

## LODGING OF SUGARCANE AND ITS INFLUENCE ON YIELD AND QUALITY OF CERTAIN CULTIVARS

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Eventhough sugarcane is not a major crop of Kerala state, it is cultivated in an area of about 10,000 hectares in the districts of Quilon, Alleppey, Idukki and Palghat. The average recovery of sugar in the state is only 7.71 % which is the lowest in the country, the maximum being 10.85% in Maharashtra (Ramana Rao *et al.*, 1979). With the average production of 55 tonnes of cane per hectare, one can imagine the very low prospects of sugar industry in the state. Unless effective steps are taken to improve the cane yield and sugar recovery, the already sick factories of the state will find their way to become more sick. While admitting the fact that the state lies in the latitude of 8°N where the temperature at the time of ripening of sugarcane is not low enough for the accumulation of maximum sugar, the very low recovery is also due to the poor management of the crop in the cultivator's fields. In a state like Kerala where the rainfall is high followed by heavy storms during the south west and north east monsoon, the sugarcane crop is subjected to lodging. The heavy currents due to flood waters occurring in the low lying areas along the river banks where sugarcane is cultivated to a large extent also cause lodging of canes. Silt, sand and dirt are deposited on the canes so lodged, and when the flood waters recede the axillary buds germinate. The lodged canes are also subjected to attack from rodents to a great extent. The dirt and trash sticking to the canes will interfere with juice quality and affect clarification. This also causes wear and tear in factory, milling train, pumps, screens, pipe lines etc. Thus lodging causes unclear cane production resulting in low sugar recovery and loss to the sugar mills.

An attempt has been made in the present study to ascertain the loss occurring in yield and quality in the popular varieties of sugarcane due to lodging under the conditions existing in this area.

### Materials and Methods

Three popular varieties viz., Co 997, Co 785 and Co 62175 were studied from a trial plot laid out at the Sugarcane Research Station, Thiruvalla during 1980-81. The plots received a uniform fertilizer dose of 165 kg N, 82.5 kg P<sub>2</sub>O<sub>5</sub> and 82.5 kg K<sub>2</sub>O/ha and a row spacing of 90 cm. Observations were recorded from the above three varieties from fully lodged canes, half lodged canes and non-lodged canes from an area of four square metre from four locations. The observations were recorded before the harvest of the canes in December 1980, The canes in the experimental area suffered from floods due to the overflow of the river four times

during the growing period of the crop. The stagnation of water ranged for a period of 3-5 days to a depth of 30-90 cm. Three canes each from four locations were observed and the mean values of length of canes, girth, number of millable canes, number of internodes, weight of canes, sprouting of buds, rooting of nodes and quality characters like brix per cent, pol per cent and purity per cent were recorded and analysed statistically for varietal differences. The percentage gain or loss for the various characters in the three varieties give an indication on the effect of lodging.

### Results and Discussions

The data presented in Table 1 indicate that there can be a significant reduction in the height of canes which is a major factor contributing for yield.

As the cane lodges, the vegetative growth is arrested and length is reduced. The reduction in length is great in the fully lodged canes in all the three varieties. However, the girth of cane is not seen significantly affected due to lodging even though erect canes show maximum thickness.

As regards number of internodes, the data show significant difference (Table 2). The reduction in number of internodes is maximum in the fully lodged canes and minimum in the erect canes. This again shows that the growth of canes is adversely affected due to lodging and the canes fail to put forth maximum number of internodes.

The number of axillary buds sprouted and nodes rooted show substantial increase from the non-lodged canes to fully lodged canes (Table 2). The maximum bud sprouting is noticed in the fully lodged canes in all the three varieties and gradual reduction is seen in the half lodged and erect canes. But sprouting in the erect canes is minimum in the variety Co 997 and maximum in Co 62175. When full lodging occurs in maximum sprouting is noticed in Co 997 and in half lodged conditions this character is more manifested in Co 785. Sprouting of buds during the growth period of the cane is an undesirable character.

It is clear from the data presented in Table 2 that maximum rooting of nodes has occurred in the fully lodged canes. The presence of aerial roots in the nodes is maximum in the variety Co 62175 and minimum in Co. 997. This shows that Co 62175 puts forth roots from the nodes on lodging even without the development of buds. This tendency is noticed in half lodged canes also. Though Co 997 shows maximum bud sprouting in fully lodged canes the variety fails to put forth maximum roots from the nodes of fully lodged canes. In the non-lodged and half lodged canes no root development was observed in this variety. Co 785 recorded maximum bud development in the erect, half lodged and fully lodged canes. Aerial sprouting and rooting cause more expenditure on cleaning of canes, and loss in sugar recovery.

Table 1  
Effect of lodging on height and number of internodes

Variety	Mean height (cm)			Percentage gain or loss over erect canes		Mean No. of internode			Percentage gain or loss over erect canes	
	Erect	Half lodged	Fully lodged	Half lodged	Fully lodged	Erect	Half lodged	Fully lodged	Half lodged	Fully lodged
Co 997	231.60	229.60	226.60	-0.86	-2.16	21.95	20.85	20.75	-5.00	- 5.47
Co 62175	246.60	239.95	235.60	-3.91	-4.46	25.30	23.68	22.15	-6.40	-12.45
Co 785	289.50	277.50	274.40	-4.15	-5.21	23,30	22.88	22.15	-1.30	- 4.94
C. D, (0.05) between varieties					17.51	2.25				

Table 2  
Effect of lodging on the development of axillary buds and rooting on the nodes

Variety	Mean Sprouted axillary buds (No.)			Percentage gain or loss over the erect canes		Rooting on the nodes (mean No.)			Percentage gain or loss over the erect canes	
	Erect	Half lodged	Fully lodged	Half lodged	Fully lodged	Erect	Half lodged	Fully lodged	Half lodged	Fully lodged
Co 997	0.28	0.85	1.70	+ 67.06	+507.14	...	...	0,13	...	+ 13.00
Co 62175	0.73	1.08	1.63	+ 47.95	+ 123.29	0.25	0.50	0.93	+ 100.00	+ 272.00
Co 785	0.50	1.35	1.60	+170.00	+22000	3.23	3.75	4,83	+ 16.10	+ 49 64
C. D. (0.05) between varieties					N.S.	N.S.				

Table 3  
Effect of lodging on number of millable canes and yield

Variety	Mean millable canes 000's/ha			Percentage gain or loss over erect canes		Mean yield,t/ha			Percentage gain or loss over erect canes	
	Erect	Half lodged	Fully lodged	Half lodged	Fully lodged	Erect	Half lodged	Fully lodged	Half lodged	Fully lodged
Co 997	86.250	91.875	66.875	+6.52	-22.46	69.375	60.325	47.825	-13.05	-31.06
Co 62175	90.000	90.625	88.125	+0.69	-7.60	107.500	96.575	74.375	-10.16	-30.81
Co 785	85.625	79.375	62.500	-7.29	-27.01	77.500	62.813	47.500	-18.95	-38.71
C.D. (0.05) between varieties			14.11			11.92				

Table 4  
Effect of lodging on brix, pol of juice and purity (percent)

Variety	Mean brix (per cent)			Percentage gain or loss over erect canes		Mean pol (per cent)			Percentage gain or loss over erect canes		Mean purity (per cent)			Percentage gain or loss over erect canes	
	Erect	Half lodged	Fully lodged	Half lodged	Fully lodged	Erect	Half lodged	Fully lodged	Half lodged	Fully lodged	Erect	Half lodged	Fully lodged	Half lodged	Fully lodged
Co 997	18.28	18.15	17.98	-0.13	-0.30	16.44	16.17	15.90	-0.27	-0.54	89.86	88.90	88.51	-0.96	-1.35
Co 62175	18.61	17.17	16.83	-1.44	-1.78	16.85	15.22	14.77	-1.63	-2.08	90.22	88.47	88.05	-1.75	-2.17
Co 785	17.75	17.31	16.64	-0.44	-1.11	15.53	14.83	14.40	-0.70	-1.13	87.71	85.75	85.57	-1.96	-2.14
C. D. (0.05) between varieties				N. S.		N. S.									

Table 5  
Effect of lodging on the recovery of sugar and commercial cane sugar production

Variety	Mean sugar recovery (per cent)			Percentage gain or loss over erect canes		Mean CCS,t/ha			Percentage gain or loss over erect canes	
	Erect	Half lodged	Fully lodged	Half lodged	Fully lodged	Erect	Half lodged	Fully lodged	Half lodged	Fully lodged
Co 997	11.46	11.23	11.00	-0.23	-0.46	7.95	6.77	5.26	-14.84	-33.84
Co 62175	11.79	10.54	10.18	-1.25	-1.61	12.67	10.18	7.57	-19.65	-40.25
Co 785	10.69	10.10	9.86	-0.59	-0.83	8.28	6.34	4.68	-23.43	-43.48
C. D. (0.05) between varieties						2.02				

Table 6  
Effect of lodging on girth of cane

Variety	Mean girth (cm)			Percentage gain or loss over erect canes	
	Erect	Half lodged	Fully lodged	Half lodged	Fully lodged
Co 997	6.1	6.1	6.0	0.00	-1.6
Co 62175	7.5	7.5	6.7	0.00	-10.6
Co 785	6.3	6.1	5.8	3.17	-7.9

C. D. (0.05) between varieties 0.69

The effects of lodging on the number of millable canes/ha and yield/ha are presented in Table 3. There is a slight increase in number of millable canes in half lodged canes in the varieties Co 997 and Co 62175, but this increase is not manifested in the variety Co 785. Clear reduction in number of millable canes is noticed in the fully lodged canes in all the three varieties, the maximum being in Co 785 and minimum in Co62175. The increase in number of millable canes in the half lodged canes may be due to the development of shoots from the underground stem. This phenomenon is not observed in fully lodged condition due to the breaking of roots.

The maximum weight of millable canes was recorded from the erect canes in all the three varieties followed by half lodged and fully lodged canes. The loss in weight is 13.05% in half lodged and 31.06% in fully lodged canes over the erect canes in the case of Co 997. In the case of Co 62175, the loss is 10.16% and 30.18% respectively for half lodged and fully lodged canes. For Co 785, the weight loss is 18.95% and 38.71 % for half lodged and fully lodged canes respectively.

Reduction in cane weight has been recorded by many workers due to lodging of sugarcane. Mathuria and Agrawal (1976) reported that lodging of cane reduced yield upto 55%. Agnihotri (1965) also reported the loss in yield and sugar due to lodging of cane. Sharma and Sharma (1979) observed reduction in yield of half lodged canes which varied from 39.20 to 54.40 quintals/ha and of fully lodged canes from 50.05 to 71.72 quintals/ha. The reduction in cane weight is contributed by the reduced length, less number of internodes, less thickness, more rooting and bud sprouting and also low number of millable canes.

### Quality

Table 4 presents the quality characters of the lodged and erect canes of the three varieties. The brix, sucrose content, purity and estimated sugar have been ascertained and all these quality parameters have been found to be superior in erect canes as compared to the half lodged and fully lodged canes.

### *Brix*

The nonlodged canes in all the varieties recorded maximum brix when compared to the half lodged and fully lodged ones. The percentage reduction in brix varied from 0.71 in Co 997 to 7.74 in Co 62175 in half lodged canes and 1.64 to 9.56 in fully lodged canes. Sharma and Sharma (1979) noticed a reduction in brix values upto the extent of 1.20% in half lodged canes and upto 6.50% in full lodged canes.

### *Sucrose*

The data in Table 4 clearly indicate that the decrease in sucrose content is minimum in the lodged canes over the unlodged canes, but Co 62175 shows higher percentage of loss in sucrose content when the cane lodges. The fully lodged canes showed maximum decrease in sucrose content in all the varieties studied. Mathuria and Agrawal (1976) and Sharma (1979) also reported similar results. The low sucrose content in lodged canes is due to the inversion of sugar consequent to bud sprouting and root formation at the nodes.

### *Purity*

The purity of juice (Table 4) was found to be the least in fully lodged canes when compared with the nonlodged and half lodged canes. A reduction upto 2.17% was observed in the purity of canes. The reduction in purity ranged between 0.96% and 1.96% in half lodged canes and 1.35% and 2.14% in fully lodged canes.

### *Commercial cane sugar and recovery*

The commercial cane sugar production depends solely on the yield and quality factors. It is clear from the data presented in Table 5 that lodging of canes affects adversely on the recovery of sugar. In the fully lodged canes the recovery was maximum. Co 785 recorded the minimum recovery in the fully lodged canes (4.68 t/ha). The half lodged canes always recorded values in between erect and fully lodged canes indicated that lodging of canes will adversely affect yield and sugar recovery. The percentage reduction of C.C.S. ranged from 14.84 to 23.43 in half lodged canes and 33.84 to 43.48 in fully lodged canes. It is quite evident that lodging of canes is one of the major factors for the low recovery of sugar. Agnihotri (1965) also obtained similar results from their studies. Sharma and Sharma (1979) recorded loss in commercial cane sugar upto 44.93 q/ha in fully lodged canes.

### **Summary**

In order to estimate the loss in weight and recovery of sugar in the lodged crop of sugarcane a study was conducted at the Sugarcane Research Station, Thiruvalla, Kerala during 1980-81. The length of canes, number of millable canes, weight and recovery of sugar were found to be reduced as the canes lodge. The loss

in weight ranged from 10.16% to 18.95% for half lodged canes and 30.81% to 38.71% in full lodged canes. The loss in cane sugar varied from 33.84% to 43.48% when the cane lodged completely. This phenomenon was more in fully lodged canes when compared with half lodged canes. It is therefore evident that lodging of sugarcane is one of the factors which decrease the production of cane and sugar.

### സംഗ്രഹം

തിരുവല്ല കരിമ്പു ഗവേഷണ കേന്ദ്രത്തിൽ നടത്തിയ പഠനങ്ങളിൽനിന്നും കരിമ്പു വീണുപോകുന്നതു നിമിത്തം വിളവിലും പഞ്ചസാരയുടെ ഉല്പാദനത്തിലും സാരമായ കുറവുണ്ടാകുന്നതായി തെളിഞ്ഞിരിക്കുന്നു. പകുതി വീഴാതെ കരിമ്പിനെത്തേക്കുപോകുന്നതിനും വീണുപോയ കരിമ്പാണ് കൂടുതൽ നഷ്ടം ഉണ്ടാക്കുന്നത്. കരിമ്പു വീണു പോകുന്നതു തടയുന്നതിന്റെ ആവശ്യം ഈ പഠനത്തിൽനിന്ന് മനസ്സിലാക്കാവുന്നതാണ്.

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