

# IMPACTS OF GREENCANE HARVESTING ON SUGAR FACTORY OPERATION AT SEZELA

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## Abstract

Public pressure against cane burning is mounting in urban areas. Many cane growing areas in South Africa are affected by this and a number of factories expect that in the near future much of the cane delivered to them may have to be harvested green. In order to assess the overall impacts of greencane harvesting on the operation of a sugar factory a four-day trial was conducted at Sezela during which a significant proportion of the cane delivered was unburnt. In this paper the authors provide an overview of how this change affected the factory.

## Introduction

Burning of cane just before harvest is a very efficient way of removing the leaves (trash) that adhere to the cane stalks. When unburnt cane that contains a significant amount of leaves is processed, the quantity of non-sucrose dissolved substances (including colour) increases (Reid and Lionnet, 1989). In addition the amount of fibre passing through the factory per unit of sucrose in the cane stalk increases.

The terrain on which much of the cane is grown at the coast of Kwazulu-Natal consists of steep hills. It is not possible to use mechanical harvesters and it becomes necessary to remove the leaves manually. This complicates the normal cutting operation and results in a decreased cutter output. Furthermore, this operation is generally not as effective as burning off the leaves prior to cutting, with the result that cane harvested in this way generally has a higher fibre content than burnt cane. Since the leaves have a lower bulk density than the sucrose-rich cane stalks, the payloads of the transporting vehicles are less (de Beer *et al.*, 1989).

Environmental concerns, particularly in areas where tourism is a major source of income, are exerting increasing pressure on the sugar industry to discontinue burning. Impacts of cane harvested green have been reported previously. De Beer *et al.* (1989) compared the agricultural consequences of harvesting burnt and unburnt cane and Reid and Lionnet (1989- same trial as described by De Beer *et al.*) described the influence of cane quality on milling parameters. That trial differed from the one reported here in that the unburnt cane was delivered with all the adhering leaves (trash). Furthermore, the cane was processed in a milling tandem, whereas in the Sezela trial sucrose extraction was done in a diffuser. Lamusse and Munsamy (1979) focused on the effect of tops, trash and soil in the extraction plant. In an attempt to be proactive, the management at Sezela mill decided, in conjunction with the Sugar Milling Research Institute (SMRI), to carry out a factory trial lasting four days (Thursday 9 - Sunday 12 September 1999). The objective of this trial was to quantify the effects of unburnt cane on the whole fac-

tory operation. No attempt was made to separate extraneous matter into different components. This paper gives an overview of the results of this trial. In this paper the terms green, unburnt or trashed cane are taken to mean the same.

## Front end operation and cane characteristics

Figure 1 gives an indication of how the trashed cane affected the average payload of the delivery vehicles. The trial took place in week 28. Although most growers normally deliver burnt cane, an attempt was made to encourage all growers to deliver only trashed cane over the period of the trial. Comparative data from the previous week (27) and the following week (29) are also included.

Figure 1 also shows payloads for mixed cane comprising varying proportions of burnt and trash cane on the same loads. The trial showed that the average payload for burnt cane of 30-31 tons decreased to 24-26 tons for trashed cane.

The relative amounts of burnt, mixed and trashed cane for the three weeks under consideration are shown in Figure 2. It was estimated that approximately 50% of the mixed cane was trash cane, hence only about one third of the total cane delivered during week 28 was unburnt. One needs to keep this in mind when evaluating the impacts of the trash cane on the operation.

The hourly throughputs (in tons cane/hour) for each day during the trial are shown in Figure 3. A significant reduction is

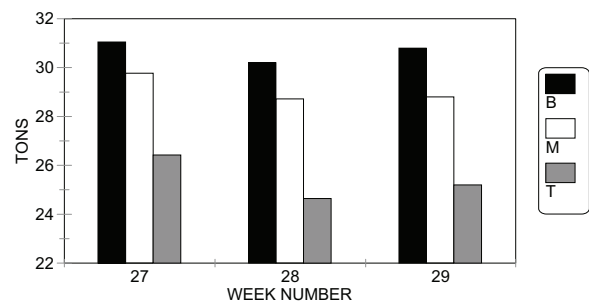


Figure 1. Average vehicle payloads for weeks 27 to 29. Burnt (B), mixed (M) and trashed (T) cane.

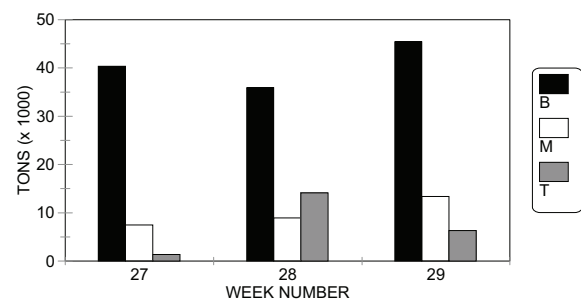


Figure 2. Relative quantities of burnt (B), mixed (M) and trash (T) cane delivered.

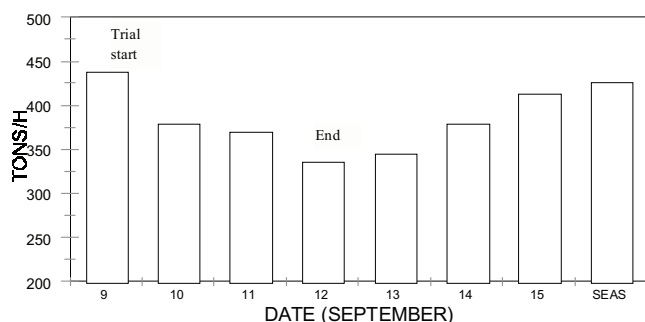


Figure 3. Average hourly throughputs during the different days of the trial.

evident. The reasons for this are twofold. Firstly, as more effort is required to harvest greencane, most growers could not maintain the same harvesting rates with their existing cutting crews when compared with harvesting burnt cane. The rate of delivery of cane to the mill slowed down, as it was not feasible to recruit additional labour just for the period of the trial. The mill kept in step with the slower delivery rate by crushing slower. Secondly, several chokes occurred in the preparation line and at transfer points in the conveyor system because of the increased amount of fibre.

In terms of quality, the average pol % cane during weeks 27 to 29 for burnt, mixed and trash cane is shown in Figure 4. The reduced pol for trash cane is partly due to the higher fibre content. Note that the pol in burnt cane after the trial (week 29) is higher than before the trial. The probable reason for this was that cane was fresher in terms of average burn-to-cut delay than before the trial, due to the heightened awareness of the delays and better cane management practices. The lower pol of burnt cane in week 27 compared with that in week 28 was due to significant falls of rain during that week. Cane burns were incomplete and higher cane moistures and increased soil levels were experienced.

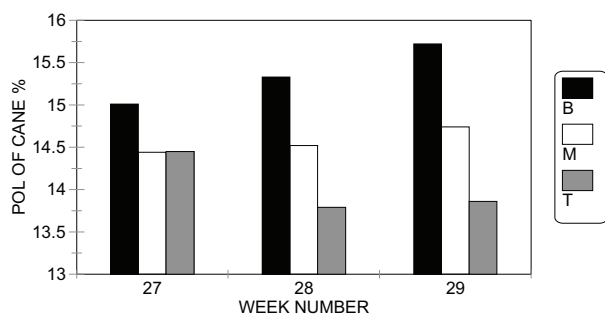


Figure 4. Pol of burnt, mixed and trash cane.

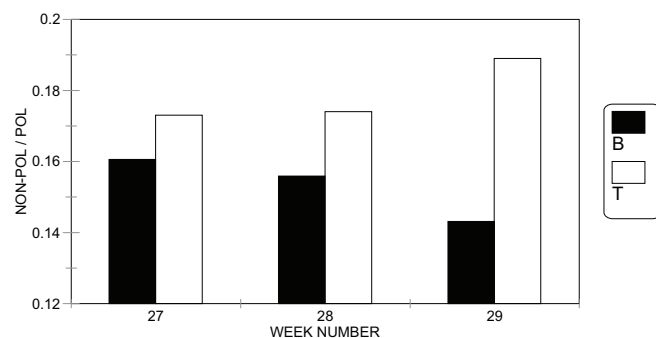


Figure 5. Ratio of non-pol to pol of burnt and trash cane.

Figure 5 depicts the ratio of non-pol to pol for burnt and trash cane. This ratio is higher for trash cane, as expected. As mentioned, trash cane contains a higher proportion of cane leaf remnants than burnt cane. Sucrose (pol) content in leaves is less than in the stalks, while the relative concentration of soluble non-sucrose substances in the leaves is higher than in the stalks.

The average fibre contents of burnt and trash cane for the three weeks are shown in Figure 6. It is interesting that the fibre % cane for the trash cane in the week before the trial was considerably less than for week 28 and 29. This could be ascribed to some growers who deliver only trashed cane. Cutters on these farms are used to the operation of stripping the leaves (trashing) and are conceivably more efficient at it than those cutters who normally harvest burnt cane, for whom the trashing operation during the trial was an added task. The rise in fibre could not be attributed to increased ash levels in cane. These were essentially constant over this period.

During the trial a storage test of burnt and trash cane was done in the factory's caneyard to determine if a noticeable difference exists between the "keeping properties" of burnt and trash cane. Some data from this test is presented in Figure 7. Two separate stockpiles of cane were accumulated, one with burnt cane, the other with trash cane. The marked difference in the ethanol values between burnt and trash cane is very evident. This confirms the frequently quoted increased deterioration rate of burnt cane (Lionnet, 1986).

### Process Characteristics

A significant increase in mixed juice colour was noticed during the trial, as shown in Figure 8. This is because of the increased leaf remnants which contain a higher concentration of colour than the stalks. The increased colour was carried through to clear juice and syrup, with the expected time delay as the juices

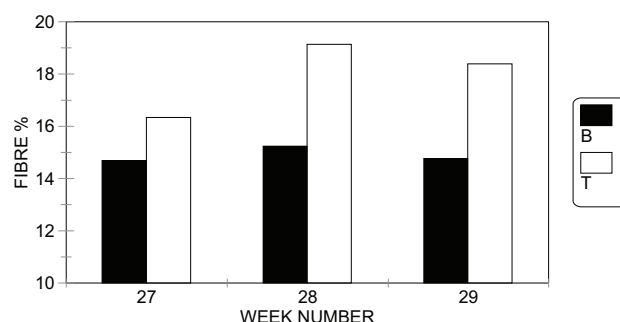


Figure 6. Fibre % cane for burnt and trash cane.

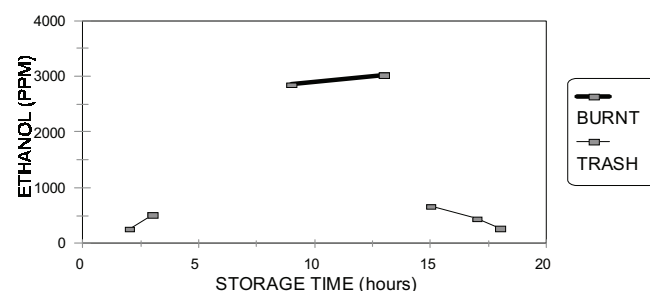


Figure 7. Ethanol levels of burnt and trash cane stored in the caneyard.

move through the factory. This contributed to the increased colour in the sugar, as indicated in Figure 9.

It was of interest to note that the phosphate concentration in the mixed juice showed a decline during the trial (see Figure 10), while the starch levels increased (as shown in Figure 11).

### Sugar Recovery

The effect of processing greencane on sucrose lost in final molasses and boiling house recovery is indicated in Figure 12. There is a rise in the amount of sucrose lost in final molasses during weeks 28 and 29. This is accompanied by a corresponding drop in the boiling house recovery. There is a considerable improvement in the boiling house recovery in week 30, by which time most of the cane delivered was again burnt before harvest.

### Conclusions

Although only approximately one third of the total cane delivered to the factory during the four-day trial was unburnt, significant impacts on the operation were noticed. There was a reduction in harvesting rate and hence cane supply, an increase

in choking tendencies, an increase in sugar colour and a decrease in the boiling house recovery. Preparation equipment will need to be modified to handle increased fibre throughputs. However, the impact of processing greencane would be much less if removal of leaves from the cane (trashing) during harvesting was done more effectively.

Whilst this paper indicates that growers were reluctant to supply unburnt cane due to reductions in cutter productivity and an increase in transport costs, the introduction of the recoverable value (RV) cane payment system may address some of these issues by creating incentives for the supply of trash-free (low fibre), high purity (fresh and ripe) cane. As the burning of cane significantly hastens the deterioration process, there has been a tendency for more growers to refrain from burning (especially when conditions are not suitable), and to deliver properly trashed cane to the mill. At the time of writing, the proportions of trashed, mixed and burnt cane delivered at Sezela are 4%, 26% and 70% respectively.

### Acknowledgments

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1. All growers who delivered trash cane
2. The cutters and management of Sezela farm for doing cutter productivity tests
3. The cane supply department for making available the necessary cane delivery data
4. The laboratory personnel at Sezela who ensured that the necessary samples were taken

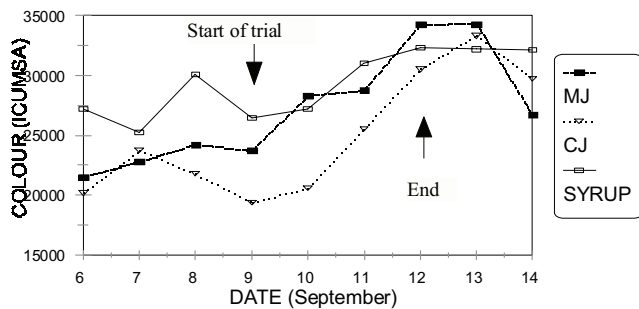


Figure 8. Colour profile of mixed juice, clear juice and syrup.

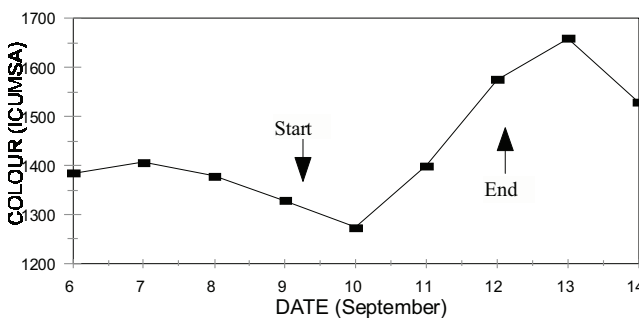


Figure 9. Raw sugar colour.

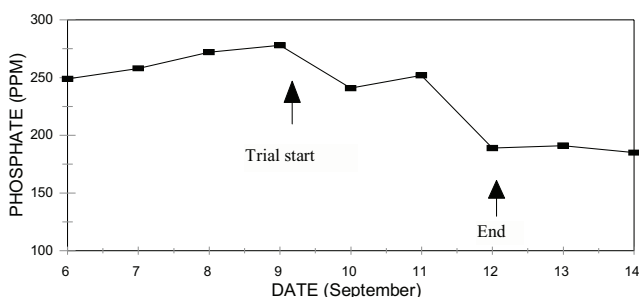


Figure 10. Mixed juice phosphate levels (on sample).

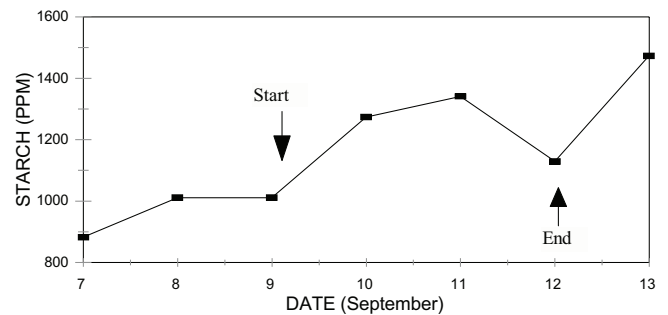


Figure 11. Starch levels in mixed juice.

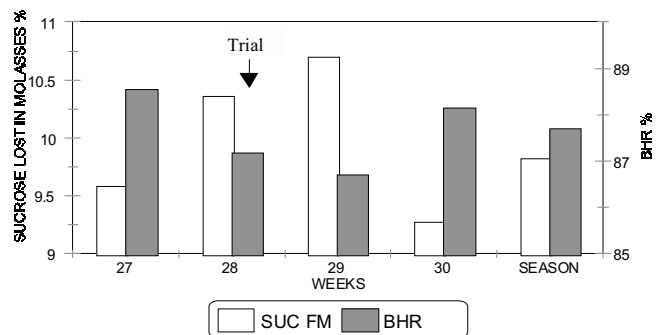


Figure 12. Sucrose lost in final molasses and boiling house recovery (BHR).

5. The caneyard staff for recording the types of cane processed and performing the storage test
6. The divisional managers who informed their staff of the functions and tasks during the trial, and ensured that these were carried out
7. The senior management at Sezela who committed considerable expense for the project
8. The management and staff of the downstream division who took the necessary readings and observed operational changes
9. The laboratory staff in the analytical and chemical divisions of the SMRI who performed the numerous analyses requested for the project.

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