DIFFERENT LOADING SYSTEMS AND THEIR EFFECT ON SOIL IN CANE

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Abstract

Noodsberg Sugar Company experienced high ash % cane at the start of the 1981/82 crushing season. The reasons for this phenomenon are investigated. Ash % cane values are correlated with different cane loading methods in the field. Some observations and recommendations are made to reduce the inclusion of soil in cane.

Introduction

Noodsberg Sugar Company experienced abnormally high ash % cane and ash % bagasse at the start of the 1981/82 crushing season. One 12 hour period in mid-May yielded figures of 6,14 ash % cane and 11,94 ash % bagasse. The low quality cane was giving tremendous problems in the mill because the boiler fires were being damped, unscheduled stops were required to change and replace cane knives and shredder hammers, and high rates of wear on the mill rollers were experienced.

It was decided to investigate the problem and to institute regular ash % cane analysis with the help of the Cane Testing Service (CTS) Laboratory.

Method

A portion of the hatch sample for sucrose was analysed for ash % cane. This was done continuously for two hours on each grower's consignment then stopped for two hours because of the lack of facilities in the CTS Laboratory. The ash % cane was analysed according to the procedure laid down by the Cane Testing Service. The results were passed to the Grower Liaison Officer for his attention. Growers were visited if their ash % cane was 1% or more higher than the weekly mill average.

Results

It was found that the high ash % cane was due to the following factors :

(a) *Weather*

The cutting season started when the weather was abnormally wet with about 50 mm of rain during May. The soil remained moist during the cooler winter months and this contributed to high ash % cane in several ways.

(i) Soil adhered to the cane more easily.
(ii) Cane stools were removed and incorporated in the cane bundle more easily with mechanical loaders.
(iii) Weeds were removed with roots and soil.
(iv) The pushpiler of the mechanical loaders penetrated the soil more easily when it was moist than when it was dry.
(v) Burns were cooler therefore more weeds were able to survive the fire.
(vi) Weeds stayed green and were more resistant to burning.

(b) *Short cane*

The 1981/82 crop was exceptionally small due to two consecutive years of drought and most of the cane stalks were short. This contributed to high ash % cane because it meant that :

- mechanical loaders had to pushpile the windrow further to fill the grab.
- weeds were worse because of the poor canopy.
- topping was poor and this permitted each stalk to trap and hold more soil.

These factors were greatly compounded by the fact that the soil was moist.

(c) *Incorrect windrowing*

Many of the growers visited had been placing the windrow in the inter-row which meant that the pushpiler prongs had to travel very close to or actually on the cane row which is normally higher than the inter-row. This practice resulted in increased damage to the cane stools and the number of dug up stools included in the cane bundle also increased.

(d) *Mechanical maladies*

Poor design and wear of pushpilers and also damaged equipment played a part in the inclusion of soil in the cane bundle.

1. *Poor design*

Some pushpilers had no prongs making it necessary to bulldoze the cane to make bundles. The better designs lift the cane from the ground and build the bundle on the prongs away from the ground. This allows soil to fall away during the pushpiling operation and ensures that the jaws of the grab do not contact the ground when closing on the bundle.

2. *Wear*

The small protruding forks of the prongs wear off, necessitating the lowering of the pushpiler prongs which then start digging and lifting soil into the bundle.

3. *Damage*

This usually involves damage to the prongs so that they are pushed out of alignment. Such damage usually causes one prong to engage the soil earlier than the other, necessitating the lowering of the pushpiler to ensure that no cane is left behind.

(e) *Base cutting*

The amount of soil included by incorrect base cutting was more than normal because the short crop made it necessary to bend over further to grasp a bundle of cane before cutting. This caused base cutting problems with the long handled cane knife because the shoulders of the cane cutter were then too close to the ground.

(f) *Training and supervision*

Many loader operators and cutters were unaware of the importance of excluding soil from the cane. The biggest problem was motivating them to monitor more closely the height of the pushpiler and ensuring that this motivation continued in the absence of the supervisor.

At the close of the season there were 5 743 individual ash % cane results available. These results were all associated with quota numbers so it was possible to determine average ash % cane for each grower. A survey was undertaken to determine what loading systems were being used throughout the district. It was found that there were five separate systems.

(1) Hand loading. This includes hand built bundles loaded by self loader and hand loading directly into transport.

(2) The use of the Bell loader.

(3) Buck loader. The locally designed and manufactured Buck loader is used and is similar to the front end loader but is mounted at the rear of the tractor.

(4) Front-end loader. This system includes the use of equipment which bolts onto a tractor such as the Quicke, Horndraulic and John Deere. The tractor travels down a pre-cut windrow pushpiling the cane with the jaw open until it is filled. The jaw is then closed around the bundle, lifted and manoeuvred until it is deposited in the transport.

(5) Slewing loader. This system involves the use of loaders such as the Upfold, Dalton and Tamhe. The system involves the loader where it travels down a pre-cut windrow and makes a small bundle by means of a pushpiler. The bundle is deposited by a slewing grab into the transporter which travels adjacent to the loader.

The ash % cane figures were then determined for each of the different loading systems. The results are given in Table 1.

TABLE 1
Different loading systems and ash % cane

Loading system	Ash % cane
Hand	1,25
Bell	1,74
Buck	1,90
Front end	2,05
Slewing	2,06
Mill Average	1,66

A breakdown of the different loading systems and the contribution each makes to the cane supply of the mill is given in Table 2.

TABLE 2
Different loading systems and proportions of cane supply loaded by means of different systems

Loading system	Total tons	No. of quotas	Average delivery per quota, tons
Hand	171 246	68	2 518
Bell	244 347	24	10 181
Buck	62 092	8	7 762
Front end	103 097	34	3 032
Slewing	251 385	31	8 109
Total	832 167	165	5 043

Discussion

It is clear from Table 1 that there is a significant increase in ash % cane when mechanical loaders of any kind are used. However, the effects of using different loaders are not significant, but the results confirm the trend which would be expected.

Front end loaders and slewing loaders are worst because of their push-piling mechanisms which are constantly engaged with the soil while loading and are not visible while loading because they are covered by cane or hidden from view behind the tractor bonnet. The Bell loader is the best loading system because of its "flicking" action as the cane is bundled. The prongs of the mechanism are also visible during operations and make adjustment easier.

In an attempt to reduce soil entering the mill, it would be preferable to improve all the systems rather than recommend the use of only one system such as the Bell. There are financial and practical reasons which often decide for the farmer which system he will use, so the aim should be to ensure that he uses his choice of system as effectively as possible. There are several ways in which this can be achieved.

(a) Cut as many rows of cane into one windrow as possible. Changing from four rows of cane to five rows of cane into one windrow reduces windrow length and consequently pushpiling length by 20%.

(b) If a serious soil problem is being experienced, it has been shown (Gordon[1]) that making small bundles out out of the windrow helps. These bundles should ideally be the size of one full grab load. However, this practice seriously decreases cutter productivity and topping height accuracy.

(c) Where weeds are a problem a hotter burn should be aimed at. This can be achieved by burning in the late afternoon if possible.

(d) Place the windrow with its centre across the row and not in the inter-row to allow the pushpiler prongs to engage the windrow unimpeded by the cane row.

(e) Ridge up the row if slewing type loaders are to be used to allow easy access to the base of the windrow by the pushpiler prongs. This practice is not advisable if the machines have to cross the rows.

(f) Correct the base cutting height. If the Australian cane knife is being used it could be exchanged for the short handled curved cane knife in short cane where the cane cutter has to bend over to grasp the cane.

(g) Correct the pushpiler height. This is the main problem when pushpilers are being used. The ultimate answer here is to design a pushpiler which controls its own height by either ground wheels or skids below the pushpiler frame. Careful thought must be put into the design of such a pushpiler because most of the modifications seen on the farm in the form of skids have made the problem worse.

(h) Introduce effective water control measures to prevent the formation of washes and gulleys in the field, which cause the pushpiler prongs to dig deep as they are negotiated by the machine.

(i) Carry out effective land smoothing to ensure the fields are level at planting.

(j) Maintain equipment to eliminate problems caused by wear, incorrect tyre pressures and damage.

(k) Most important of all, the training of each operator involved with any operation in which soil could be picked up is vital. Each operator should be aware of the soil problem and how he can affect it. Subsequent supervision to ensure the maintenance of higher standards is also necessary.

The amount of soil in a consignment cannot be assessed directly from ash % cane figures. It has been shown by Brokensha and Mellet[2] that the ash % "soil free" cane can range from 0,4 to 1,2%, not only because there is a range of ash values that can be found in each component of the cane stalk, but also because the relative proportions that these components bear to each other in the cane sample may vary.

The short cane harvested in the 1981/82 season at Noodsberg probably had a high ash % "soil free" cane due to the poor topping and burning. Components such as trash and tops which are left on the stalk have a high ash value. This belief is indicated by the very high ash % cane value (1,25%) for cane loaded by hand.

In conclusion it should be noted that rain during the cutting season has a very large effect on daily ash % cane figures. It was observed that two days after rain these figures could double for a period of two days, then decline to previous levels over the next three days.

REFERENCES

1. Gordon, R. (1977). Reducing extraneous matter in cane loaded mechanically. *SASTA Proc* **52**: 178–179.
2. Brokensha and Mellet. (1977). Sampling and analysis of prepared cane for its ash content with reference to estimating soil levels in cane. *SASTA Proc* **51**: 97–100.