

Effects of Smut on Juice Quality of Sugarcane

M.S.Rahman, S.Rahman, M.B.Meah¹ and M.M.Hossain¹

Bangladesh Sugarcane Research institute,
Ishurdi, Pabna, Bangladesh.

Received on 17.2.97.

ABSTRACT

The effects of smut disease on two sugarcane clones I-291/87 and I-31/88 were studied in respect to juice quality including fibre content. Analysis of juice with respect to percent extraction, Brix, pol, purity and commercial cane sugar (C.C.S.) were found significantly lower in the diseased canes of both the test clones. Smutted canes significantly reduced the percent of juice extraction by 17.25 and 14.07; Brix 31.05 and 14.12; pol 47.08 and 27.45; purity 23.16 and 15.57, commercial cane sugar 64.12 and 39.39 in the clones I-291/87 and I-31/88 respectively compared to control. Fibre content was also found significantly higher in the diseased canes by 16.15 and 28.96 percent in the clones I-291/87 and I-31/88 respectively.

INTRODUCTION

Smut caused by *Ustilago scitaminea* Sydow is a serious disease of sugarcane occurring in many countries of the world (Agnihotri, 1990). The severity of smut reported from different sugar producing countries varies widely. In Bangladesh, it is a common and economically important disease of sugarcane (Ahmed, 1974). Goyal *et al.* (1982) reported that there was a decrease in juice quality viz., percentage of extraction, Brix, pol, purity and commercial cane sugar (C.C.S.) due to smut infection.

In abroad, considerable work have been done on juice quality of cane and changes on physiological aspects due to smut disease, but there is hardly any published report on these aspects in Bangladesh. Considering the importance of the disease, the present study was undertaken for the first time in Bangladesh with the objectives to assess the quality losses due to smut in sugarcane.

MATERIALS AND METHODS

The experiment was conducted with healthy and naturally smut infected (systemic infection) canes of two clones I-291/87 and I-31/88. The healthy and infected canes of both clones were planted in randomized block design (RBD) with three replications. Plot size 4m x 4m was used having 4 rows with row to row and plant to plant distance of 100 and 40 cm respectively. Individual plot contained 40 clumps in 4 rows (10 clumps/row). The experiment was laid out during the month of February, 1994 and the samples were taken in the month of December, 1994 at harvest to determine the changes induced in juice quality parameters viz., extraction percentage, Brix(%), pol (%), purity (%), commercial cane sugar and fibre content in sugarcane by adopting standard methods (Spencer and Meade, 1952).

¹ Professor, Department of Plant Pathology, BAU, Mymensingh.

RESULTS AND DISCUSSION

It is revealed from the Table 1 that diseased canes of clones I-291/87 and I-31/88 showed a significant reduction in juice extraction by 17.3 and 14.1 percent respectively compared to healthy canes (check). Similar results have been reported earlier (Goyal *et al.*, 1982; Bachchhav *et al.*, 1979; Kumar *et al.*, 1989). They observed reduction of juice extraction ranged from 13.33 to 60.87 percent due to smut disease. Kamal *et al.* (1981) recorded reduced juice extraction percentage when sugarcane was infected by red rot. A significant reduction in juice extraction percentage was also observed in grassy shoot disease, a systemic disease of sugarcane caused by mycoplasma (Singh, 1974).

Table 1. Effects of smut infection on juice quality.

Parameters (%)	Clone I-291/88		% Decrease (-)/ Increase (+) over healthy check	Clone I-31/88		% Decrease (-)/ increase (+) over healthy check	LSD at	
	Healthy	Diseased		Healthy	Diseased		5%	1%
Juice extraction	49.7	41.1	-17.3	51.8	44.5	-14.1	1.93	2.29
Brix in juice	16.2	11.2	-31.1	12.5	10.7	-14.1	1.26	1.90
Pol in juice	13.0	6.9	-47.1	9.2	6.7	-27.5	1.87	2.83
Purity	80.3	61.7	-23.2	73.8	62.3	-15.6	9.97	15.10
Commercial cane								
sugar (C.C.S)	10.1	3.6	-64.1	5.9	3.6	-39.4	1.21	1.84
Fibre content	14.2	16.6	+16.2	12.2	15.7	+29.0	1.92	2.90

In the present study, the clone I-291/87 and I-31/88 showed significant reduction in Brix by 31.1 and 14.1 percent respectively in the diseased canes compared to healthy ones. The results are in agreement with the earlier findings (Bachchhav *et al.* 1979; Goyal *et al.* 1982; Padmanaban *et al.* 1988 and Kumar *et al.* 1989). They found the reduction of Brix in juice ranged from 3.39 to 27.25 percent. Reduction of Brix % in juice was reported due to red rot disease of sugarcane (Shindhu *et al.*, 1969; Rao *et al.*, 1984). GSD decreased the Brix% in juice of sugarcane (Singh and Rao, 1967; Singh, 1974). Talukder (1994) also found reduction of Brix % in juice due to WLD ranged from 24.53 to 29.69 percent compared to control.

Pol percent in juice was found to be decreased significantly in both the tested clones due to smut. The reduction was 47.1 and 27.5 percent in the diseased canes of clones I-291/87 and I-31/88 respectively compared to healthy canes. The results are in conformity with the findings of other researchers (Bachchhav *et al.*, 1979; Goyal *et al.*, 1982; Padmanaban *et al.*, 1988 and Kumar *et al.*, 1989). They reported that the pol percent in juice was reduced by 6.55 to 38.70 due to smut compared to control. Similar observations on reduction of pol percent in juice were recorded in other systemic diseases like GSD and WLD of sugarcane. Singh and Rao (1967) observed reduction in pol percent in juice in GSD infected cane. Talukder (1994) also found that the pol percent in juice was dropped between 27.78 to 35.55 in WLD infected cane.

Significant reduction of purity percent of juice was observed in the present study due to smut in cane. The reduction was 23.2 and 15.6 percent in the smut infected canes of clone I-291/87 and I-31/88 respectively compared to healthy canes. This is in agreement with the findings of various workers (Mohan Rao and Prakasam, 1956; Bachchhav *et al.*, 1979; Goyal *et al.*, 1982; Padmanaban *et al.*, 1988 and Kumar *et al.*, 1989). They stated that purity percent of juice decreased in smut infected cane ranging from 2.53 to 16.64. Red rot also reduced purity percent of juice (Singh and Waraitch, 1977; Kamal *et al.*, 1981; Singh and Waraitch, 1981; Rao *et al.*, 1984). Reduction of purity percent in juice was also observed in GSD infected cane (Singh, 1974). Talukder (1994) also found the reduction of purity percent in juice ranging from 4.52 to 8.30 in WLD infected cane.

Smut infection caused a significant decrease of commercial cane sugar (C.C.S.) in both the tested clones in the present investigation. It was found that C.C.S. was reduced by 64.1 and 39.4 percent in the diseased canes of clones I-291/87 and I-31/88 respectively compared to healthy canes. Similar results were also obtained by Goyal *et al.*, (1982) and Kumar *et al.*, (1989). They found the reduction in C.C.S. ranging from 8.26 to 18.30 percent in smut infected canes. Talukder (1994) reported a decrease in C.C.S. by 30.05 to 39.06 percent in the WLD infected canes.

It is also seen from the Table 1 that fibre content in cane was also observed significantly higher in smut infected canes. It was found that the fibre content increased by 16.2 and 29.0 percent in the diseased cane of clone I-291/87 and I-31/88 respectively than that of healthy ones. James (1973) reported that the fibre content of smut infected canes was much higher. Goyal (1980) also found higher fibre content in sugarcane due to smut infection in the variety Co. 1158.

From this experiment it can be concluded that smut infected cane deteriorates the important juice quality parameters like Brix, pol, purity finally affecting the commercial cane sugar. Therefore, the smut susceptible varieties should not be released or cultivated.

ACKNOWLEDGEMENT

The authors are grateful to the Director, Bangladesh Sugarcane Research Institute for providing necessary facilities for carrying out the present investigation.

REFERENCES

- Agnihotri, V.P. 1990. Diseases of sugarcane and sugarbeet (Revised edition). Oxford and IBH Publishing Co. Pvt. Ltd. 66 Janpath, New Delhi. pp. 73-103.
- Ahmed, H.U. 1974. Disease Problems of Bangladesh. Bangladesh Sugar Journal. 1.11
- Anonymous, 1970. Laboratory Manual for Queensland Sugar Mills (Fifth ed.). Watson, Ferguson and company, Brisbane, Australia. p.250.
- Bachchhav, M.B.; Hapase, D.G.; Shingte, V.V. and Ghure, T.K. 1979. Note on losses in yield and juice quality of sugarcane affected by smut. *Indian J. Agric. Sc.*, 49: 905-907.
- Dhumal, K.N. and Nimbalkar, J.D. 1983. Studies in grassy shoot disease affected sugarcane cultivars Co. 419 and Co. 740. *Indian Phytopath.*, 36: 448-452.

- Ghorpade, L.N. and Joshi, G.V. 1981. Studies on photosynthesis in sugarcane var. co. 740, infected by mosaic virus. *Indian Phytopath.*, **33**:33-37.
- Goyal, S.P. 1980. Studies on sugarcane smut by *Ustilago scitaminea* Sydow. M.Sc. thesis. pp. 1-38.
- Goyal, S.P.; Vir, S. and Taneja, A.D. 1982. Effect of sugarcane smut on cane yield and juice quality. *Indian Sugar*, **32**(3) : 173-175.
- James, G.L. 1973. Effect of smut infection on sugar yield. *Sugarcane Path. Newsl.*, **10**: 32-33.
- Joshi, L.K. and Sharma, B.L. 1967. Studies on losses in sugarcane yield and juice quality due to incidence of smut in Dabra region of Moddha Pradesh. *J.N.K.V.V. Res. Jnl.*, **1** : 24-26.
- Kamal; Singh, R.P. and Verma, K.P. 1981. Effect of red rot of sugarcane on the yield and juice quality. *Co-op. Sug.*, **12** : 413-414.
- Kar, K. and Varma, H.S. 1962. A review of effect of sugarcane disease on yield and juice quality in Uttar Pradesh. *Indian Sugar*, **12** : 103-108.
- Kumar, S.; Kumar, D. and Sindhu, R.N. 1989. Change in yield attributes, juice quality and mineral nutrients in cane juice due to smut infection. *Indian Sugar*, **39** (4): 233-237.
- Madan, V.K.; Poonam Srivastava; Misra, S.R.; Namita Soni and Saxena, Y.R. 1988. Bio-Chemical studies on smut affected sugarcane. *Indian J. Bio. Res.*, **8**(1) : 41-43.
- Miller, G.L. 1972. Use of dinitrosalicylic acid reagent for determination of reducing sugar. *Anal. Chem.*, **31** : 426-428.
- Mohan Rao, N.V. and Prakassam, P. 1956. Studies on sugarcane smut. *Proc. ISSCT*, **9**: 1048-1057.
- Padmanaban, P.; Alexander, K.C. and Shanmugam, N. 1988. Some metabolic changes induced in sugarcane by *Ustilago scitaminea*. *Indian Phytopath.*, **41**(2): 229-232.
- Padmanaban, P.; Alexander, K.C. and Shanmugam, N. 1988. Effect of smut on growth and yield parameters of sugarcane. *Indian Phytopath.*, **41** (3): 367-369.
- Rao, P.; Ramakrishna, M.; Reddy, S.; Rao, P.N.; Nirendranath, U.V. and Reddy, G.L. 1984. Juice quality and mineral nutrient status in red rot infected cane. *Indian Sugar*, **33** : 615-620.
- Sankpal, S.D. and Nimbalkar, J.D. 1979. Effect of smut infection on sucrose metabolism in sugarcane. *Indian Phytopath.*, **32**: 306-307.
- Shindhu, S.S.; Bhatti, D.S. and Rattan, B.K. 1969. *J.Res. P.A.U., Ludhiana.*, **6**: 341-344.
- Singh, G.R. and Rao, M.M. 1967. SBI Annual Report 1966-67. Sugarcane Breeding Institute, Coimbatore. pp. 52-60.
- Singh, G.R. 1974. Loss in yield of cane and juice quality due to GSD. *Indian Sugar*, **24**: 109-112.
- Singh, O. and Waraitch, K.S. 1977. Metabolic changes induced by *Collectotrichum falcatum*. went. in sugarcane. *Sug. Cane Path. Newsl.*, **19**: 7-9.
- Singh, O. and Waraitch, K.S. 1981. Effect of wilt and red rot induced disease stress on quality deterioration of sugarcane. *Sug. Path. Newsl.*, **27** : 25-30.
- Spencer, G.I. and Meade, G.P. 1952. Cane Sugar Handbook (8th edn.) John Willey & Sons Inc., London. pp. 755-760.
- Talukder, M.I. 1994. Studies on white leaf disease of sugarcane in Bangladesh. Ph.D. Thesis. pp. 95-121.