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The Control of Smut with Fungicides in two Sugarcane Cultivars in Nigeria

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ABSTRACT

Field investigations were conducted at the Nigerian Sugar Company Estate Bacita on the control of sugarcane smut using three fungicides.

Cane setts of cultivars Co.957 and Co.440 were treated by either cold soaking or spraying with Bayleton (triadimefon 25% w. p.) Aretan (2-Methoxyethyl mercury chloride, 6% Hg) and Benlate (benomyl 50% w. p.). Cold soaking with Benlate and Bayleton was better than spraying while Aretan was more effective when sprayed. The disease was controlled when cane setts of the cultivars were treated by cold soaking in Bayleton at 1.3gm/litre water.

Considering the economy of usage and effectiveness, cold soaking in Bayleton was the most promising chemical.

INTRODUCTION

Sugarcane smut disease caused by *Ustilago scitaminea* Sydow is a major problem of sugarcane growing areas of the world (Antoine, 1961). The disease is common in both South and East Africa (Bailey, 1977). In India, the most susceptible cultivars of sugarcane smut infection was found to be Co.6411 and Co.5512. These cultivars were different from those of South Africa and Rhodesia (Muthusamy and Rajasubba, 1973). Thus it could be reaffirmed that different cultivars could be resistant or susceptible in different geo-ecological locations, which could give different performance of trials in different areas of the world.

James (1976) in Rhodesia observed that dipping of cane setts of cultivars NCO.310 and NCO.376 in Aretan before planting moderately controlled smut. Hot water treatment at about 50.5°C for about two hours was found to exhibit moderate control on smut in Rhodesia (James, 1971). Bailey (1979), explained that in the above named cultivars, there was high probability of disease outbreak in the ratoon crop of the cane setts treated with hot water alone.

Eventhough, some control measures on smut such as rogueing and short time dipping have been tried in some parts of the world (James and Burton, 1972 ; James 1976), yet the problem has not been completely solved. The use of resistant cultivars has been classified as the best, but the problems of yield and other good qualities were sometimes lacking with the most resistant cultivars. For instance, at the Nigerian Sugar Company Bacita, Co.957 cultivar is high yielding, but susceptible to sugarcane smut while cultivar Co.1001 is resistant to smut but yield is lower than Co.957 cultivar.

This project was taken up to determine the effectiveness of three fungicides in controlling smut at the Estate of the Nigerian Sugar Company Bacita and to find the best application method.

MATERIALS AND METHODS

During the sugarcane planting season in May 1981, three fungicides were applied on two cane cultivars using two major methods of application, i. e. spraying and soaking. The layout of the experiment was 7 x 4 Randomised Complete Block. The set-up was as follows :

a. Cold soaking in Aretan at 3.00gm/litre water for two hours.
b. Spraying on setts in planting furrows by Aretan at 5.00gm/litre water
c. Cold soaking in Benlate at 1.00gm/litre water
d. Spraying with Benlate at 1.40gm/litre water
e. Cold soaking in Bayleton at 1.30gm/litre water
f. Spraying with Bayleton at 2.00gm/litre water
g. No fungicidal treatment (control).

The above quantities of the fungicides used were in accordance with the manufacturers or their agents recommendations.

Two-eye cane setts of about (1,100) x 2 were used for the experiments. Each plot ($20m^2$) was planted with 40 setts. Before and after planting (which ever is applicable) the treatments specified above were carried out on the cane setts. The cane setts were also dipped in smut spore suspension (Circa ; 5.0×10^6 spores/ml of water) for 15 minutes before planting.

The spraying was done with a cp3 knapsack sprayer fitted with TG3 core nozzle that discharged at the rate of 151 litre/ha. Germination counts were taken at four and eight weeks after planting. The black whip characteristics of the smut disease was assessed fortnightly from the eighth week after planting till the sixth month. The data were statistically analysed.

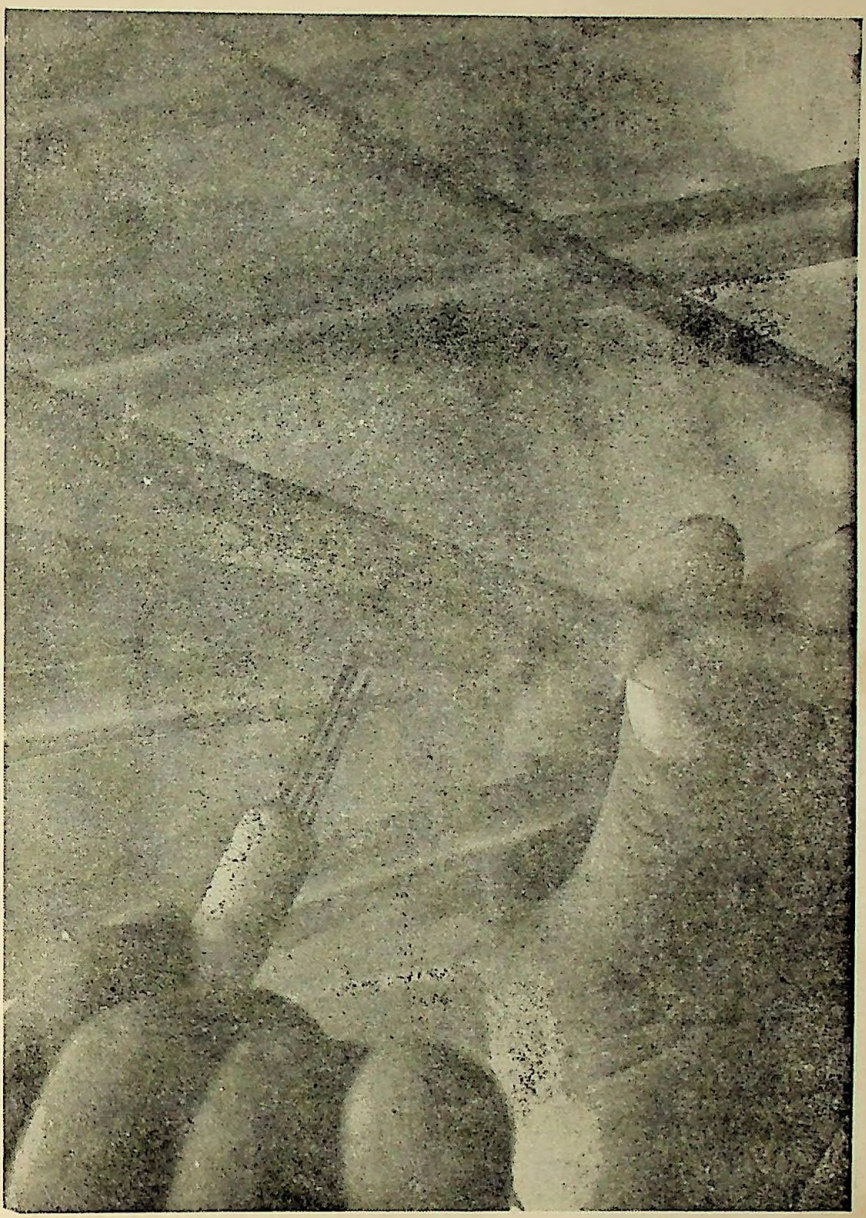

Figure 3. Needle Prick

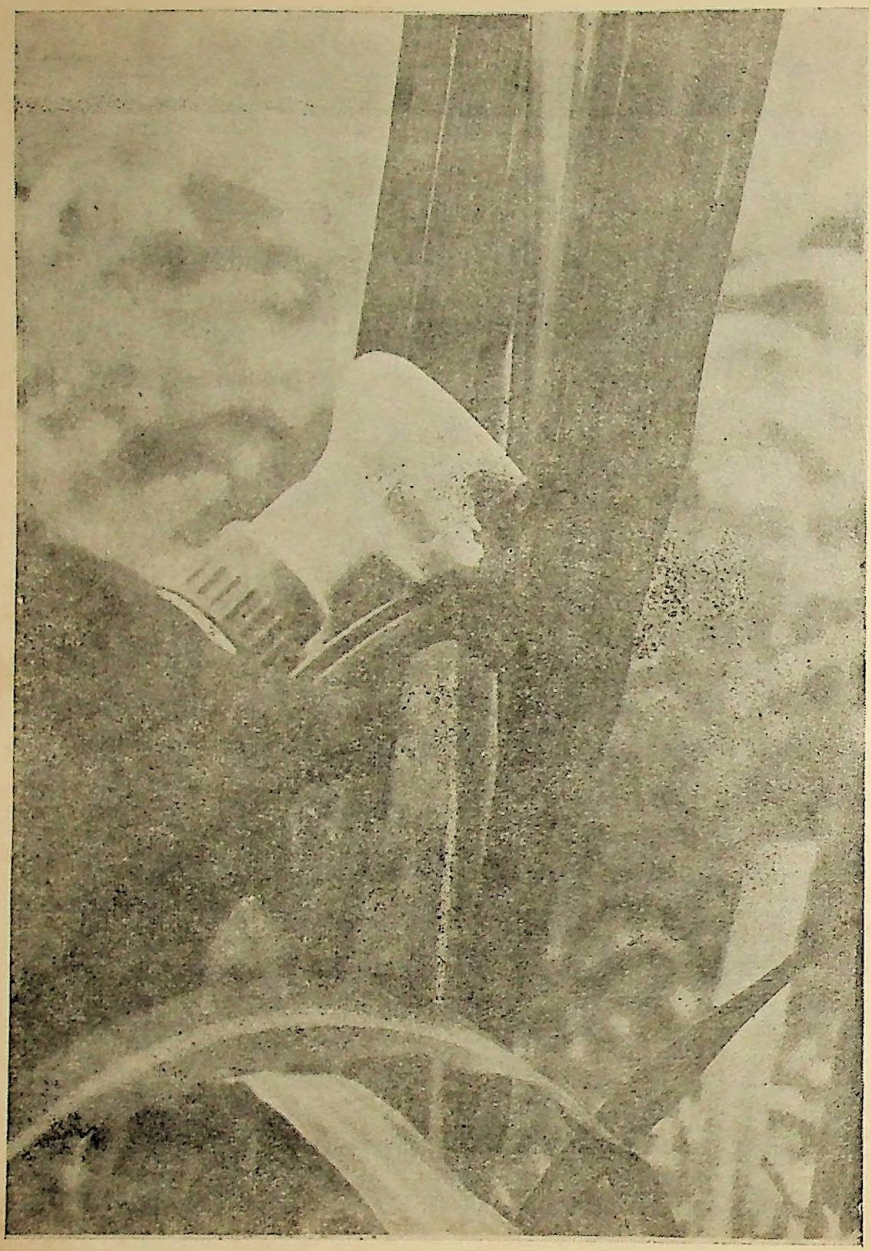

Figure 4. Control

Two weeks before inoculation and six weeks after inoculation the recorded temperatures ranged between 30±2°C and the relative humidity was 85 percent and above. There was a total of fifteen centimeter of rainfall during the period of this study.

RESULTS AND DISCUSSION

Of the three methods studied, success in developing red stripe/top rot symptoms was obtained only with the hypodermic syringe method. No symptoms developed when the plants were inoculated by either needle-prick or spray method. In the control too, no symptoms were noticed. It is difficult to explain why symptoms did not occur in needle-prick or spray methods. It could be ascribed that these two methods did not cause enough bruise and openings for easy entry by the bacteria into the plant cells, thereby causing no infection and no disease development. So, the discussion is made, based on results obtained by hypodermic syringe method. Table 1 shows that the varieties/strains of Isd 1/53, Isd.2/54 Isd.9/57, Isd.16, L. Jaba-C, Co.975, Co.1158, BO.70, BO.71, I-18/74, I-60/74, I-96/74, I-106/74, I-45/74, I-59/74, I-21/75, I-79/75 showed red stripe symptoms in the first week following inoculation whereas I-29/75 showed symptoms in the second week and I-59/75 in the third week respectively. Top rot did not develop until third week when there were 20%, 15% and 10% infections in Isd.1/53 BO.71 and L. Jaba-C respectively and 5% infection amongst Isd.9/57, Co.975, Co.1158, BO.70, I-106/74, I-21/75, I-29/75 and I-79/75. In the varieties/strains of Isd.16, I-18/74, I-60/74, I-96/74, I-45/75 and I-59/75, the top rot did not develop at all.

But it is obvious that none of the varieties or strains was free from the attack by red stripe bacteria. It was also noticed that at the end of third week, red stripe development took place in all of the varieties/strains and at the end of fifth week, 70% of the varieties/strains developed top rot (Table 2). The varieties/strains varied in their degree of susceptibility to red stripe/top rot; Isd. 1/53 was the most severely affected one while I-60/74 and I-59/75 were the least affected ones. It is also to be noted that the more was the red stripe infection the greater was the top rot developmenf.

It is also worth mentioning that an earlier attempt failed to develop symptoms of red stripe of fifteen varieties and strains using pin, syringe and spray methods. The reasons may be attributed more to the climatic factors having low temperature and low relative humidity which prevailed at the time of inoculation and were unfavourable to red stripe/top rot development. Also, the plant age at the time of inoculation was seven to eight months which might be a factor for no symptom development. Therefore, to gain success in red stripe/top rot development, plant age and a period of high temperature and high humidity in the weather following inoculation are important.

Table 1. Varieties/strains showing red stripe/top rot symptoms.

Sl No.	Varietystrain	Number of observation																			
		1st week				2nd week				3rd week				4th week				5th week			
		RR		TR		RS		TR		RS		TR		RS		TR		RS		TR	
		No.	%	No.	%	No.	[a]	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1.	Isd.1/53	6	30	—	—	7	35	—	—	13	65	4	20	13	65	6	30	13	65	6	30
2.	Isd.2/54	3	15	—	—	3	15	—	—	5	25	—	—	5	25	2	10	5	25	2	10
3.	Isd.9/57	6	30	—	—	6	30	—	—	8	40	1	5	8	40	2	10	8	40	2	10
4.	Isd.16	2	10	—	—	2	10	—	—	2	10	—	—	2	10	—	—	2	10	—	—
5.	L.Jaba-C	7	35	—	—	7	35	—	—	7	35	2	10	7	35	2	10	7	35	2	10
6.	Co.975	3	15	—	—	4	20	—	—	7	35	1	5	7	35	4	20	7	35	4	20
7.	Co.1158	4	20	—	—	5	25	—	—	5	25	1	5	5	25	1	5	5	25	1	5
8.	BO.70	10	50	—	—	10	50	—	—	11	55	1	5	11	55	4	20	11	55	4	20
9.	BO.71	3	15	—	—	6	30	—	—	6	30	3	15	6	30	3	15	6	30	3	15
10.	I-18/74	1	5	—	—	2	10	—	—	2	10	—	—	2	10	—	—	2	10	—	—
11.	I-60/74	1	5	—	—	1	5	—	—	1	5	—	—	1	5	—	—	1	5	—	—
12.	I-96/74	1	5	—	—	2	10	—	—	2	10	—	—	2	10	—	—	2	10	—	—
13.	I-106/74	3	15	—	—	5	25	—	—	7	35	1	5	7	35	1	5	7	35	1	5
14.	I-45/74	2	10	—	—	1	5	—	—	1	5	—	—	1	5	1	5	1	5	1	5
15.	I-59/74	5	25	—	—	5	25	—	—	5	25	—	—	5	25	2	10	5	25	2	10
16.	I-21/75	5	20	—	—	5	25	—	—	6	30	1	5	6	30	3	15	6	30	3	15
17.	I-29/75	—	—	—	—	3	15	—	—	5	25	1	5	5	25	2	10	5	25	2	10
18.	I-45/75	1	5	—	—	4	20	—	—	4	20	—	—	4	20	—	—	4	20	—	—
19.	I-59/75	—	—	—	—	—	—	—	—	1	5	—	—	1	5	—	—	1	5	—	—
20.	I-79/75	1	5	—	—	3	15	—	—	3	15	1	5	3	15	1	5	3	15	1	5

a. the numbers are the cumulative figures. b. RS = Red Stripes, TR = Top Rot.

Christopher and Edgerton (1930) succedded in obtaining symptoms of bacterial mottled stripe only in the summer when the temperature and the relative humidity were quite high. Fors(1980)found that the red stripe/top rot became active at the beginning of the rainy season and its symptoms of gradually disappeared with the drier and cooler conditions of the weather. Our results agree with those of above workers. Plant age (four to five months) seems to be better for symptom development irrespective of studies, either the virulence of different isolates or the massive inoculation of the same isolate etc.

Table 2. Percentage of red stripe/top rot development.

No. of varieties/ strains	1st week		2nd week		3rd week		4th week		5th week	
	Red Stripe	Top Rot	Red Stripe	Top Rot	Red Stripe	Top Rot	Red Stripe	Top Rot	Red Stripe	Top Rot
20	90	—	95	—	100	55	100	70	100	70

During the course of this study it was observed that the plant growth sometimes became faster than the red stripe becteria could reach the apical meristemetic tissues thus failing to cause top rot. If the bacteria can not reach the soft apical tissues in time by travelling through the spindle leaves in the form of stripes, the tissues get hardened by further growth and development and form a sort of resistance to the attack by the bacteria. As a result top rot does not develop all the time although the plant becomes affected by red stripes in the leaves.

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RESULTS AND DISCUSSION

The three fungicides did not significantly affect the germinability of the cane setts (Table 1). This deviated from the work of Bailey (1979), when he tried some funigcides on cane setts, and reported that pyracarbolid significantly decreased the germination percentage of the cane setts. The decrease in germination of the cane setts was probably due to the oil components of the emulsifiable concentrate formulation of the pyracarbolid which was phytotoxic (Bailey, 1979).

Cold soaking in Bayleton was the most promising of all the fungicides treatments in controlling smut (Table 2). Long time soaking method has the advantages of intensive penetration into the interior of the cane setts for effectiveness and high retention capacity to prevent incoming smut fungus. Muthusamy and Raja subba (1973) supported soaking method after a similar experiment using fungicides like Agallol 0.5% and Dithane-Z2-78 0.3%. Their experiments showed promising results when the fungicides were applied on to highly susceptible sugarcane cultivars ; Co.6512 and Co.6411. One big disadvantage of spraying method, using the fungicides is the temporary retention in the cane setts and the subsequent wash off into the soil during rainfall and irrigation.

Table 1. Percentage germination of cane setts in fungicide trial experiment with cultivars, Co.957 and Co.440.

Treatments	Rate of application	Percentage germination (±S.D)	
		Co.957	Co.440
Soaking in Aretan	3.00gm/litre	68.61±2.6	70.2±2.2
Spraying with Aretan	5.00gm/litre	69.11±4.2	60.17±3.1
Soaking in Benlate	1.00gm/litre	68.87±3.6	68.82±4.2
Spraying with Benlate	1.40gm/litre	69.18±5.2	66.16±6.1
Soaking in Bayleton	1.30gm/litre	67.22±3.3	64.33±5.7
Spraying with Bayleton	2.00gm/litre	66.18±6.2	67.46±4.8
No fungicidal treatment	Control	65.36±4.8	65.23±5.5

L. S. D.=Least Significant Difference.

Table 2. Percentage of smut emergence on cultivars, Co.957 and Co.440.

Treatments	Rate of application per litre	Smut Counts (%)															
		10th wk.		12th wk.		14th wk.		16th wk.		18th wk.		20th wk.		22th wk.		24th wk.	
		oC. 957	Co. 440	Co. 957	Co. 440	Co. 957	Co. 440	Co. 957	Co. 440	Co. 957	Co. 440	Co. 957	Co. 440	Co. 957	Co. 440	Co. 957	Co. 440
Soaking in Aretan	3.00gm	12.1	13.0 *	12.4	14.1	30.0	30.8	36.8	33.6	45.7	45.7	48.3	49.1	49.1	51.2	52.8	51.2
Spraying with Aretan	5.00gm	5.0 **	7.1	7.3 **	9.8	21.3	22.2	26.2	23.8	28.8	26.8	29.2	30.1	30.7	32.4	32.6	36.3 *
Soaking in Benlate	1.00gm	5.2 **	8.2	5.9 **	8.4	21.6 *	22.6	25.8 *	25.2	45.8	35.6	46.8	41.7	43.6	50.1	47.2	51.2
Spraying with Benlate	1.40gm	7.4 **	6.3	15.2	6.4	40.1	29.8	40.0	41.6	55.5	47.7	56.7	57.7	57.2	60.1	60.1	60.3
Soaking in Bayleton	1.30gm	1.9 **	3.0 **	2.1 **	3.1 **	2.4 **	3.8 **	5.1 **	6.2 **	5.4 **	6.3 **	9.1 **	6.8 **	10.0 **	8.8 **	10.1 **	10.7 **
Spraying with Bayleton	2.00gm	6.8 **	7.1	13.8	5.3	24.8	25.7	29.3	32.9	43.6	44.6	48.6	47.9	55.7	53.7	53.7	55.3
No fungicidal treatment		14.3	8.9	16.2	13.9	32.7	34.8	40.7	39.6	55.9	57.3	56.2	57.3	55.9	60.1	58.6	62.8

* Significant at 5% level

** Significant at 1% level

The percentage of smut emergence increased with an increase in age of the sugarcane as well as the plant population. This may be due to the increase in the surface areas of the sugarcane exposed to smut attack. Differences in the control levels observed in the different fungicides, showed differences in the effectiveness of their properties in eleminating the smut. This was in conformity with the work of Muthusamy and Rajasubba (1973), when they detected the differences in performance of seven fungicides in controlling smut of sugarcane.

Soaking method appeared better than spraying in two major ways. Firstly, it is more economical since less quantity of the fungicide would be used, secondly, it is more effective in terms of activity due to its retention for a considerable longer period of time in the cane setts. Protection of cane setts against smut disease should be possible with pre-plant soaking in Bayleton. Soaking and spraying with Benlate and Aretan respectively could also help to some extent but they are less effective than soaking in Bayleton.

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