

A QUANTITATIVE STUDY OF POST HARVEST DETERIORATION OF SUGARCANE

M. M. Haque, M. A. A. Sarkar and S. M. E. Ali
Sugarcane Research Institute,
Ishurdi, Pabna.

SUMMARY

An experiment was conducted at the Sugarcane Research Institute (SRI) to study the quantitative deterioration of Sugarcane after harvest. Chemical analysis of staled cane showed increased brix, but reduced pol, purity and recoverable sugar. A steady loss in cane weight and in total sugar content compared to the cane analysed immediately after harvest was also observed.

The rate and extent of deterioration varied with time and climatic conditions prevailing during the period of the experiment and staleness by one day caused no significant deterioration whereas the same for the subsequent days affected the cane significantly. The total sugar per acre lost over a period of six days of staleness alone during a crushing season, varied from 30% to 54%. Canes must be guarded against this factor by all means for economic reason.

INTRODUCTION

The phenomenon of post harvest deterioration of sugarcane is a common problem with sugar industry. Delays by two to three days or even a week between harvesting and milling are common due to distance, transport problems, bad communication systems and/or occasional break down of mills. Such delays result invariably in losses of cane weight and recoverable sugar.

A number of workers in Australia, Hawaii, South Africa, India and in other major sugar producing countries of the world have investigated into the problem and reported loss of cane weight, recoverable Sugar, increase in reducing sugars, changes in juice quality and chemical composition (Lingerfelt *et al*, 1965; Gupta *et al*; 1968; Wood *et al* 1972; Wood, 1973; Bose *et al* 1974 and Long, 1977)

The post harvest deterioration of sugarcane appears to be a more acute problem in Bangladesh than it is in other countries of the world for reasons mentioned above and still very little work has been done in the line under her agroclimatic conditions. The present investigation was undertaken to quantify the extent of damage caused due to different length of staleness over the crushing seasons.

MATERIALS AND METHODS

The experiment was conducted at SRI farm. The cane variety Co 1158 planted on 15th November, 1976 was grown under rainfed conditions from planting to harvest and has all managements, fertilizations and other inter-cultural practices identical.

The experiment consisted of three independent trials at an interval of 40 days in order to represent early (December), mid (late January) and late (early March) crushing season. Consequently, the age of the crop varied from 388 days to 453 days.

Each of the above mentioned trials followed the same procedures outlined below :-

Random samples in total 126 canes, representing average cane stand of the field, were harvested, detashed, bound into 21 bundles of 6 canes and weighed. Three such bundles representing 3 replications were reweighed and chemically analysed for brix, pol, purity and % recovery on each day at 24 hours interval starting from the date of harvest at 00 hours over a period of 7 days.

The weight loss due to staleness was obtained by subtracting the final weight of canes at the time of chemical analysis from the initial weight of respective bundles whereas for brix, pol, purity or % recovery, the same obtained from the samples analysed on starting day were taken as initials. Loss in total sugar was calculated on the basis of average cane yield/acre of 30 tons.

RESULTS AND DISCUSSION

Both qualitative and quantitative loss that resulted due to staleness was studied in this piece of work. Tables 1-3 show the mean observations on weight loss, brix, pol, purity, recovery as well as on total sugar lost as affected by different lengths of staleness and climatic factors prevailing during the period. Data for early, mid and late part of crushing season representing 3 climatic regions are given in tables 1, 2 and 3 respectively. Except for brix that resulted in an increase from 16.40 to 17.62 for early from 17.19 to 19.17 for mid from 18.65 to 20.43 for late crushing season, all other parameters have recorded a highly significant (1% level) decrease due to staleness. Perdomo and Ramos (1977) in a 'deterioration of cane after harvesting study' also observed similar increase in brix but a fall in pol, purity etc.

The trend of effect of staleness on all the parameters studied is gradual but cumulative. Initially, the effect for one day staleness is not significant but then the deterioration has become sharp and highly significant. Kapur and Kumar (1977) while studying post harvest deterioration of sugarcane reported that by third day, the effect of staleness in terms of sugar content, purity etc. were significant and they suggested transportation of cane to the factory before this. Gupta et al (1968) also reported that post harvest deterioration after lapse of certain time was very significant.

The weight loss of green cane is one of the parameters studied that fits into the above description. The green detashed cane when left exposed has simply dried up due to staleness through the physiological process and the weight loss has increased upto 8.23%, 8.47% and 11.39% over a period of six days during the different part of the crushing season.

Pol. purity and %recovery have also shown similar significant decrease and % recovery in the parameter that is affected worst. The loss is a colossal one and almost 50% of the total recoverable sugar is lost (48.72 for early and 47.31 for late crushing season). During the cooler period i.e. the mid crushing season of late January when the temperature is lowest, the loss is a little bit lower but nonetheless it (loss) has reached (35.12%). Wood et al (1972) reported about 14% recoverable sugar loss for a staling period of 4-7 days.

The total sugar per acre lost due to staleness is, except for the first day of staleness, highly significant and when our tons sugar production per acre is on around 2.35 (even with 30 TCA), already the lowest in the world, the loss due to this factor alone is as high as 50% which is evident when seen dropping it to as low as 1.105 TSA (Figure-1) against the initial of 2.39 TSA. Lingerfelt et al (1965) while studying the rate of deterioration after harvest reported that the loss of cane weight and inversion of sucrose has an extremely important effect on the rates of recoverable sugar to tonnage of fresh cane and they termed these losses as 'hidden losses'. They quantified the daily average loss of 96° sugar slightly greater than 10lbs of sugar per ton of cane per day or approximately 4% of initially available sugar.

The climatic effect is, as seen from the same figure, once again prominent when we consider the graph for late season. In this case, the start is at the highest (2.397 TSA) but still the same has the lowest figure of 1.105 TSA indicating a heavy loss. Interestingly, the mid season graph, though started with a lowest figure of 2.289 TSA, has also the lowest slope and consequently, the minimum loss. The early season graph is in between these two extremes and the position is clearly mostly a weather-dependent one. Wood et al (1972) while conducting an experiment to study deterioration losses in whole stalk sugarcane observed that the rate of deterioration varied considerably depending on weather conditions and that the loss was most rapid in the hot summer months.

Because of its so great an economic impact cane should be guarded against staleness by all means and greater attention is needed during drier and warmer periods i.e. during the early and late crushing season.

Table-1 Effect of different lengths of staleness on Weight, Brix, Pol, Purity, % Recovery and Total sugar per acre during the early crushing Season (Data are average of a minimum of 4 observations).

Staleness (days)	Weight loss (Kg)		Brix	Pol	Purity	% Recovery	TS loA st
	Initial Wt.	Final Wt.					
0	6.23	6.23	16.40	14.34	87.43	7.80	0.0000
1	5.30	5.17	16.65	14.39	86.39	7.46	0.0250
2.	6.03	5.88	16.60	14.25	85.88	6.85	0.0710
3.	5.45	5.27	17.09	13.00	76.09	5.55	0.2228
4	6.50	6.08	17.39	12.31	70.85	4.78	0.6202
5	6.02	5.54	17.62	12.17	69.02	4.44	0.8034
6	6.32	5.80	16.96	11.41	67.26	4.00	0.9382

Table-2 Effect of different lengths of staleness on Weight, Brix, Pol, Purity, % Recovery and Total sugar per acre during the mid crushing season (Data are average of a minimum of 4 observations)

Staleness (days)	Weight loss (Kg)		Brix	Pol	Purity	% Recovery	TSA lost
	Initial Wt.	Final Wt.					
0	6.45	6.45	17.19	15.50	90.19	7.63	0.0000
1	6.12	5.98	17.96	15.89	88.46	7.33	0.0206
2	6.12	5.88	17.55	15.36	87.52	6.61	0.1200
3	6.53	6.17	18.55	15.70	84.67	6.56	0.1769
4	6.20	5.83	18.22	14.63	80.27	5.85	0.3188
5	6.92	6.50	18.69	14.69	78.67	5.67	0.3716
6	5.90	5.40	19.17	14.16	73.92	4.95	0.6810

Table-3 Effect of different lengths of staleness on Weight, Brix, Pol, Purity, % Recovery and Total sugar per acre during the late crushing season (Data are average of a minimum of 4 observations)

Staleness (days)	Weight loss (Kg)		Brix	Pol	Purity	% Recovery	TSA lost
	Initial	Final					
0	6.10	6.10	18.65	16.46	88.23	7.99	0.0000
1	5.53	5.40	18.43	15.94	86.47	7.40	0.0434
2	5.92	5.68	18.55	14.98	80.74	6.48	0.1835
3	5.70	5.40	18.77	14.87	78.74	6.25	0.2786
4	5.78	5.25	20.43	15.23	74.52	5.47	0.6933
5	5.72	5.15	20.43	14.04	68.71	4.65	0.9990
6	5.62	4.98	20.37	13.63	66.78	4.21	1.2916

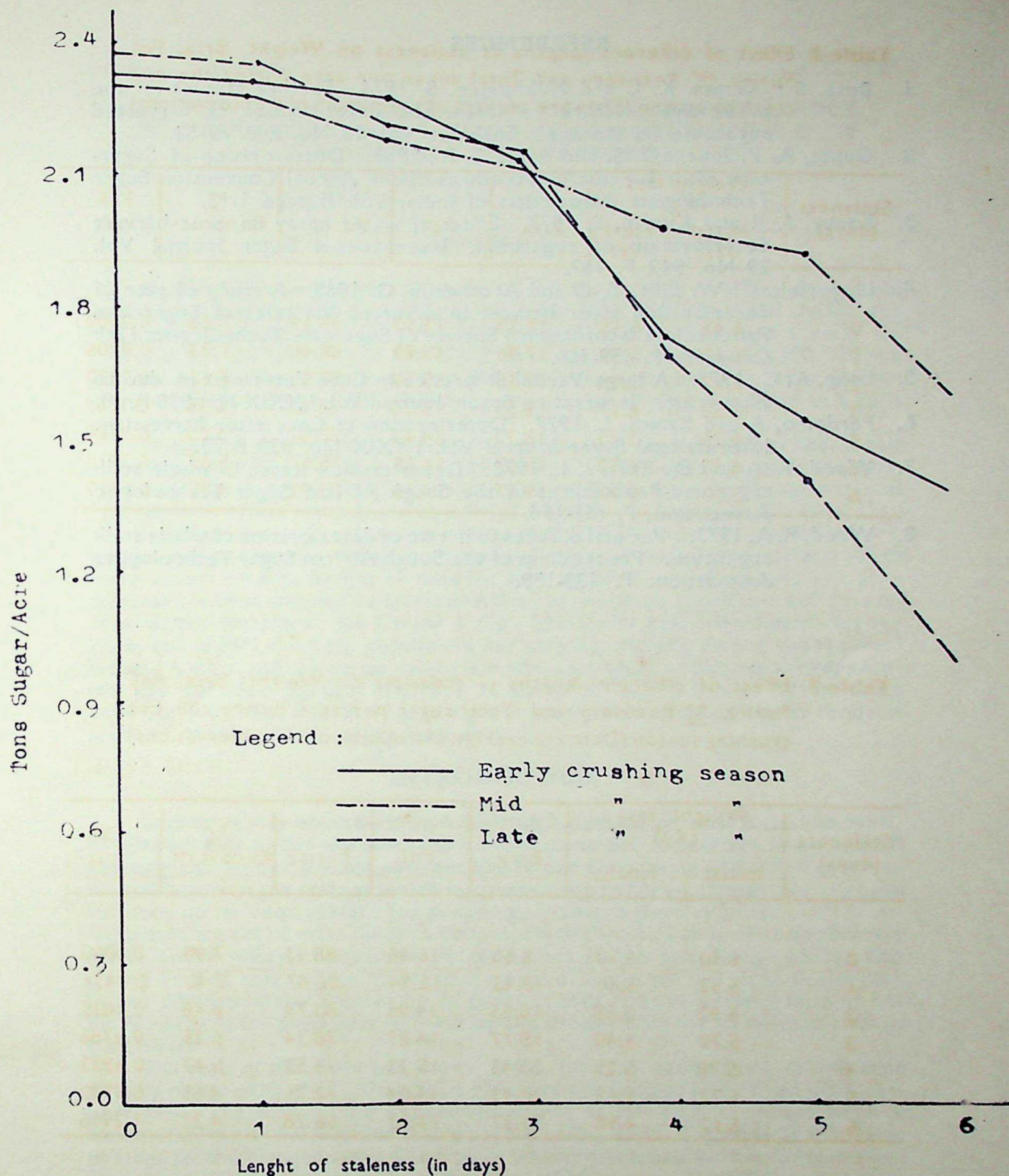


Figure 1 : Reduction in total sugar production/acre caused by different lengths of staleness during early, mid and late crushing season.

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