

NOTES ON DISEASES OF SUGARCANE AT HIPPO VALLEY ESTATES LIMITED— 1962 to 1967

by M. J. P. KOENIG
Hippo Valley Estates Limited

Hippo Valley Estates Limited is located in the South Eastern Lowveldt of Rhodesia, Latitude 21° 05'S and Longitude 31° 39'E at 1,300 feet altitude. It covers an area of approximately 150,000 acres, of which 24,000 are planted to sugar cane, including 42 Settler farmers. The climate is somewhat different from other sugarcane growing areas of the world. With an annual rainfall of about 20 inches, restricted mainly to the months of November to March, mean monthly temperatures vary from 80°F in November to 60°F in June, and diurnal temperature ranges of up to 40°F, 30°F are very common. Maximum temperatures of 108°F and minimum of 32°F have been recorded. Generally speaking the atmosphere is dry, except during the rainy season. About 80% of the sugar cane is grown on reddish brown fine grained sandy clay loams derived from Paragneiss. The rest is either on deep forest sands or dark heavy active clays of basaltic origin. The pH varies from neutral to alkaline on the Paragneiss to very alkaline in the basaltic clays. Full irrigation is being practised and the yearly water consumption averages 6.5 acre feet including rainfall and is based on Class "A" pan evaporation figures. The water comes from a large storage dam of a maximum capacity of 1,100,000 acre feet and is of almost perfect quality for sugarcane and, indeed, any crop. It reaches the fields through an extensive system of concrete-lined canals and then fed into a furrow irrigation layout based on a contour system, with an average slope of 1:150.

Only two varieties are grown on a commercial scale. N:Co.310 and N:Co.376. Many varieties have been imported and are being tested. Those showing

signs of promise such as Co 462, B4362, B42231, CB 38/22 and M 31/45 are being bulked up to produce sufficient cane for a long factory mill test. Many more varieties have been included in trials but have been rejected because of their susceptibility to either or both of the major diseases of Hippo Valley, namely Smut and Leaf Scald.

The diseases recorded so far at Hippo Valley are: Smut, Leaf Scald, Gummy, Brown Spot, Pineapple Disease, Pokkah Boeng, Red Rot of Leaf Sheath, Red Spot of Leaf Sheath and Leaf Galls, the first two only being of economic importance and the last one of doubtful origin.

SMUT: *Ustilago scitaminea* Sydow.

In 1962 when Mr. Robert Antoine, Chief Pathologist of the Mauritius Sugar Industry Research Institute, visited the Estate, a warning was given that if immediate steps were not taken to control this disease it might reach epidemic proportions and prove to be a limiting factor to production, a fact which was later proved correct. In 1966, 250 acres of N:Co.310 were ploughed out due to very heavy Smut infestation. At this stage it was found that N:Co.310 was much more affected than N:Co.376. Infection rates varied from 1% to as high as 10% with an overall average infection of 3%. At the beginning of the first crushing season, in 1962, an extensive roguing programme was set up. Only 3,000 acres of cane were planted then, but new lands were being prepared and by careful selection of seed material and treatment of the cane sets in a solution of a mercurial fungicide before planting the disease was kept under control. Table I shows some of the results obtained.

TABLE I

		1963		1964		1965—1966	
		N:Co. 310	N:Co. 376	N:Co. 310	N:Co. 376	N:Co. 310	N:Co. 376
Block A, ± 3000 acres	Infected Stools/acre % Infected	488 5.6%	64 0.8%				
Block B, ± 3000 acres	Infected Stools/acre % Infected	5.6 0.07%	4.0 0.05%	64.0 0.8%	5.60 0.07%	24.0 0.3%	12.0 0.15%
Block C, ± 8000 acres	Infected Stools/acre % Infected			2.4 0.03%	0.8 0.01%	6.4 0.08%	3.2 0.04%
Block D, ± 700 acres	Infected Stools/acre % Infected					6.47 0.08%	0.31 0.004%

BLOCK A represents the oldest canes on the Estate. Seed cane to plant BLOCK B was taken from the least infected fields of BLOCK A. Thus BLOCK B supplied seed for BLOCK C and so on, BLOCK D being plant cane in 1966.

Smut control in the commercial plantations is done in the following way: Detection of the disease by trained staff who walk along each cane line and flag the infected stools. Then roguing is done by a separate gang.

Various roguing methods have been tried on the Estate, depending on the stage of infection and the size of the cane.

The aim is to detect the disease in the early stages, before the whips have appeared and the spores released, in which case the stools are dug out and carried away for burning.

If whips have been produced but the cane is short, 2-3 feet high, a gunny sack or plastic bag is gently placed over the stool and pulled down to enclose the latter completely. The bag is tied around the cane at soil level, the stool dug out and taken away, the bag being removed only prior to burning. The bags can be used many times by dipping in a solution of a mercurial fungicide. A stool is then removed on each of the four sides of the infected cane. When the cane is bigger, a 44-gallon drum is used, opened at both ends. One end is first covered by means of a piece of plastic tied around the rim and the drum is placed over the infected stool, the cover being to prevent an upward draft carrying away the spores. The cover is then removed and trash and spent oil used to obtain a hot burn inside the drum. If properly done the heat is enough to kill the spores and the stool can then be removed without the need of a bag. The advantages of this method are that the drum can be used for a long time, being more resistant than bags, there is no need for disinfection, and if short of labour the burnt stool may be left in position for removal at a later date.

In addition to control in the fields, all the other imported varieties are being tested for resistance to Smut using a method produced by K. R. Bock. Single bud setts taken from the upper third of cane stalks are incubated overnight at 88°F. A suspension of fresh Smut spores at a concentration of 10⁷

spores per ml. is sprayed over the buds. The setts are again incubated overnight and then planted out. Infected plants are uprooted and destroyed. Table II shows the results obtained.

It will be noted that N:Co.376 is showing a higher susceptibility than N:Co.310, but it has been found on the Estate that when this variety has been growing for some time next to a field of badly infected N:Co.310, it would show a very high degree of infection.

Susceptibility rating:

0 - 5% = Very resistant.

5 - 10% = Resistant.

10-20% = Susceptible.

20% = Very susceptible.

LEAF SCALD: *Xanthomonas albilineans* (Ashby) Dowson.

This disease was first recorded at Hippo Valley by Mr. Robert Antoine in April 1965 on B 34104, a recently imported variety. Immediate steps were taken to destroy all infected material in an attempt to contain the disease. Further surveys showed infection in other varieties throughout the Estate. How this disease which had never been recorded in Africa before got into Rhodesia is still not known. Fortunately, the two commercial varieties appear to be tolerant but some of the imported varieties have shown the acute phase followed by death of the stools. The variety CP 44/155 in one trial had 11% of the stools dead after 4 months. As this disease can exist in a latent or mild form and thus escape detection, the selection of disease-free planting material is difficult. Being easily transmitted by the cutting knife it makes things even more complicated and has set back the programme of release of new varieties. In the meantime, two Leaf Scald resistance trials were established, one of which is now in its second year. No new varieties will be released unless showing resistance or a high degree of tolerance to this disease. Table III shows the results obtained in the first trial. The trial consists of four lines of one variety planted between two lines of a known susceptible variety. When the tillers are about 2-3 feet high and the majority of the growing points are above ground level, the tillers in the 2 central rows of the varieties under test as well as those of the susceptible guard canes are cut just above the growing point and inoculated with a solution of the bacterium. Thus for every variety there is first a line of infected susceptible cane, then one not inoculated of the variety to be tested, then two inoculated rows of that same variety and again one row of the infected susceptible cane. Records of stripes on the leaves and tillers killed by the disease are kept.

TABLE II

Variety	No. of Germinated buds per 100 planted	No. of infected stools	% Infection
B 3439	80	6	7.5
B 4362	92	2	2.2
Co 419	94	10	10.6
Co 421	93	3	3.2
Co 462	92	0	0
Co 911	77	53	68.8
CB 36/14	95	1	1.1
CB 38/22	81	2	2.5
CP 29/116	85	0	0
M 31/45	93	0	0
NCo 310	93	8	8.6
NCo 376	84	23	27.4
P R 1000	72	0	0

TABLE III
Trial No. 1

Variety	Infection								Rating
	Inoculated				Not Inoculated				
	Dead shoots		Leaf St.		Dead shoots		Leaf St.		
1966	25/4	12/8	25/4	12/8	25/4	12/8	25/4	12/8	
CB 36/14	—	7	7	7	—	31	9	2	16
Co 775	—	16	12	0	—	9	0	1	15
Co 419	—	3	0	0	—	5	0	1	13
PR 1000	—	8	10	3	—	3	1	1	13
CP 29/116	—	6	14	5	—	0	2	4	11
CB 38/22	—	3	0	0	—	2	0	1	10
Co 462	—	10	0	0	—	2	0	0	9
Co 421	—	0	0	0	—	2	1	0	7
B 3439	—	0	0	0	—	2	0	0	7
B4362	—	0	1	0	—	1	0	0	5
N:Co. 310	—	0	0	0	—	1	0	0	5
M 134/32	—	0	0	0	—	1	0	0	5
N:Co. 376	—	0	6	2	—	0	0	0	3
B 4744	—	0	0	2	—	0	0	0	3
B 42231	—	0	0	0	—	0	0	0	1
M 31/45	—	0	1	0	—	0	0	0	1.

GUMMING: *Xanthomonas vasculorum* (Cobb)
Dowson.

This disease has been present at Hippo Valley since 1959, showing at times rather numerous leaf symptoms on N:Co.310 but so far is of little economic importance. Both types of stripes can be seen: the one red in colour and with definite margins, and the other yellowish, wider and with less defined margins. The leaf symptoms are only visible for a short time of the year mostly in the young ratoons and disappear, leaving the canes unaffected. The stripes are encountered mostly in fields under spray irrigation, the disease being more easily transmitted under this regime. On one occasion leaf symptoms of the systemic infection were visible in N:Co.310 on a few plants but the acute phase was never recorded. No further planting of N:Co.310 under spray irrigation is contemplated. It is thought that due to the dry climate gumming will never become of economic importance.

BROWN SPOT: *Cercospora longipes*. Butler.

It is commonly observed at Hippo Valley, more so in fields under spray irrigation and mostly on N:Co.376. The spots are rather small and reddish brown in colour with a small black central portion. This disease is of no economic importance.

PINEAPPLE DISEASE: *Ceratocystis paradoxa* (de Seynes) Moreau.

As it is current practice on the Estate to dip all planting material in a solution of a mercurial fungicide, this disease has only been recorded in experimental plots when the cane had not been treated on purpose. Isolated cases in the fields have been found and traced back to improper dipping.

POKKAH BOENG: *Gibberella moniliformis* (Sheldon) Wineland.

Common in both commercial varieties but of no economic importance. Very rare cases of death of

the growing point have been observed. The spindle is usually affected at about an inch above the growing point and the top portion is severed, but growth is not checked and only mild leaf symptoms can be observed later on.

RED ROT OF LEAF SHEATH: *Pellicularia rolfsii* (Sacc.) E. West.

AND

RED SPOT OF LEAF SHEATH: *Cercospora vaginiae* Krüger.

Both found at Hippo Valley and generally associated with water-logging. The affected canes are usually thinner and shorter than usual. These diseases are of no economic importance.

LEAF GALLS:

These galls were identified some five years ago and were at first confused with those produced by Fiji disease. The characteristic symptom of the dreaded Fiji disease lies in the production of galls on the lower surface of the leaves. So, when leaf galling was first observed at Hippo Valley with galls produced on the underside of the cane leaf, it was feared that Fiji disease had reached the area. However, examination revealed that the Leaf Galls at Hippo Valley were quite distinct in structure and anatomy from those caused by Fiji disease. In addition, none of the other symptoms associated with Fiji disease has been seen. So far the leaf galling does not seem to affect the cane in spite of the presence of a large number of galls on the leaves of the plant. In Madagascar similar leaf galls have been observed on several grasses, thus indicating that it may be transmitted from cane to grass or perhaps from grass to cane.

References

- Antoine, R. Miscellaneous reports on Sugar Cane Diseases Hippo Valley Estates. Unpublished.
Bock, K. R. Studies on Sugar Cane Smut in Kenya. T.B.M.S.

Discussion

Dr. Dick (in the chair): I notice that none of the virus diseases such as ratoon stunting has been mentioned.

Mr. Koenig: We fortunately do not appear to have them and by treating our seed material hope to prevent them.

All imported varieties received the long hot water treatment.

Mr. Gosnell: We think that Smut is the biggest threat in the lowveld of Rhodesia.

The newly established research station in Rhodesia will, as one of its main functions, study the ecology and epidemiology of Smut.

Mr. G. M. Thomson: For Smut testing we have recently put out a greenhouse experiment in tins to test our varieties for susceptibility. The most resistant are N:Co.382, N.50/211, both CB varieties and

N:Co.334 and the least resistant are Co.301, N:Co.310 and Co.331.

There are certain anomalies. N:Co.339 had the least resistance of all, whereas N:Co.293 behaved quite well.

We also tried a method of inoculation by direct injection into the bud.

Germination was rather poor, Possibly because some of the buds were destroyed by the inoculation, but the percentage infection was very high and the varietal susceptibility was still on the whole what we would expect in the field.

I was surprised to see in this paper that N:Co.376 is more susceptible than N:Co.310.

Mr. Koenig: In our commercial plantations N:Co.376 is fairly resistant but in the presence of a high inoculum, that is, next to a heavily infected field of N:Co.310, shows infection figures of up to 5%.