Disadvantages include high harvesting costs, slower ratooning, an upsurge of insect pests and the trash blanket being a fire hazard. Higher cane yields have been reported from fields with a trash blanket (Wood 1991). Sutton *et al.* (1996) reported an increase in soil microbial biomass as a result of a trash blanket, which may in turn result in increased nitrogen and nitrogen mineralisation.

Weeds can be suppressed by retention of a trash blanket. Lorenzi (1989) showed that weed suppression was caused by leachates from the cane residues rather than by actual physical suppression. It was noted that the leachates also suppress the initial ratoon regrowth.

This paper reports the observations that were made at Mkwasine Estate in respect of harvesting, weed control, ratoon development, moisture retention and yield.

Procedure

In 1994, two fields were selected for monitoring. One was harvested in winter and the other in summer. Each of the fields was divided into two, with half the field being burnt and the other half green harvested. The labour requirement for harvesting was recorded. The subsequent frequency of irrigation was determined by the use of an auger and the number of irrigation cycles applied to each area was recorded.

In 1995, an area of 273,1 hectares was hand trashed before harvest and the development of the cane after harvest was monitored. Fifteen fields of this same area were identified and left with a complete cover of a thick trash blanket. Thirteen other fields were selected where there were limited quantities of trash material because the fields were burnt in the morning, resulting in an incomplete burn. Fourteen other fields were selected where the trash was completely burnt and the ground left bare. The cane yields from these fields were recorded and compared.

Harvesting

Table 1 shows the difference in labour requirement for harvesting burnt and green cane. The labour required for green cane harvesting was more than twice that required for burnt cane.

Table 1
Labour requirement per hectare for burnt and green cane harvesting.

	Cut and trash (man-days)	Windrow (man-days)	Total man-days	Cost per man-day (ZW$)	Total cost (ZW$)
Burnt	24,8	3,0	27,8	24,70	686,66
Green	57,0	7,5	64,5	20,60	1 328,70
Difference	32,2	4,5	36,7	–4,10	642,04

Green cane harvesting required additional labour to remove the leaves clinging to the stalks. More labour was also required to windrow the trash after harvesting to allow cane regrowth and field operations. Because the trash repeatedly fell back over the cane row, it was necessary to repeat the windrowing operation.

In fields where the previous crop had also been harvested green, the trash blanket had not completely decomposed, leaving a thick blanket over the ground. This interfered with the cutting

and cane was not cut at ground level. This left stumps which is unsatisfactory. Cane was laid on the ground over a trash blanket and when the bundles were tied with chains, they contained large quantities of trash. Consequently, poor quality bundles were sent to the mill .

Irrigation management

In flood irrigated fields, excessive water was applied in green cane harvested fields where the furrows were covered by trash. The trash material absorbed some of the water and restricted flow, and thereby increased the amount of water applied per cycle. The workers could not easily see where the water had reached in the row, making it difficult to judge when to move the siphons. This resulted in some water losses.

Fertilisation

Workers had difficulty in applying fertiliser over the trash blanket. They were required to walk on the trash blanket to apply fertiliser and consistently lost their balance, reducing accuracy of application and worker productivity.

Weed control

Table 2 shows a comparison of weed control costs between green harvested fields and burnt fields. The cost of labour and herbicides was calculated using 1995 prices. Light hand weeding was done in green harvested fields to eliminate the few weeds that had penetrated through the trash blanket. More than twice the cost was incurred to hand weed burnt cane areas.

The standard herbicide practice was necessary on the burnt cane, whereas no herbicide was required in green cane harvested fields. This constituted a substantial saving.

Table 2
Comparison of weed control costs.
(ZW$/ha - 1995 prices)

	Hand weeding	Herbicide	Total
Burnt	347,30	242,80	590,10
Green	147,00	-	147,00
Difference	-200,30	-242,80	-443,10

Ratooning

Where there was a trash blanket, the shoots took longer to emerge above the trash. In some instances, especially during the cold months, some stools rotted and hence there was no regrowth. Where there was regrowth, the shoots struggled to come through the trash. Continuous parting of the trash was necessary because the heavy trash kept sliding back over the cane. The cane emerged faster where there was no trash blanket.

In 1994, stools and stalks were counted in one field where half the field was burnt and half green harvested. There were more stools and more stalks where there was no trash blanket. These results are shown in table 3.

Table 3
Stool and stalk counts in burnt and green cane harvested areas.
(N14 - 1 field)

	Stools/ha	Stalks/ha
Burnt	9 659	152 711
Green	6 838	98 120
Difference	-2 821	-54 591

Root growth

Where the previous crop had been green harvested the trash had not decomposed, probably because of the extremely dry conditions experienced that year. In these instances, the lower 200 mm of the cane stalk remained buried in trash. The nodes thus buried developed roots. Bundles delivered from such fields looked untidy because of the roots but, having grown through the trash, they did not contain soil.

Insect damage

The part of cane stalk buried in the trash was attacked by insects. *Sesamia* burrowed into the lower parts of the stalks, which then dried at the bottom.

Moisture retention

In a sprinkler irrigated area harvested in 1994, half the field was burnt and the other half green cane harvested. Irrigation frequency on both areas was determined by use of an auger and hand feel. Table 4 shows the differences in the number of cycles of irrigation and the amount of water applied over the two areas.

Table 4
Irrigation frequency and volume of water applied on burnt and green cane areas (1 field).

	No. of cycles	Total water applied (mm)	ML/ha	Water price (ZW$/ML)	Cost (ZW$)
Burnt	17	612	6,1	47,50	290,70
Green	9	324	3,3	47,50	154,38
Difference	-8	-288	-2,8	-	-136,32

Table 5
Average yields of fields with different trash volumes.

	No. of fields	Hectares	Total tons cane	Tons cane/ha	ERC (tons)	ERC (%)	Price/ton ERC (ZW$)	Return/ha (ZW$)
Trash blanket	15	136,0	8 235,45	60,55	904,56	10,98	3 400	22 614,00
Reduced trash	13	154,1	7 775,23	50,46	840,78	10,81	3 400	18 550,63
Burnt	14	142,6	6 679,53	46,84	710,07	10,63	3 400	16 930,14

Table 6
Cost comparison of green and burnt cane in a drought situation (ZW$).

	Green cane	Burnt cane	Reduced trash	Difference green/burnt	Difference green/reduced
Cut and trash	1 174,00	612,50	659,90	561,50	514,10
Windrow	154,50	74,10	74,10	80,40	80,40
Hand weeding	147,00	347,30	347,30	−200,30	−200,30
Herbicides	–	242,80	242,80	−242,80	−242,80
Irrigation	154,40	290,70	290,70	−136,30	−136,30
Haulage	2 447,00	1 893,00	2 039,00	554,00	408,00
Total costs	4 076,90	3 460,40	3 653,80	616,50	423,10
Revenue	22 164,00	16 930,00	18 550,60	5 684,00	4 063,40
Gross margin	18 537,10	13 469,60	14 896,80	5 067,50	3 640,30

The burnt area required nearly twice the number of cycles and consequently nearly twice the amount of water, a critical factor in times of limited water availability. There was a corresponding reduction in the amount of labour used for irrigation.

During periods of moisture stress, fields that were covered by a trash blanket were observed to be in better condition than those without.

Cane yield comparisons

Table 5 shows the average yields obtained from each of the treatments. Overall yields were low, because the amount of water available was only 19% of normal. Results indicate that in times of restricted irrigation a greater percentage of the crop could be kept alive by trashing the cane.

Fields with a full trash blanket produced the highest yield and, where there was no trash, the yields were the lowest.

Discussion and Conclusions

Higher harvesting costs were incurred where the cane was harvested green. However, at 1995 prices of labour and chemicals, the higher costs of harvesting were offset by savings in the cost of weed control. The important considerations are the increased yield and water saving effected by the trash blanket.

During the cold period, some of the cane under the trash blanket did not come through the trash. Consequently the numbers of stools and stalks were reduced. The combination of low temperatures and moisture under the trash blanket caused rotting of some cane stumps. Despite this, the trashed cane outyielded the burnt cane under exceptionally dry conditions.

The trash blanket took more than one season to decompose under the dry conditions experienced during the trial, and became unmanageable. However, it is possible that during a normal season the trash would rot at a faster rate. Root growth and increased insect damage were a problem. Ways of managing trash need to be investigated. Incorporation of trash would hasten decomposition and make irrigation and fertilisation more manageable.

There is little doubt that, in times of drought, and despite the disadvantages of the trash blanket, consideration should be given to adopting green cane harvesting.

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