

# SMUT INCIDENCE SURVEY IN THE RHODESIAN LOWVELD

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## Introduction

As smut is the main disease problem of sugarcane in the Lowveld the establishment of a disease inspection service was considered to be one of the prime functions of the newly established Experiment Station. The survey of smut incidence was started in October, 1966, and is carried out by a team of Africans trained solely to observe and record smut symptoms. The techniques used were developed after consultations with the Biometrics Branch of the erstwhile Agricultural Research Council of Central Africa.

Preliminary work done on the distribution of smut-infected stools in various fields revealed that the disease was randomly scattered—an observation that has been repeatedly recorded since the start of the survey. This indicates that the major method of spread of smut in the past has been the planting of infected seedcane.

Sugarcane in the Lowveld is irrigated either by sprinkler or furrow methods, and separate survey techniques were designed to assess smut intensity under each irrigation regime.

## Survey Techniques

### (a) *Furrow Irrigated Fields*

Such fields are usually irregular in shape, the location of irrigation furrows, and thus cane lines, being dependent on land contour. For smut survey purposes the field is first divided into approximately 1 acre blocks by using 12.5ft metal sighting rods. Two members of the survey team are then given two random numbers (0-99) by the disease inspector, one for the cane row and one for the number of paces to be taken before observations on smut incidence are started. One man acts as pacer and the other as observer. Each sample consists of observations on the incidence of smut in a row length of 500 paces, the pacer checking that sampling is made within the area previously demarcated by the sighting rods (Fig. 1).

The mean pace length for the team is 2.3ft, therefore the length of row sampled is 1,150ft. Considering one row, an acre of cane with an inter-row interval of 5ft will give a row length 8,712ft. The number of infected stools in each sample is then multiplied by 7.6 to give an estimate of smutted stools per acre. This number can be expressed as percentage infection if the total stool population per acre is taken to be approximately 7,000.

### (b) *Sprinkler Irrigated Fields*

These fields are laid out in a rectangular pattern and divided at regular intervals by breaks at right angles to the cane rows to facilitate the placing of

portable irrigation pipes between the blocks of cane. For survey purposes the field is divided into several adjacent strips of 10 rows, running the whole length of the field. From a table of random numbers, one cane row from each strip and a block is selected. Two members of the team then walk along the cane row until the chosen block is reached. As before, one man acts as pacer and the other as observer even though the length of cane row between breaks is known—this is to save any confusion of the team as the survey may involve work in both furrow and sprinkler irrigated fields in one day. A third random number (0-99) then denotes the paces to be taken before the 500-pace sample starting point is reached.

The smut incidence survey is carried out in cane between 1 and 5 months old, that is from 2 to approximately 8ft high for cane grown under optimum conditions in the Lowveld.

As the distribution for smutted stools within a field is known to be random, a 1% infection means that approximately 70 smutted stools are scattered throughout an acre of cane. This amount is considered to be serious, as an appreciable amount of time and effort will have to be spent in locating and roguing the affected stools. It is considered economically feasible to rogue up to a 4% infection; however, above this figure it is recommended that the field in question should be considered for ploughing out.

## Results

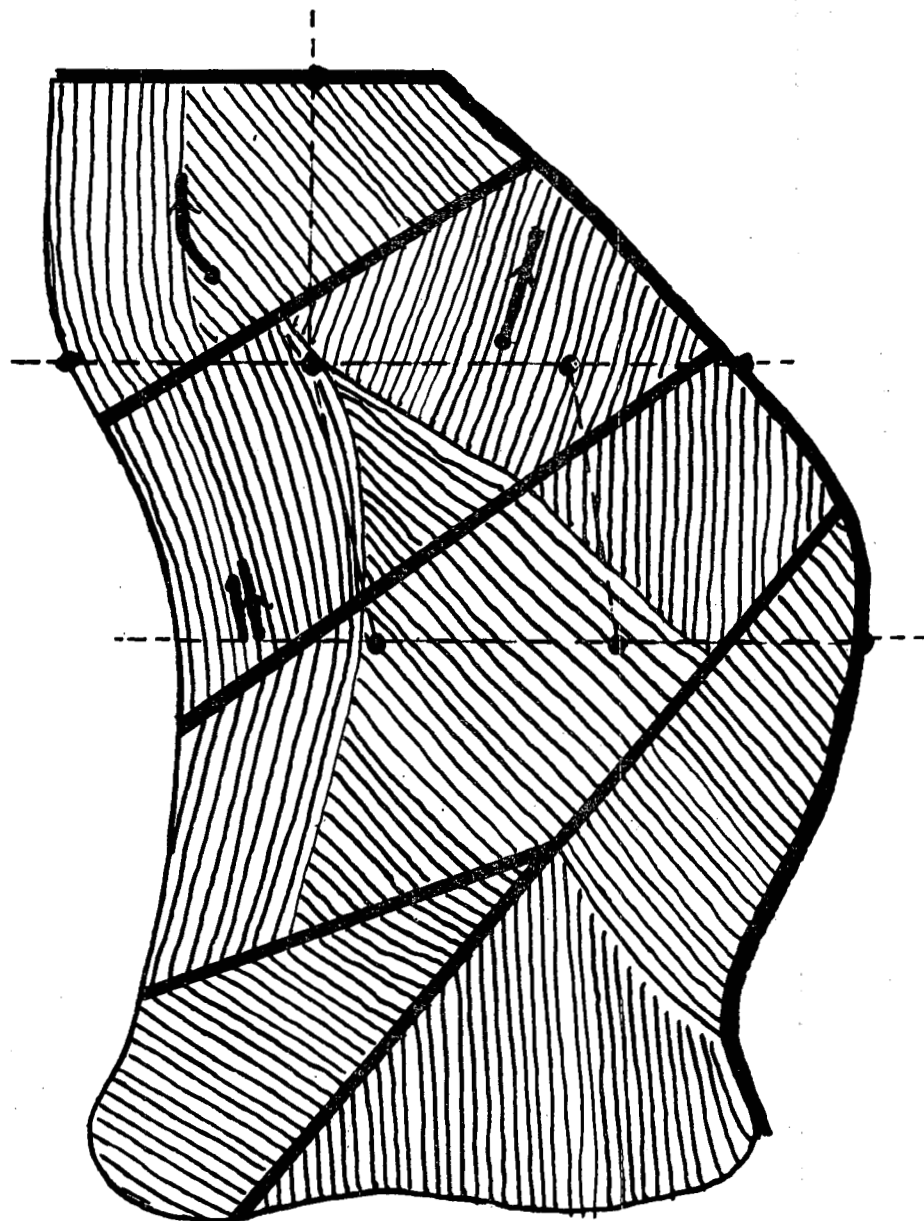
### *Varietal Response to Smut Infection*


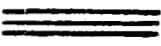


The most popular variety in the Lowveld is N:Co.376 followed closely by N:Co.310 (Fig. 3). The large acreage of C.P.29/116 grown on Triangle Ltd. and the attendant settlers makes this the third most popular variety. Hippo Valley Estates Ltd. depends almost entirely upon N:Co.376 and N:Co.310, and only small areas are planted with other varieties.

From the overall picture (Fig. 4) it can be seen that Triangle has a greater incidence of smut in commercial cane than Hippo Valley, due to a more intensive roguing programme on the latter estate.

N:Co.310 generally has a higher percentage of disease incidence in the field than N:Co.376, though the latter variety can develop symptoms of smut to an equally high intensity in certain circumstances. Average figures for the three main varieties as well as the minor ones are shown in Table I. Of the minor varieties, no smut symptoms have yet been seen in Co.462. B.4362, though showing a very low incidence of smut, is affected seriously by rust, *Puccinia erianthi* Padw. et Khan. Salvo, N.50/211, is very susceptible to both smut and leaf scald. In cer-

Fig 1. Sampling technique in furrow irrigated fields



	Irrigation furrow	
Legend	Cane rows	
	Sighting poles	
	500 pace sample	

**TABLE I**  
Percentage smut infection of the sugarcane varieties grown in the Lowveld

Variety	Acreage	Mean percentage infection
N:Co.376	10901.5	1.5
N:Co.310	8229.9	4.4
C.P.29/116	2936.5	1.0
N:Co.334	859.0	1.4
N:Co.339	314.0	1.2
C.B.36/14	96.0	1.0
N.50/211	33.0	2.7
N:Co.293	29.0	11.1
Co.462	27.0	0.0
Co.421	25.0	0.1
Co.419	17.0	1.1
B.42231	15.0	<0.1
C.B.38/22	14.0	<0.1
B.4362	7.0	<0.1

tain circumstances C.B.36/14 can show a high incidence of smut, in one instance a percentage infection of over 12.0 has been recorded.

#### Soil transmission of smut

C.P.29/116 usually has a very much lower incidence of the disease than the other two varieties; however, it can sometimes develop a surprisingly high level of smut. Most of the land at present under C.P.29/116 on Sections 1 to 6, Triangle, had been previously planted with N:Co.310. When smut became prevalent in this variety it was ploughed out and very quickly replanted to C.P.29/116. Though there are quite a number of volunteers still left in the land to act as a source of inoculum, the majority of the infection is definitely in C.P.29/116. It is thought that the high level of infection has been caused by planting this variety in a soil which had a high smut spore inoculum present. The mean percentage smut incidence on sections 1 to 6 in 448 acres of C.P.29/116 is 4.0 while the incidence in 447 acres of the same variety on other sections is 0.2%. C.P.29/116 therefore suffers much less from smut when it has been planted in relatively clean land.

**TABLE II**  
Level of smut incidence in N:Co.376 on Sections 61 to 65 Triangle 1967

Section	Acreage inspected	Percentage infection
Section 61 Triangle	95	0.7
" 62 "	—	—
" 63 "	32	0.1
" 64 "	399	1.9
" 65 "	362	4.7

#### Transmission by infected seedcane

The survey results from sections 61 to 65, Triangle Ltd., illustrate the importance of a supply of smut free seedcane for planting new lands. In 1964, when these sections were developed, N:Co.376 seedcane supplied to the first three sections was relatively free from smut infection; however, the source of clean seedcane was exhausted when only two-thirds of

section 64 had been planted, and the remaining third of that section and all section 65 was planted with N:Co.376 from a section having high incidence of smut. Table II shows the results of initially planting infected seedcane on the level of smut incidence 3 years later.

The first allocation of land to settlers in Hippo Valley was in 1961, the second in 1964 and the last in 1965. A comparison of the smut incidence in these three blocks is interesting (Table III).

In both N:Co.310 and N:Co.376 the percentage of smut infection decreases from the oldest to the most recent settlement block. There are three reasons for this:

- Source of seedcane.
- Appreciation of the importance of smut resulting in more intensive roguing.
- Number of ratoons since planting.

It was not until 1962 that the importance of the disease to sugarcane culture was fully appreciated by settlers and section managers in Hippo Valley. Furthermore, the supply of seedcane to the first settlers was from an area in which there was a considerable amount of smut. By 1964 growers were more smut conscious; however, the supply of seed material to the second settlement block was not altogether smut free. Finally, the sources of seedcane for the third settlement block were relatively free of the disease, and, in addition, extensive roguing was carried out. The results in Table III reflect these points.

#### Effect of cattle grazing

In the 1966/67 season, cane fields of certain sections of Hippo Valley Estates Ltd. were fenced, and cattle were allowed to graze on the free range system from September, 1966, until May, 1967. This practice resulted in a very intensive cropping of certain areas, whilst others remained virtually ungrazed. The regrowth of the cane in the heavily grazed areas was thus exposed to repeated infections. This, coupled with the fact that no roguing was carried out due to labour shortage, resulted in an increase in the amount of smut (Table IV).

#### Discussion and Conclusions

In the Lowveld inspections have revealed over 600 acres in which the level of infection is over 15% (1000 stools/acre)—in some cases infections of over 50% have been recorded. One depressing feature of this is that N:Co.376 tends to be as bad as N:Co.310 in those areas where high incidence of smut is common. There is at present a strong appreciation of the dangers of smut, and several thousand acres are being ploughed out in order to reduce the hazard.

Co.462, a variety that has been released recently to the industry, is recommended for planting in those areas where smut incidence is high. The surveys in this variety have revealed no smut symptoms to date. Further plantings of N.Co. 310 are not recommended at present except in areas of low smut incidence. When smut has been reduced to negligible propor-

**TABLE III**  
Smut incidence in the three settlement blocks, Hippo Valley

Settlement Blocks Hippo Valley	N:Co.310		N:Co.376	
	Acreage	Percentage inf.	Acreage	Percentage inf.
1 (1961)	201	7.3	38	2.0
2 (1964)	219	1.7	282	0.5
3 (1965)	783	0.6	1391	0.1

**TABLE IV**  
Effect of grazing on smut incidence

Variety	Acres	Mean percentage infection	
		March 1966*	November 1967
N:Co.310	228	1.7	15.1
N:Co.376	140	1.8	17.3

\*Calculated from H.V.E. records.

tions by strict roguing, then N:Co.310 could be reconsidered for general planting again.

The frequent surveys carried out by the Disease Inspection Team give an idea whether the roguing programme carried out on the farm or section is efficient. The aim is to have a specialised smut scouting team on every farm and section. Then the disease can be caught and eradicated in its early stages; and the complications of removing smut whips from the field no longer arise.

Smut is an eradicable disease in the Rhodesian Lowveld; at least it can be reduced to negligible proportions if there is an all round improvement in agronomic practice. As it is absolutely essential that any replanting of cane lands should be done with clean seed material, the R.S.A. Disease Inspection Team is available to the industry as a whole to

inspect those fields that have been set aside by the section manager or grower as seedcane nurseries. These nurseries are inspected monthly, and a record is made of the total amount of smut observed by the team and the number of stools rogued by the grower or section manager, in order that as complete a field history as possible is recorded. If any field has more than 0.5% smut infection over all inspections, it is then recommended that it should not be used for seedcane supply. This "start clean—stay clean" policy is essential for the reduction of smut intensity in the Lowveld.

#### Summary

In the survey of the incidence of sugarcane it was shown that the distribution of the disease is random throughout the fields. Two survey techniques are described and results from these revealed that, of the three main commercial varieties grown, N:Co.310 has the highest smut incidence. C.P.29/116, normally a resistant variety, was shown to suffer from the disease if planted in soil containing a large spore inoculum. A study of a series of sections on Triangle Ltd., and the three phases of settlement in Hippo Valley has shown the importance of clean seedcane on the ultimate development of smut. The results of cattle grazing cane was an increase in smut incidence if no roguing was carried out. A "start clean—stay clean" policy is put forward as the means of reducing smut intensity in the Rhodesian Lowveld.



FIG 3  
 COMMERCIAL SUGARCANE VARIETIES IN THE RHODESIAN LOWVELD, AND  
 THEIR PERCENTAGE OF THE TOTAL ACREAGE INSPECTED.

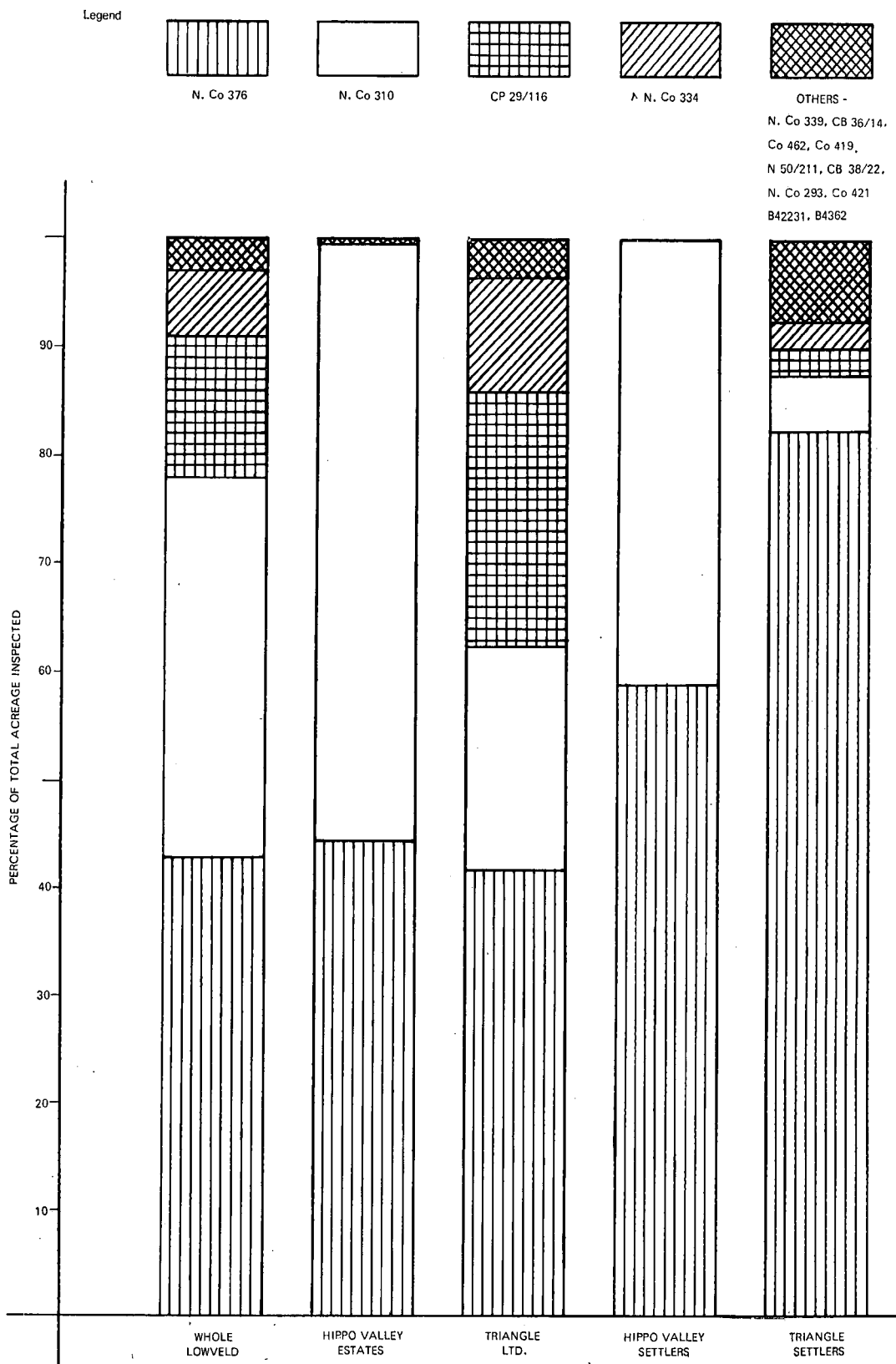
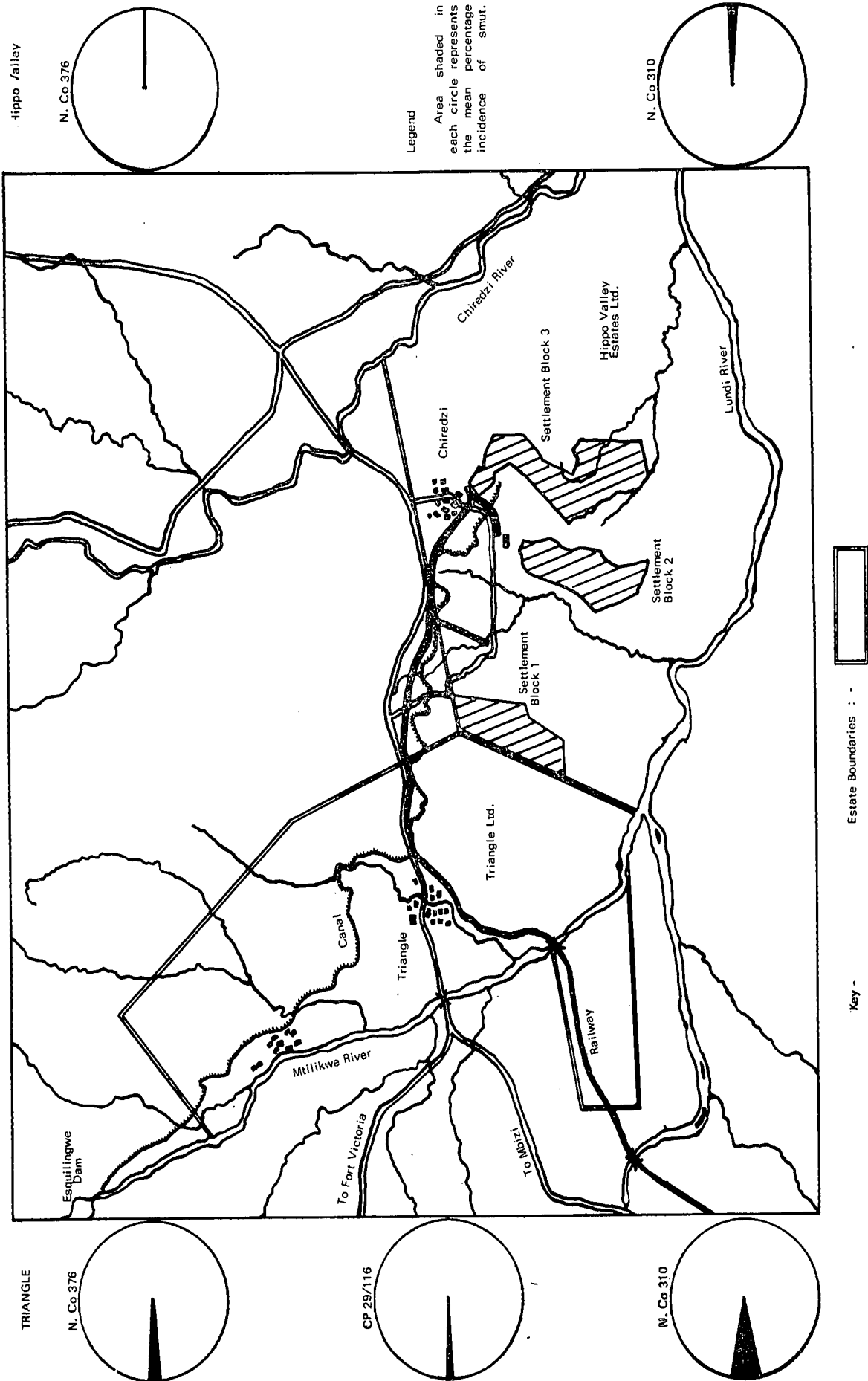


Fig 4. Sugarcane areas of Triangle and Hippo Valley showing the incidence of smut in the commercial cans.



### Discussion

**Dr. Thompson** (in the chair): How are stools identified in the field? You mention that a 1% infection in an acre is 70 stools, i.e., 7,000 stools per acre.

**Dr. James:** It is easy in plant cane but more difficult with ratoons, particularly in the Lowveld; however, it is the only practical unit one can use that is appreciated by the grower.

**Mr. Wilson:** I visited Pakistan recently where N:Co.310 is grown extensively and, although smut was recorded on other varieties, N:Co.310 remained free.

**Dr. James:** Dr. Bock, in Kenya, has worked on smut, and he points out that N:Co.310 has a very good field resistance whereas C.P.29/116, which is relatively resistant in our conditions in Rhodesia, he considers highly susceptible. This points to smut races or a different response to environment with respect to the disease.

**Mr. Gosnell:** It is certain that our varieties in Rhodesia are going to be selected relative to their susceptibility to smut. We have in the past had to eliminate entire varieties, e.g., Co.301, because of smut.

N:Co.376, regarded as resistant in Natal, is susceptible in Rhodesia.

We have Co.462 which, although agronomically it is slightly inferior to N:Co.376, has so far not been susceptible to smut.

**Mr. G. M. Thomson:** We have a potential smut hazard in the new areas in the Transvaal.

N:Co.376 in South Africa is so far highly resistant to smut although when it is affected the damage is drastic.

N 50/211 seldom shows smut disease in South Africa. This may be due to smut races or to an environmental factor.

**Mr. Wardle:** Is the high incidence of smut in the Lowveld of Rhodesia associated with any particularly good host plant?

**Dr. James:** Smut is specific to sugarcane. The main reason for the high incidence of the disease in the Lowveld is the ideal climatic conditions for smut.

**Mr. Gosnell:** All the seed cane for the Lowveld initially came from Natal and was infected before it arrived; subsequently the situation was allowed to get out of hand.

**Mr. Wilson:** There are old reports from Triangle which repeatedly drew attention to the danger of smut in the area.

**Mr. du Toit:** It was when Co.301 was planted from Natal that trouble started.

This paper shows the danger of a big pool of infection which can endanger other varieties formerly regarded as resistant.

It is most surprising that mosaic has never been found in Rhodesia.

**Dr. James:** We are keeping watch for mosaic but have seen none as yet; although it may be there.