CANE YARD EVAPORATION FROM SHORT BILLET CHOPPER HARVESTED/LOADED CANE IN BINS

By W. R. VAN DUYKER, H. LUNG KIT and P. M. SCHORN*

Royal Swaziland Sugar Corporation - Simunye Sugar Estate

Abstract

Investigation into the low pol factor at Simunye revealed that the problem was partly due to an elevated pol % cane figure resulting from a moisture loss in the cane. Results show that short billet, chopped cane stored in bins in the cane yard after passing over the weighbridge can lose up to 2,5% in weight during daylight hours.

Introduction

Simunye is situated in the North Eastern part of Swaziland in the semi-arid lowveld with an average annual rainfall of 835 mm. The annual evaporation is over 2 000 mm with an average maximum temperature of 28° C and a relative humidity at 53% at 14h00 hours.

Approximately 50% of cane crushed is chopper harvested, while the rest is hand-cut and laid into windrows. This windrowed cane is picked up by chopper loaders and loaded into bins. Except for gleanings (2%), the cane crushed is all in billets of 200–300 mm in length. After weighing at the factory, the cane is either crushed directly or put into storage.

Evaporation after weighing poses serious problems for factory control since the pol % cane derived from the Direct Analysis of Cane (DAC) is applied to cane weights which are measured before any possible evaporation has taken place.

At Simunye evaporation can occur in four areas

(i) The cane yard

(ii) The feeder tables and the cane carrier before and after the knives, over an open distance of ± 90 metres to the shredder

(iii) The 20 metres length of main cane carrier from the shredder to the DAC sampling point and

(iv) Within the DAC sampling system.

It is quite likely that significant evaporation occurs between the knives and the sampling point, considering the higher temperature of the prepared cane and the travelling time of about 6–8 minutes. In this paper, however, only evaporation in the cane yard and its effect on pol factor has been investigated.

Method and Results

A number of tests were carried out on cane bins containing about 10 tons of chopped cane over a range of climatic conditions.

The selected incoming bins were weighed and then set aside in the cane yard next to the stored bins. The test bins were reweighed at 2 or 4 hour intervals throughout the test period and the mass loss determined. The cumulative moisture loss % cane reached at the end of the daylight hours is shown in Table 1. This ranged from 0,89% to 2,46%.

*Now at Hulett Sugar Ltd. (Darnall Mill)

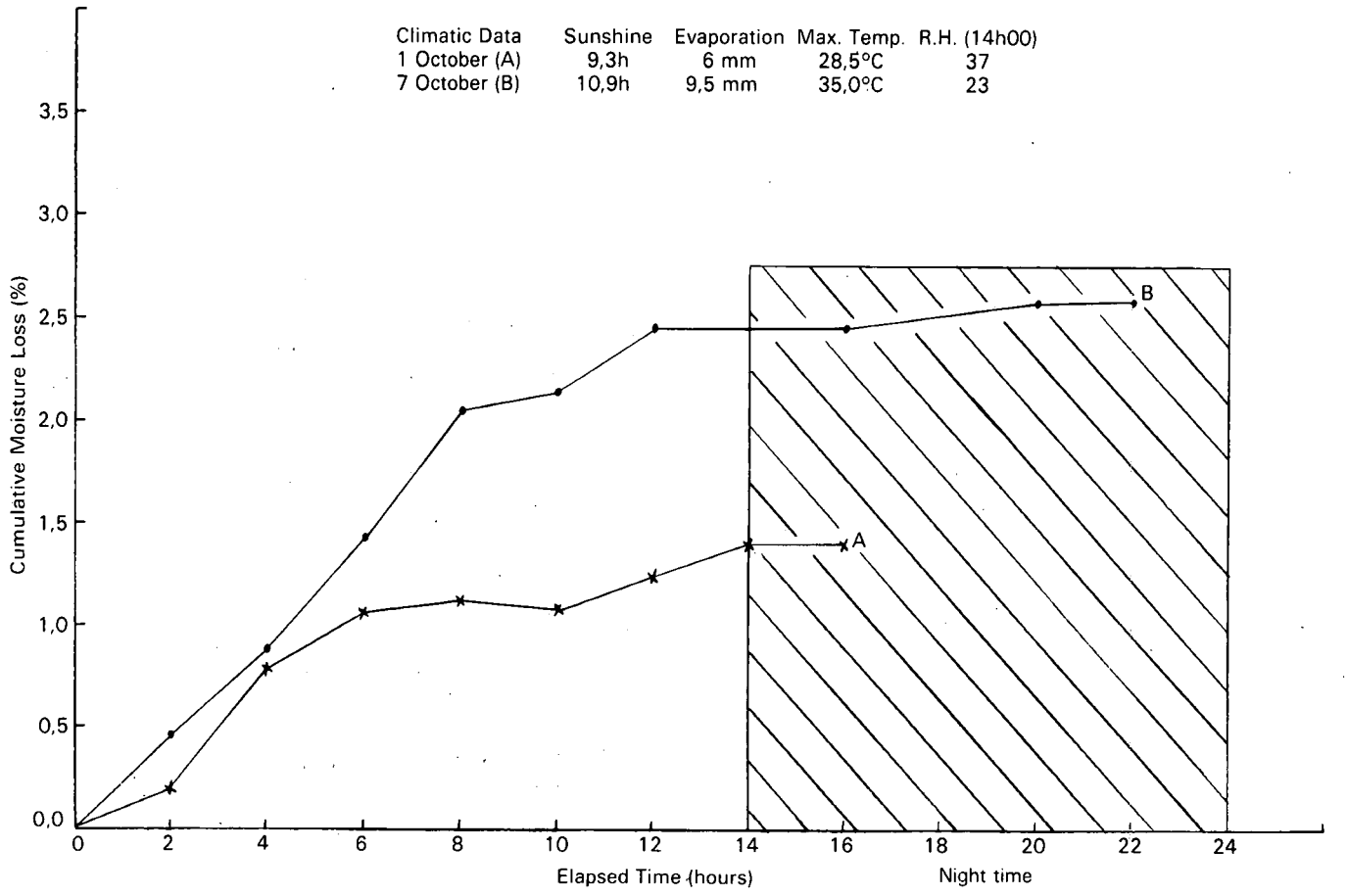

FIGURE 1 Evaporation pattern, October 1 and October 7.

TABLE 1

Total % Mass Loss over 12 Hours (Mainly Daylight Hours)	No. of bins used	Meteorological Data						
		Sunshine	Relative Humidity		Temperature °C		Evap.	Rain
		Hours	08h00	14h00	Min.	Max.	mm	mm
2,46	2	10,9	42	23	17,7	35,0	9,5	0
2,38	2	11,1	91	99	19,5	38,0	11,0	0
1,67	4	7,1	79	39	17,5	29,0	7,0	0
1,41	4	8,5	72	30	16,0	32,4	7,0	0
1,41	4	9,1	79	31	16,0	31,0	8,0	0
1,23	2	9,3	79	37	16,6	28,5	6,0	0
1,20	4	8,7	59	25	15,0	31,2	9,0	0
0,89	4	3,5	81	52	19,5	27,6	4,5	0

In Figures 1 and 2 a pattern of evaporation can be identified. There is a high rate of moisture loss during daylight hours and, as expected, this decreases during the night.

Moreover the physical state of the cane will also influence the moisture rate loss. A test carried out on 4 bins over a period of three days (see Figure 2) indicates a progressive falloff of moisture loss during the daylight hours from the first to the third days (viz. 0,119, 0,088 and 0,062%/hour respectively for each day). This is probably due to the fact that the dried exposed tissues offer some protection to the underlying tissues against further moisture migration/loss.

TABLE 2

Delivery to Crush Delay (7 October 1982)

Average Delay (Hours)	1	4	9	18	27	Total
% Cane	65	12	7	12	4	100
Evaporation	0,13	0,10	0,13	0,31	0,13	0,80

TABLE 3

Changes in Factory Data due to 0,80% Evaporation Correction

	Uncorrected Figures	Corrected figures	% Change
Tons cane	5 052,660	5 012,239	−0,80
Tons fibre in cane (by DAC)	688,467	682,959	−0,80
Tons pol in cane (by DAC)	699,759	694,161	−0,80
Tons brix in cane (by DAC)	837,245	830,547	−0,80
Tons pol in cane (by mill balance)	683,543	683,405	−0,02
Tons brix in cane (by mill balance)	824,306	824,008	−0,04
Tons bagasse	1 347,841	1 336,219	−0,86
Tons pol in bagasse	16,039	15,901	−0,86
Tons brix in bagasse	34,505	34,207	−0,86
Tons fibre in bagasse	638,742	633,234	−0,86
Tons moisture in bagasse	674,595	668,777	−0,86
Tons imbibition water	2 145,181	2 173,980	+1,34
Extraction	97,654	97,673	+0,02
Pol factor	97,68	98,45	+0,79
Brix factor	98,45	99,21	+0,77

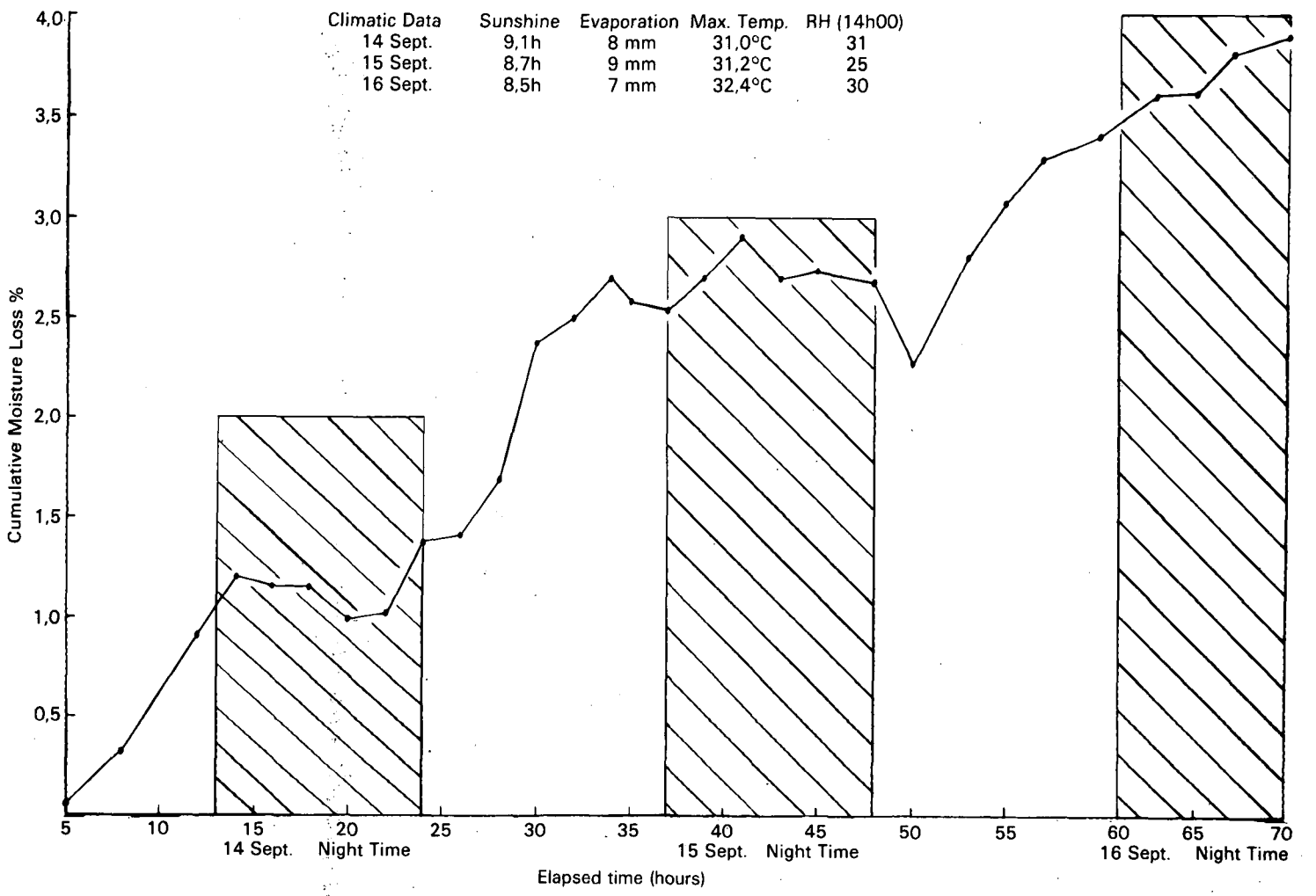

FIGURE 2 Evaporation pattern September 14, 15 and 16.

Effect of Evaporation on Factory Results

The rate of moisture loss during the daylight hours and the night hours was 0,205% per hour and 0,014% per hour respectively on 7 October 1982 (see Figure 1 curve B). Using these figures in conjunction with the delivery to crush delay for the day (Table 2), the total cane yard evaporation for the day can be estimated.

The normal uncorrected figures for the day (7 October) are shown in Table 3 together with the same data after 0,80% moisture correction on the cane mass.

For the most of the DAC data the change is approximately equal to the moisture loss (i.e. 0,8%), while for the bagasse the change is −0,86%.

The pol and brix factors changed by +0,79 and +0,77 respectively, which is slightly less than the moisture loss percentage.

However, for the tons pol in cane on which cane payment is based, the change is of the order of −0,02% only.

Conclusion

There is a definite correlation between pol factor drop and evaporation. The % reduction in pol factor is of the same order as that of the % moisture loss in cane.

There is evidence of a further reduction in pol factor due to losses in weight occurring in the process of cane preparation. Further tests will be carried out in this area, although the development of an acceptable method of testing will be difficult.