

Effects of Smut disease on some Yield components of Sugarcane

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ABSTRACT

The effect of smut disease on some parameters contributing to cane yield were studied in two sugarcane clones I 291-87 and I 31-88. In the smut infected cane different parameters showed significant reduction compared to their respective healthy ones such as germination of setts were reduced by 49.05 and 15%, millable cane 44.57 and 38.98%, height of cane 29.78 and 26.21%, girth of cane 41.37 and 34.11%, number of internode per cane 12.29 and 14.01% and finally on yield of cane by 83.92 and 59.45% in the clones I 291-87 and I 31-88 respectively. Diseased plants produced significantly higher number of tillers compared to healthy ones but most of the tillers failed to produce normal cane stalk. Diseased setts of the clones I 291-87 and I 31-88 also showed significantly higher mortality of clumps by 70.0 and 47.5% respectively.

INTRODUCTION

Smut is a serious disease of sugarcane occurring in many countries of the world (Agnihotri, 1990). In India, it has been considered as the most important disease of sugarcane next to red rot (Chona, 1956). In Bangladesh, it is also a common and economically important disease of sugarcane (Ahmed, 1974). The severity of smut reported from different sugar producing countries varies widely. Economic losses range from negligible proportion to serious levels (Lee-Lovick, 1978). The loss may go up to 100 percent when naturally infected setts are planted and the loss may range from 42.47 to 59.20 percent when artificially inoculated setts are planted (Bachchhav *et al.* 1979; Goyal *et al.* 1982). In an assessment, losses was recorded on yield ranging from 39 to 56% in plant crop and 52 to 73% in ratoon crop (Mohan Rao and Prakasam, 1956). Kar and Varma (1962) reported that there was a considerable reduction in germination rate, average height, girth, weight of cane and percentage of sucrose content of cane due to smut infection. Goyal *et al.* (1982) also observed that there was a remarkable reduction in average height, girth and weight of whip bearing canes emerging from artificially inoculated setts.

In abroad, considerable work have been done on yield parameters of cane due to smut disease, but there is hardly any published report in Bangladesh. Considering the importance of the disease in the country, the present study was undertaken for the first time to investigate the effects of smut intection on yield and some yield components of sugarcane.

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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 the clones were planted in three replicated plots in randomized block design (RBD) with the plot size 4m x 4m having 4 rows with row to row and plant to plant distance of 100 and 40 cm respectively. Each replicated individual plot contained 40 clumps in 4 rows i.e., 10 clumps in each row. The experiment was laid out during the month of February, 1994 and the various observations were recorded during the growing period of the crop and at harvest in December, 1994. For studying the yield parameters, 20 cane stalks were collected from randomly selected 10 clumps (two canes from each clump) of each plot. Data on tillers were recorded at the age of 2, 3, 4, 5 and 6 months old plants in the field. Total number of tillers per plot was recorded and average number of tillers per clump was determined. Data on whip emerged clumps were recorded at the age of 60, 75, 90, 105, 120 and 135 days (15 days interval) of plants in the fields and the percentage of whip bearing clumps was calculated. For yield estimation, all the millable cane stalks of each plot were harvested and weighed separately.

RESULTS AND DISCUSSION

Effects of smut on some yield parameters :

The data on germination, mortality of clumps, millable canes, height, girth, number of internode and weight of smutted and healthy canes are presented in the Table 1.

Table 1. Effects of smut on some yield parameters.

Parameters	Clone I 291-87		% Increase (+) or decrease(-) over healthy check	Clone I 31-88		% Increase (+) or decrease(-) over healthy check	LSD at	
	Healthy	Diseased		Healthy	Diseased		5%	1%
Germination(%)	88.33	45.00	-49.05	73.33	62.33	-15.00	8.05	12.27
Mortality of Clump (%)	0.00	70.00	+70.00	0.00	47.50	+47.50	-	-
Millable cane (No./clump)	4.33	2.40	-44.57	3.95	2.41	-38.98	0.03	0.46
Height of cane (m)	2.25	1.59	-29.78	2.48	1.83	-26.21	0.51	0.78
Girth of cane(cm)	2.32	1.36	-41.37	2.58	1.70	-34.11	0.35	0.53
No. of internode/cane	19.94	17.49	-12.29	20.45	17.57	-14.08	3.35	-
Weight of cane/16 sq.m. area (kg)	94.33	15.17	-83.92	120.00	48.66	-59.45	6.20	9.39

Data indicate that smut infection caused a significant reduction in germination of setts. Naturally infected setts showed 49.05 and 15.00 percent germination loss in clones I 291-87 and I 31-88 respectively compared to their respective healthy checks. The results are in agreement with the findings of Kar and Varma (1962). Bachchhav *et al.* (1979) also

reported that the germination loss was 63.96 percent in the variety Co 740 compared to control when the setts from naturally infected canes were used as planting material. A considerable increase in mortality percent of tillers was obtained in diseased canes of both the clones while the healthy canes did not show any mortality. The clones I 291-87 and I 31-88 showed 70.0 and 47.5 percent mortality of tillers due to smut infection at harvest (Table 1).

The data in the Table 1 indicate that the diseased plants produced significantly less number of millable cane compared to healthy check. Reduction of millable canes per clump was observed 44.57 and 38.98 percent in the clones I 291-87 and I 31-88 respectively due to smut infection. It was observed that smutted plants produced large number of pencil-like thin and stunted tillers which dried early in the season as a result a few number of thin stalks survived in the field. The results are in conformity with the findings of Chona (1943). Reduction of millable cane per clump due to smut infection ranging from 24.21 to 86.32 percent was observed by Padmanaban *et al.* (1988).

Plants attacked with smut disease were stunted in appearance and height of the diseased plants were significantly lower than that of healthy Check. Reduction of average height was observed 29.78 and 26.28 percent in the clones I 291-87 and I 31-88 respectively compared to healthy checks (Table 1). Many workers have also reported similar trend of reduction in average height of cane by 30 percent (Kar and Varma, 1962; Joshi and Sharma, 1967; Seshadri *et al.*, 1984). Average height of cane was found to decrease in the diseased plants of variety Co. 1158 by 30.14 percent (Goyal *et al.* 1982) and 58.94 percent the variety CoJ 1287 (Padmanaban *et al.* 1988). Kumar *et al.* (1989) also reported that the average height of cane decreased by 27.76 and 39.69 percent respectively in the variety CoJ 64 and BO 110 due to smut infection compared to that of healthy ones.

In general, smut infected plants produced thin lanky canes. In the present investigation, results revealed a significant reduction in girth of smutted canes of both the tested clones. The reduction was 41.37 and 34.11 percent in the diseased canes of the clones I 291-87 and I 31-88 respectively than that of respective healthy ones (Table 1).

The results are in conformity with the reports of other workers (Kar and Varma, 1962; Joshi and Sharma, 1967). Goyal *et al.* (1982) observed 24.68 percent reduction in girth of diseased canes of Co 1158. Similar reduction (34.58%) in girth of cane was reported in CoJ 287 (Padmanaban *et al.* 1988). Kumar *et al.* (1989) also reported that the girth of smutted cane was reduced to 31.33 and 34.37 percent in the variety CoJ 64 and BO 110 respectively compared to control.

In the present study, the number of internodes per cane was reduced due to smut infection in both the tested clones which was significant ($P>0.05$) compared to their

healthy checks. The number of internodes per cane was found to be reduced by 12.29 and 14.08 percent in the clone I 291-87 and I 31-88 respectively (Table 1). Seshadri *et al.* (1984) also reported 27.57 and 31.02 percent reduction in number of internode in the diseased plants of variety CoJ 64 and BO 110 compared to other healthy check.

Smut infected plants resulted a significant reduction in yield of cane as demonstrated in Table 1. Losses in yield were 83.92 and 59.45 percent in the diseased canes of I 291-87 and I 31-88 respectively compared to healthy checks. A wide range of yield reduction due to smut infection has been reported by many workers (Chona, 1956; Mohan Rao and Prakasam, 1956; Kar and Varma, 1962; Joshi and Sharma, 1967; Shindhu *et al.* 1969; Raja *et al.* 1972; James, 1973). It was recorded that losses in yield were 71.0 to 73.0 percent when naturally smutted canes were used as planting material (Anon. 1952, 1953). Kumar *et al.* (1989) also found reduction in yield of cane by 31.00 and 44.23 percent in the variety CoJ 64 and BO 110 respectively when naturally smutted sets were used. The results of present study are in agreement with the above findings. But Bachchhav *et al.* (1979) and Goyal *et al.* (1982) found cent percent loss in sugarcane when naturally infected sets were used as planting material. A remarkable reduction in yield was also observed when artificial inoculated sets were used (Seshadri *et al.* 1984; Padmanaban *et al.* 1988). Reduction in cane yield was mainly due to mortality of tillers and clumps, decrease in height and girth of canes and lower number of millable cane formation in the smut infected clumps. Chona (1943) also found the similar causes and reported that smutted clumps produced only thin, spindly canes or small grassy shoots but in later stages of growth a few thin millable canes were produced.

In the present investigation, both the tested clones showed a significant decrease in number of tiller production in the diseased plants up to the age of four months of crop compared to their healthy checks (Figure 1). But after four months of age, both the tested clones I 291-87 and I 31-88 showed a significant increase in number of tiller production in the diseased plants compared to their healthy ones. The findings are in line with the reports of Agnihotri (1990) who stated that smutted sugarcane plants produced more tillers than the healthy ones. Similar observations are also available (Sharma, 1956; Byther and Stainer, 1974; Nasr and Talballa, 1976; Bhombe and Somani, 1978).

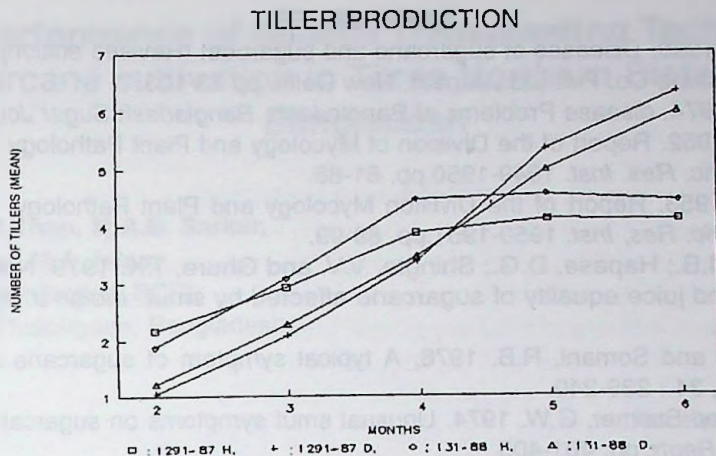


Figure 1. Tillering in smutted and healthy canes over a period of 6 months.

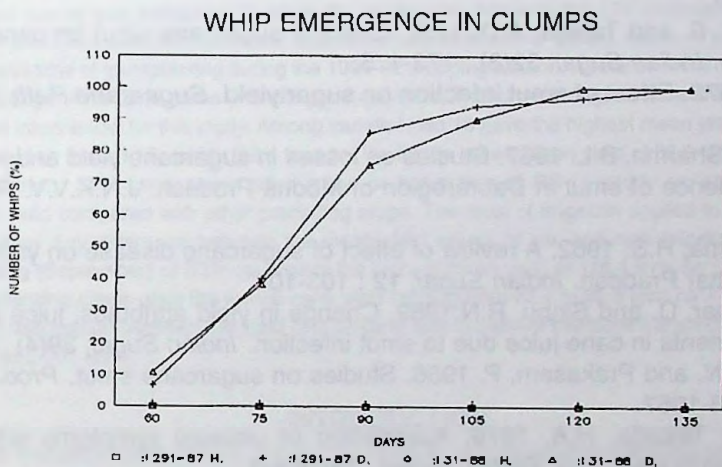


Figure 2. Emergence of whip in smutted and healthy sugarcane clones over a period of 135 days.

It was revealed that, at the age of 60, 75, 90, 105, 120 and 135 days of crop, the diseased plants of clones 1291-87 and 131-88 respectively showed whip bearing clumps by 6.67 and 10.83 percent; 40.00 and 38.33 percent; 85.83 and 75.83 percent; 94.17 and 90.00 percent; 96.67 and 100.00 percent and cent percent in both the tested clones under investigation. On the other hand, the healthy plants did not produce any whip (Figure 2). Similar observation was reported by Bachchhav *et al.* (1979) and Goyal *et al.* (1982). They found 100.00 percent infection from naturally infected setts when plants from healthy setts did not show any symptom of smut disease. James (1973) also reported the flush of whip production to be in the first four to five months of cane growth which is in agreement with the present findings.

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