

Impact of Pre Harvest Burning in Sugacane

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ABSTRACT

Sugarcane is one of the important commercial crops of India. Now a days due to scarcity of labour and increased cost of cultivation sugarcane cultivation is under doldrums. Under scarcity of labour pre-harvest burning and crushing of cane is a practice in overseas. Loss of cane in terms of cane weight and quality was more in burnt cane as harvesting delays after burning. The loss in cane weight and quality was less within 24 hours after burning. Cane quality in terms of reducing sugar percentage, dextrins contain in cane was high in burnt cane than unburnt cane. Loss in cane weight within 24 hours after burning was 4.5% and it raised up to 17.35% at 96 hours after burning. Burning of cane drastically reduces Juice extraction percentage up to 44.23% at 96 hours after burning. Juice pH was more acidic in burnt cane than Unburnt cane. Burning of cane reduces sucrose Percent 8.73% within 24 hours and it rises up to 24.66% at 96 hours after burning. Intentional burning of cane as a means of cost of harvest is not advisable because of loss in cane quality and quantity, environmental problems, additional cost in harvesting charges and differential cropping patterns of farming community etc.

Key words: Pre harvest burning, Juice quality, Dextran, T A I (Titreble acidity index), C C S yield.

INTRODUCTION

Now-a-days cane cultivation in India has become a difficult task due to increased cost of cultivation coupled with labour scarcity. From the estimated figures of sugarcane cost of cultivation nearly 32 to 36% of cost of cultivation goes to harvesting alone. Mechanisation in harvesting is the only solution to meet the present day labour problem in sugarcane cultivation in India especially for coastal districts of Andhra

Pradesh. But, unfortunately due to various reasons mechanical harvesting in sugarcane was at reformation stage for adoptability.

One school of thought to overcome the problem for cane harvesting under hike in labour charges or labour scarcity is pre harvest burning. Pre harvest burning of sugarcane fields is primarily to get rid of the dried leaves or trash, as it is called, which has accumulated over a growing period as long as 12 months.

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Farmers burn sugarcane to reduce the amount of leafy extraneous material including stalk tops, delivered with cane to the factories for processing. Sugarcane plant consists 75 to 80% net cane (stalks) from which the juice is extracted and the sugar crystallized. The other 20-25% of plant consists leafy material including tops from which little or no sugar produced. Ill effects of sugarcane burning includes environmental problems and health problems (Anonymous, 2011).

Burning of cane is a common practice in abroad and to some extent in the Gujarat state of India (Bhaumik et al., 2010). Burning destroys sucrose particles in the cane and also promotes chemical changes facilitating deterioration of sucrose and juice purity. The concrete evidence of the direct effect of burning on sugar recovery related to the dextran which interferes with both milling and manufacturing process. (Bhaumik et al., 2010). There are different methods of sugarcane harvesting practiced world over. In abroad cane fields are burnt before harvesting perhaps to make it easier for manual harvesting. In India accidentally burned cane fields will be crushed early and the factories also buy such burnt cane, but at a discounted price of upto 10% of cane whether it is comparable to the loss of sugar recovery if any or not. In view of the above facts, the study was made to study on chemistry and economics of pre harvest burnt cane crushing.

MATERIALS AND METHODS

During sugarcane crop season 2010-11 one random cane field (sugarcane variety 2000 A226) in the farm area is chosen and the field is set fire. The leaves are burnt off the stalk about 80% of the trash including straw, the dry leaves are burned off. After completion of burning, 50 stalks of burnt cane were cut and sent to the laboratory analysis along with 50 stalks of normal cane of similar variety and age which are harvested at similar time. The laboratory analysis based on 24 hours duration are performed upto 96 hours with burnt and unburnt cane. The data was compared with mean of six samples. Juice analysis and cane

quality parameters were studied by standard procedures given by Chen and Chow (1993), i.e., juice sucrose (Made & chen, 1977), reducing sugars (Nelsan 1944), P^H of the juice was recorded with systronics P^H system Chen and Chow (1993), Titreble acidity index(TAI) was measured by the method give by Chen & Chow (1993) and soloman et al. (2011). Commercial cane sugars (CCS) was calculated by following equation $CCS\% = 1.029 \text{ pol}\% \text{ in juice} - 0.292 \text{ brix } \%$ in juice (Bakshiram et al., 2001). Dextran content in juice was estimated by Haze method, procedure given by Keinry (1969).

RESULTS AND DISCUSSIONS

Concrete differences in juice quality parameters and cane weight were observed between burnt and unburnt canes. Data on juice quality parameters and economics of burnt and unburnt cane crushing were presented in table 1 and 2.

Brix%: Juice brix percent was decreased over a period of 96 hours after burning when compared to unburnt cane.

Sucrose%: Reduction in sucrose percent was at 8.73% when cane was crushed at 24 hours after burning and it was raised to 24.6% at 96 hours after burning over unburnt cane.

P^H , Ec and TAI: Juice P^H , Ec and Titreble acidity index was also shown similar trend like juice sucrose percent in burnt cane over unburnt cane.

Reducing Sugars: Percent reducing sugars were more in burnt cane over unburnt cane. The percent increase in reducing sugars was 62% at 24 hours after burning ant it was at 75.4% at 96 hours after burning.

Dextran (PPm): Dextran content in juice was higher in burnt cane than unburnt cane. As the crushing delays after burning the Dextran content increased to 2 to 3 folds at 96 hours after burning.

Juice extraction percent: Cane juice extraction percent was low in burnt cane over unburnt cane over a period of delayed crushing. It was at 50.2 percent at 24 hours after burning and decreased to 44.2 percent at

96 hours after burning due to loss of moisture content in cane by burning.

Cane Weight: Reduction in cane weight was also prominent in burnt cane over unburnt cane and it was high at 96 hours after burning than crushing within 24 hours after burning.

CCS percent: Percent commercial canesugar was also low in burnt cane over unburnt cane. It was 11.76 percent at 96 hours after burning, which is low when compared to cane crushed at 24 hours after burning (13.75 %).

CCS Yield (t/ha): Commercial cane sugar yield was low in burnt cane when compared to unburnt cane. The reduction pace was high at 96 hours after burning than 24 hours after burning.

Similar findings on reduction in cane weight and juice quality parameters of sugarcane due to crushing of preharvested burnt cane was also reported in sugarcane by Chiranjeevi Rao (1989), Patel et al. (1993) and Bhaumik et al. (2010) due to cane tissue damage and loss of moisture from cane coupled with extermination of organic matter.

On a over view the following points to be discussed critically on impact of preharvest burning on quality on sugarcane

- A. Reduction in weight because of burning (Loss to farmer) ;
- B. Reduction in sugar recovery after burning (Loss to factory) ;
- C. Reduction in harvesting and transportation expenses

A. Reduction in weight because of burning (Loss to farmer)

After burning of cane, we have to harvest and crush within 24 hours, otherwise we will face reduction in burnt cane weight and quality due to inversion of sugars and loss of cane moisture. After cane harvesting deterioration of cane quality will be much faster in burnt cane when compared to unburnt cane.

Though burning process is adopted by the farmers with the agreement of factory to crush within 24 hours of burning, invariably it takes more than 3 days for crushing depending on transport and labour facilities available in the vicinity of factory operating area, because

- Burning process will take up in one day, on that day it is not possible to take up

harvesting, because it takes time for cooling of burnt cane.

- On 2nd day, harvesting will taken up with the labour, if possible loading also on 2nd day it self, if time permits.
- On 3rd day of burning Transport of cane will take up.
- By the time it reaches weighing plat form, it may take 3rd day or 4th day of burning, depending on supply of cane and stale cane in the weighing yard.
- Finally it will be crushed on 4th day, by the time where both cane and quality loss already took place.

At present factory management is effort to take up crushing of an accidentally burnt cane to an extent of small area, on priority basis by paying 10% less cane price, which may not be affordable for crushing of burnt cane from large areas or from total agreedemented cane area.

Based on experimental data it is clearly evident that there is a reduction in cane yield on burning to an extent of 4.5 percent due to loss of moisture from cane, even crushed within 24hrs after burning when compared to normal yield of 40 tonnes per acre under irrigated conditions. This percent reduction in cane was extended upto 17.35 percent under crushing at 96 hrs after burning.

According to present payment of cane price for burnt cane on 10% cane weight loss basis within 24hrs after burning, farmer is losing Rs.3240/- and Rs.2705/- per acre respectively under irrigated and rainfed cane supply. But factory is deducting only Rs.2916/- and Rs.1822/- respectively. An amount of Rs.324/- and Rs.253/- per acre respectively under irrigated and rainfed cane supply is born by the factory when cane was crushed within 24 hrs after burning.

This loss to factory goes upto Rs.1249/- and Rs.780/- per acre when cane was crushed at 96 hrs after burning under cane supply from irrigated and rainfed conditions respectively. (Table I)

B. Reduction in sugar recovery after burning (Loss of factory)

After burning of cane, we have to crush the cane with in 24 hours of burning, which may not be possible under factory operational area. In burnt cane, inversion process is faster and accumulation of non sugars is more (reducing sugars), which strongly influences sugar recovery in factory.

More over reduction in sugar recovery not only loss to the factory, but also a hidden loss to farmers, because based on factory recovery, cane price will be decided.

Sugar production (CSS yield was also low in burnt cane supply from irrigated (1.03 t/ac) and rainfed (0.14 t/ac) conditions, when cane crushed with 24 hrs after burning. This reduction is upto 1.12 and 0.71 t/ac respectively when burnt cane crushed at 96 hrs after burning.

Payment of price based on cane sugar yield (CCS) at 10% loss basis was also a loss to the factory, as they are deducting Rs.25,029/- and Rs.3402/- against Rs.27818/- and Rs.3780/- for supply of burnt cane from

irrigated and rainfed conditions respectively crushing with in 24 hrs after burning.

According to this factory is incurring a loss to an extent of Rs.2781/- and Rs.378/- per acre respectively when cane supply from irrigated and rainfed conditions and crushed with in 24 hrs after burning. This loss goes around Rs.4000/- and Rs.3000/- respectively when crushing of burnt cane delayed beyond 74 hrs after burning. (Table II).

C. Reduction in harvesting and transportation expenses.

Though burning of cane reduces dredgery to some extent, by reducing labour cost towards detashing of cane at harvest, at the same time, it requires a minimum of labour, towards cutting of crown leaves which will remain unburnt and attached to the cane during burning of cane. More over the labour demand more price to harvest the burnt cane, as the burnt field is not as convenient as the un burnt (green) field, because of ash.

There won't be any reduction in transport expenses, why because, cane transport is same both in burnt and unburnt canes.

TABLE I: Data on Cane Quality and Cane weight parameters of Burnt and Un burnt canes. (Sugarcane 2000A 226)

Treatment	Brix (%)	Sucrose (%)	% reduction in burnt cane over UB	pH	Ec ds m ⁻¹	TAI	R.S %	% increase in burnt cane over UB	Dextran (PPM) at 96 hab	% Juice extraction	% Reduction in cane weight	Ccs %	CCS Yield (t/ac)	Reduction in cane yield (Kg/ac)	Cane Yield (t/ac) Due to pre harvest burning
24 hab B	18.73	18.45	8.73	5.13	2.01	27.16	0.29	62.0	35.0	50.24	4.50	13.75	5.25 (I) 3.79 (RF)	1800 (I) 1125(RF)	38.2 (I) 23.875(RF)
UB	17.18	20.06	-	5.20	1.54	26.59	0.11	-	21.6	56.32	1.21	15.91	6.28 (I) 3.93(RF)	484 (I) 302(RF)	39.576 (I) 24.69(RF)
48 hab B	18.35	17.49	10.98	5.08	2.09	34.0	0.39	33.0	30.0	48.54	9.57	12.85	4.65 (I) 2.90(RF)	3828 (I) 2393(RF)	36.17 (I) 22.61(RF)
UB	19.33	19.41	-	5.21	1.60	23.93	0.26	-	25.0	54.60	3.30	14.59	5.64 (I) 3.53(RF)	1320 (I) 825(RF)	38.68 (I) 24.17(RF)
72 hab B	16.97	16.56	24.03	5.02	2.13	57.1	0.41	39.0	60.0	44.40	11.36	12.30	4.63 (I) 2.72(RF)	4544 (I) 2840(RF)	35.45 (I) 22.16(RF)
UB	19.73	20.54	-	5.19	1.68	26.53	0.25	-	20.0	56.30	4.06	15.65	6.01 (I) 3.75(RF)	1620 (I) 1015(RF)	38.18 (I) 23.98(RF)
96 hab B	18.40	16.46	24.60	5.05	2.38	48.64	1.18	75.4	100.0	44.20	17.35	11.76	3.89 (I) 2.43(RF)	6940 (I) 4340(RF)	33.06 (I) 20.66(RF)
UB	21.20	20.52	-	5.24	1.98	24.96	0.29	-	20.0	56.30	4.05	13.11	5.01 (I) 3.14(RF)	1800 (I) 1013(RF)	38.20 (I) 23.98(RF)

Normal Yields: 40 t/ac irrigated (I) (Gross 72,000.00)

25 t/ac Rainfed (RF) (Gross Rs.45,200.00)

Cane Price Rs.1800.00 per tonne

CCS Yield (Sugar) @ 2700per Qtl

TABLE II: ECONOMICS OF BURNT CANE OVER UNBURNT CANE

Treatment	Gross Amount (Rs/ac) @ Rs.1800/- per tonne	Reduction in Rs/-in Burnt cane over unburnt cane/ac	Reduction of cane price in burnt cane/ac (@ 1800/- per tonne)	Reduction of cane price by factory @ 10%less/ac (@ 1620/- per tonne)	Loss born by factory on weight basis/ac	Reduction in CCS yield in burnt cane over unburnt cane (t/ac)	Reduction of sugar price in burnt cane/ac over un burnt cane @ 27000/- per tonne sugar	Reduction of sugar price by factory @ 10%less/ac (@ 24300/- per tonne)	Loss born by factory on CCS (Sugar) basis/ac
24 hab	68,760.00 (I)	2,368.00 (I)	3240.00	2916.00	324.00	1.03 (I)	27,810.00	25,029.00	2,781.00
B	42,975(RF)	1,467.00(RF)	2025.00	1822.00	253.00	0.14 (RF)	3780.00	3402.00	378.00
UB	71,128.00 (I) 44,442.00(RF)	-	-	-	-	-	-	-	-
48 hab	65,106.00(I)	4,578.00(I)	6890.00	6201.00	689.00	0.99 (I)	26,730.00	24,057.00	2673.00
B	40,698.00(RF)	2,808.00(RF)	4307.00	3876.00	431.00	0.63 (RF)	17,010.00	15,309.00	1701.00
UB	69,624.00(I) 43,506.00(RF)	-	-	-	-	-	-	-	-
72 hab	63,810.00 (I)	4,914.00 (I)	8179.00	7361.00	818.00	1.65 (I)	44,550.00	40,095.00	4505.00
B	39,888.00(RF)	3,276.00(RF)	5112.00	4601.00	611.00	1.03 (RF)	27,810.00	25,029.00	2781.00
UB	68,724.00 (I) 43,164.00(RF)	-	-	-	-	-	-	-	-
96 hab	59,508.00 (I)	9,252.00 (I)	12,492.00	11,243.00	1249.00	1.12 (I)	30,240.00	27,216.00	3024.00
B	37,188.00(RF)	5,976.00(RF)	7,812.00	7031.00	781.00	0.71 (RF)	19,170.00	17,253.00	1917.00
UB	68,760.00 (I) 43,164.00(RF)	-	-	-	-	-	-	-	-

Normal Yields: 40 t/ac irrigated (I) (Gross 72,000.00)

25 t/ac Rainfed (RF) (Gross Rs.45,200.00)

Cane Price Rs.1800.00 per ton

CCS Yield (Sugar) @ 2700per Qtl

CONCLUSIONS

From the above observations it is clearly evident that preharvest burning leads to loss in cane weight, loss in sugar recovery and production of inferior quality sugar. The pace of loss depends on the time lag between harvesting and crushing of burnt cane.

As a over view intentional burning of cane as a means of cost of harvest is not advisable for our Indian conditions because of a) Cane weight loss (Quantity) b) Sugar loss (Quality) c) Environmental problems d) Additional cost on harvesting charges. e) Differential cropping pattern of farming community etc.

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