SMUT SUSCEPTIBILITY TESTING OF SUGARCANE VARIETIES IN RHODESIA

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Abstract

Comparing data produced from artificial inoculation experiments to evaluate smut susceptibilities of varieties, with observations on established variety trials and results from smut exposure trials, it was concluded that the varietal resistance to smut was best determined by natural infection methods. The smut susceptibility of about 50 varieties under test in the Lowveld has been determined. No relationship was found between varietal susceptibility and the degree of tightness of the bud scales.

Introduction

Smut is the main disease problem of sugarcane in the Lowveld; therefore, the evaluation of the susceptibilities of newly introduced varieties which are commercially promising is considered to be extremely important.

Experimental

1. Infection by inoculation

Experiment 1

Materials and methods

Single-budded setts of N:Co.310, N:Co.376 and C.P.29/116 of approximately the same age — 4th node from the point of severance on canes that had been both trashed and topped — were incubated overnight (16-18h) at 31°C in a humid atmosphere prior to inoculation. Spore suspensions were then prepared from freshly harvested whips, and their concentrations estimated by the use of a haemocytometer slide. Spore inocula used were 10^6 x 1 spores per ml. water, 10^6 x 2, 10^6 x 4, 10^6 x 8 and Control — water. Buds were sprayed with an "Aerograph" air brush until discrete droplets formed on their surfaces, and the setts were then incubated again for 16-18h at a temperature of 31°C in a humid atmosphere (Bock[1]).

Twenty-five setts of each treatment and variety were planted — the replication was fourfold. Observations for smut whips were made every two days; and, on appearance of symptoms, the number of whips and incipient whips was recorded just before the most mature whip had ruptured the sheath. The infected stool was then removed.

Results

Plant crop

As no smut occurred in the plant crop of C.P.29/116, this variety has been omitted from the following tables.

TABLE I
Plant Crop: Arc sine transformed percentage data (Expt. 1)

Variety	Spore concentration per ml. water					Mean	S.E.
	Control	$10^6 \times 1$	$10^6 \times 2$	$10^6 \times 4$	$10^6 \times 8$		
N:Co.310	0	7.6	17.8	19.7	15.1	12.0	±1.9
N:Co.376	3.5	21.6	33.8	27.8	30.5	23.4	
Mean	1.8	14.6	25.7	23.8	22.8	C. of V% =47.9	
S.E.	±3.0						

TABLE II
Plant Crop: Mean number of whips per acre (Expt. 1)

Variety	Spore concentration per ml. water					Mean	S.E.
	Control	$10^6 \times 1$	$10^6 \times 2$	$10^6 \times 4$	$10^6 \times 8$		
N:Co.310	0	1186	4263	5560	2484	2706	±815
N:Co.376	371	5190	7970	7414	11492	6487	
Mean	185	3188	6116	6487	7006	C. of V.% =78.8	
S.E.	±1297						

N:Co.376 had a significantly higher percentage of smutted stools — $P<0.001$ (Table I) — and a greater number of whips $P<0.01$ (Table II) — in plant cane than N:Co.310. The comparison of control vs. treatments for both percentage infected stools and numbers of smut whips was highly significant ($P<0.001$); however, no significant trend was revealed within treatments.

First ratoon

As in the plant crop, observations for smut whips were made every two days, and rogueing of infected stools was carried out as soon as the numbers of whips and incipient whips had been recorded.

C.P.29/116 has again been omitted from the following tables as only two stools developed smut in the first ratoon — a mean infection of 0.5%.

TABLE III
First Ratoon: Arc sine transformed percentage data (Expt. 1)

Variety	Spore concentration per ml. water					Mean	S.E.
	Control	$10^6 \times 1$	$10^6 \times 2$	$10^6 \times 4$	$10^6 \times 8$		
N:Co.310	3.2	17.7	6.8	13.2	24.0	13.0	±2.5
N:Co.376	11.7	13.1	23.4	14.3	25.8	17.7	
Mean	7.4	15.4	15.1	13.8	24.9	C. of V.% 72.9	
S.E.	±3.9						

TABLE IV
First Ratoon: Mean number of whips per acre (Expt. 1)

Variety	Spore concentration per ml. water					Mean	S.E.
	Control	$10^6 \times 1$	$10^6 \times 2$	$10^6 \times 4$	$10^6 \times 8$		
N:Co.310	74	1668	630	927	3225	1297	±927
N:Co.376	1372	2113	2298	1668	2966	2076	
Mean	741	1891	1483	1297	3114	C. of V.% 97.6	
S.E.	±482						

There was no significant difference between N:Co.376 and N:Co.310 in percentage smut infected stools or in the number of whips produced; nor was there any evidence of treatment differences.

Comments

The fact that C.P.29/116 developed little or no smut in the plant and first ratoon crops is in agreement with field experience — this variety usually has quite a high natural resistance. However, in the plant crop N:Co.376 was shown to be more susceptible to smut than N:Co.310, which is converse to field observations. In the ratoon crop this difference was no longer significant although the trend was still there. This was possibly due to the very high variability of the results (Tables III and IV).

Comparison of smut incidence data—plant vs. first ratoon

Considering the plant and ratoon crop data together, no statistical difference was revealed between them with respect to percentage of stools infected (Table V). However, the smut whip data showed a highly significant decrease ($P<0.001$) in the number of whips from plant to first ratoon (Table VI).

TABLE V
Mean percentage infected stools (Expt. 1)

Ratoon	Variety			Mean
	N:Co.310	N:Co.376	C.P.29/116	
Plant	7.2	19.9	0	9.0
First	7.6	13.8	0.5	7.3
Mean	7.4	16.9	0.2	

TABLE VI
Mean number of whips per acre (Expt. 1)

Ratoon	Variety		Mean	S.E.
	N:Co.310	N:Co.376		
Plant	2706	6487	4597	±445
First	1297	2076	1705	
Mean	2002	4300	C. of V.%=90.0	
S.E.	±445			

Comments

The development of smut in the ratoon crop is a result of latent infection brought about by the inoculation at the beginning of the experiment (all stools showing smut symptoms during the plant crop were rogued), and also due to aerial infection occurring during the experiment. The incidence of smut in the control plots is due either to the use of infected seedcane or subsequent aerial infection. The fact that N:Co.376 controls were much higher in smut than N:Co.310 indicates that the N:Co.376 seedcane was probably infected (in spite of cane inspection and selection) since it is known that N:Co.310 is more susceptible to aerial infection under field conditions.

Though there was no difference in the percentage of stools which developed smut in the plant and ratoon crops, analysis of the data showed a significant decrease from plant to first ratoon in the number of whips produced by infected stools.

Experiment 2

Materials and methods

As in the previous experiment, single-budded setts prepared from the 4th node were incubated prior to inoculation for 16-18h. The following four varieties were used: N:Co.310, N:Co.376, C.P.29/116 and Co.462. The range of spore inocula used was: 10^5 spores per ml. water, 10^6, 10^7, 10^8 and Control — water. The inoculation technique was the same.

Twenty-five setts of each treatment and variety were planted — replication was threefold. Observations for smut whips were made every two days, and the same procedure was used for rogueing as in Experiment 1.

Results

Plant crop

As only two stools of C.P.29/116 developed smut (giving a mean infection of 0.7%) and Co.462 had no smut, these data have been omitted from the following tables:

TABLE VII
Arc sine transformed percentage data (Expt. 2)

Variety	Spore concentration per ml. water					Mean	S.E.
	Control	10^5	10^6	10^7	10^8		
N:Co.310	3.9	16.2	19.4	35.1	36.1	22.2	±2.1
N:Co.376	0	4.2	17.0	25.7	38.0	17.0	
Mean	2.0	10.2	18.2	30.4	37.0	C. of V.% =41.4	
S.E.	±3.3						

TABLE VIII
Mean number of whips per acre (Expt. 2)

Variety	Spore concentration per ml. water					Mean	S.E.
	Control	10^5	10^6	10^7	10^8		
N:Co.310	523	1167	1394	3536	3780	2073	±296
N:Co.376	0	226	1446	2265	2665	1324	
Mean	261	697	1428	2909	3223	C. of V.% =66.5	
S.E.	±453						

No significant difference between N:Co.376 and N:Co.310 in percentage smut infected stools or in the number of whips produced was revealed. However, both the comparison control vs. treatment and the trend within treatments were highly significant ($P<0.001$) when both methods of assessing smut incidence were considered (Tables VII and VIII).

Comments

No smut developed in Co.462, and only two stools of C.P.29/116 showed whips (one in control indicating the presence of infection in the original seed-cane). This is in agreement with field experience that these two varieties are usually resistant — Co.462 highly so. (Virtually no smut has yet been observed in Co.462 in the field.)

In contrast to Experiment 1, no difference was shown in smut susceptibility between N:Co.310 and N:Co.376 though the same inoculation technique was used.

The fact that the comparison control vs. treatments and the trend within treatments was significant, shows smut intensity to be directly proportional to inoculum concentration. This trend was not obvious in Experiment 1, because the range of concentrations used was small.

It was also demonstrated that the percentage of stools infected with smut and numbers of whips produced was correlated (Figure 1).

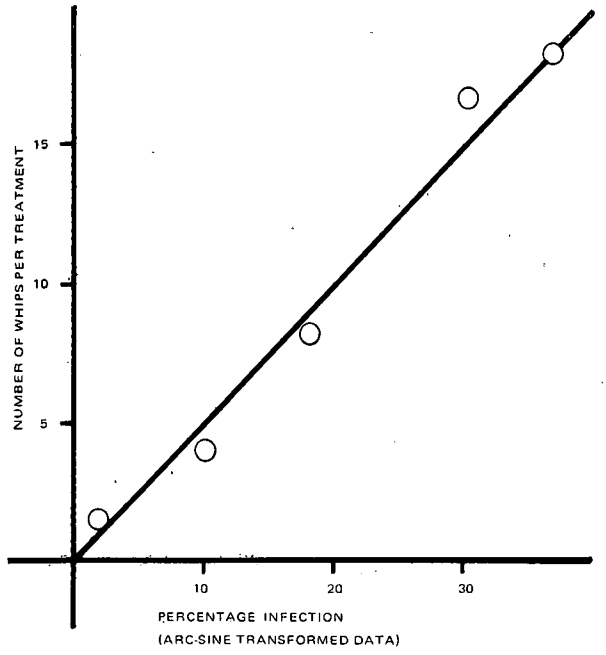

FIGURE 1. Correlation of percentage smutted stools with number of whips

2. Natural Infection

(a) Three variety trials at Triangle

Over a period of approximately 2½ years records have been taken of the amount of smut present in three variety trials at the Guy Hulett Research Station, Triangle Ltd. The incidence of smut both on the station and in surrounding commercial fields was high, therefore these trials were suitable for a study of natural infection of sugarcane.

Variety trial No. 1

Results

TABLE IX
Triangle, Variety trial No. 1: Smut incidence

Variety	Mean number of whips per acre			% Smutted stools
	2nd Ratoon	4th Ratoon	5th Ratoon	3rd Ratoon
Co.421	917	914	1013	4.1
C.P.29/116	379	419	455	2.0
N:Co.293	3376	14497	17992	14.5
N:Co.310	3703	7745	8910	9.5
N:Co.334	650	3208	3722	4.2
N:Co.376	1511	3079	4247	6.8
S.E.	±191	±1492	±1383	±1.3
C. of V.%	65.5	73.3	56.0	19.1

Analysis of the second ratoon data in Table IX revealed that both N:Co.310 and N:Co.293 had significantly more whips than the remaining four varieties ($P<0.05$). However, the percentage smutted stool data for the third ratoon showed only N:Co.293 to have more smut than the other varieties.

The number of smut whips recorded for each variety in this experiment in the fourth ratoon showed that N:Co.293 had a higher disease incidence than N:Co.310 ($P<0.01$); and N:Co.310 had more smut than the remaining four varieties — $P<0.05$ (Table IX).

Counts were again made of the number of whips present in each variety in the fifth ratoon, and N:Co.293 was shown to have very much more smut than N:Co.310 ($P<0.001$), and the latter variety had a higher smut incidence than the other varieties ($P<0.05$).

Variety trial No. 2

Results

TABLE X
Triangle, Variety trial No. 2: Smut incidence

Variety	Mean number of whips per acre			% Smutted stools
	2nd Ratoon	4th Ratoon	5th Ratoon	3rd Ratoon
C.B.36/14	106	653	518	6.3
C.B.38/22	158	287	330	3.5
Co.462	66	26	0	1.3
N:Co.79	1970	5818	6095	18.8
N:Co.310	6699	8884	5221	18.3
N.50/211	478	1429	337	4.1
S.E.	±234	±1046	±538	±0.3
C. of V.%	89.6	89.8	63.2	23.6

From the data for the second ratoon (Table X), N:Co.310 was shown to have a much greater number of whips than any other variety ($P<0.001$); and in the third ratoon the percentage infection data shows that both N:Co.310 and N:Co.79 had significantly

more smut than any other variety ($P<0.001$), whilst Co.462 had a lower disease incidence than C.B.38/22 ($P<0.01$) — Table X.

In the fourth ratoon, both N:Co.310 and N:Co.79 had significantly more smut than the remaining four varieties ($P<0.01$), as was the case in the fifth ratoon (Table X).

Variety trial No. 3

Results

TABLE XI

Triangle, Variety trial No. 3: Smut incidence

Variety	Mean number of whips per acre			
	Plant	1st Ratoon	2nd Ratoon	3rd Ratoon
B.4362	72	41	341	958
B.37172	35	170	1236	987
Co.617	45	108	491	863
Co.775	0	14	17	118
Co.911	56	352	8694	9211
Co.S.443	72	491	8677	12559
N:Co.310	128	393	2453	3587
N:Co.339	0	170	683	905
N:Co.376	14	56	590	780
P.R.1000	0	45	228	145
S.E.	±8	±23	±1331	±1302
C. of V.%	130.2	80.8	113.0	74.9

Analysis of the plant crop data revealed no significant difference between varieties with respect to the number of smut whips recorded; however, in the first ratoon the data showed that N:Co.310 had more smut than N:Co.376 ($P<0.01$). By the second ratoon there was no difference between N:Co.310 and N:Co.376. Co.911 and CoS.443 had significantly more smut than other varieties ($P<0.01$). In the next ratoon this was still the case (Table XI).

Comments

Tables IX and XI show that, when no control measures are implemented, smut intensity increases from ratoon to ratoon. However, in variety trial No. 2 there was a drop in smut intensity from fourth to fifth ratoon. The smut recorded in Co.462 in trial No. 2 was because of the presence of infected volunteer stools of another variety.

Though the assessment of varietal susceptibility to smut by exposure to natural infection is obviously a slow process for the evaluation of varieties, the results are dependable in that the same resistant varieties are found in each ratoon.

Five variety trials on the R.S.A. Experiment Station

Smut susceptibilities of over 31 varieties incorporated in five trials at the Experiment Station have been recorded over a period of two years. The experimental plots are adjacent to older commercial fields of susceptible varieties, and are downwind from them.

Results

TABLE XII

R.S.A. Experiment Station, Variety trial 1: Number of whips per acre

Variety	Number of whips per acre		
	Plant	First ratoon	Second ratoon
B.4362	0	5	17
C.B.36/14	66	153	235
Co.462	0	0	0
C.P.29/116	7	10	37
N:Co.310	7	263	2067
N:Co.376	0	104	495

TABLE XIII

R.S.A. Experiment Station Variety trial 2: Number of whips per acre

Variety	Number of whips per acre		
	Plant	First ratoon	Second ratoon
C.P.29/116	5	29	49
N:Co.310	0	444	2237
N:Co.376	2	95	451

The following varieties are planted in trial 3: B.3439, B.42231, C.B.38/22, C.B.40/77, Co.976, Co.1001, C.P.43/47, M.383/41, M.31/45, M.202/46, N.53/216, N:Co.376, PINDAR Q. 58, and Q. 70. Only N:Co.376 and PINDAR showed smut in the plant crop (seven whips per acre). In the first ratoon Co.976 developed smut (74 whips per acre), and the disease incidence in both PINDAR and N:Co.376 increased to 44 and 59 whips per acre respectively.

B.42231, Co.678, Co.775, Co.957, Co.1001, Co.S. 109, C.P.43/47, Ebene 1/37, M.383/41, M.31/45, N.51/168, N.51/539, N:Co.376, Q.57 and Q.70 were planted in variety trial 4. By the first ratoon smut developed in the following varieties: B.42231 (118 whips per acre), Co.1001 and Ebene 1/37 (7 whips per acre), N.51/168 (15 whips per acre), N.51/539 (81 whips per acre), N:Co.376 (15 whips per acre), and Q. 57 (984 whips per acre).

Of the varieties planted in trial 5 (Co.678, Co.684, Co.775, M.383/41, N.52/219, N:Co.376, Q. 57, Q. 63 and Q. 70), only Q. 57 developed smut in the plant (782 whips per acre). In the first ratoon the incidence of smut in Q. 57 rose appreciably to 5874 whips per acre, whilst smut developed in N:Co.376 (266 whips per acre) and Co.684 and M. 383/41 (both seven whips per acre).

Comments

These trials illustrate the importance of seedcane selection: C.B.36/14 in trial 1 was evidently planted with infected seedcane, and on ratooning the smut incidence increased appreciably. Even though the seedcane of N:Co.310 and N:Co.376 used in variety trials 1 and 2 was virtually clean, by the first ratoon these varieties showed an increase in infection. A comparison of the number of smut whips recorded in N:Co.310 and N:Co.376 demonstrates the higher susceptibility of the former variety.

Q. 57 was shown to be very highly susceptible to smut in trials 4 and 5. The smut incidence in trial 3 was low, and B.42231 developed no disease symptoms in the plant or ratoon crops; however, in trial 4, where the disease incidence was higher, this variety developed an appreciable amount of smut (118 whips per acre).

(b) Field exposure trials — Triangle

Experimental design and procedure

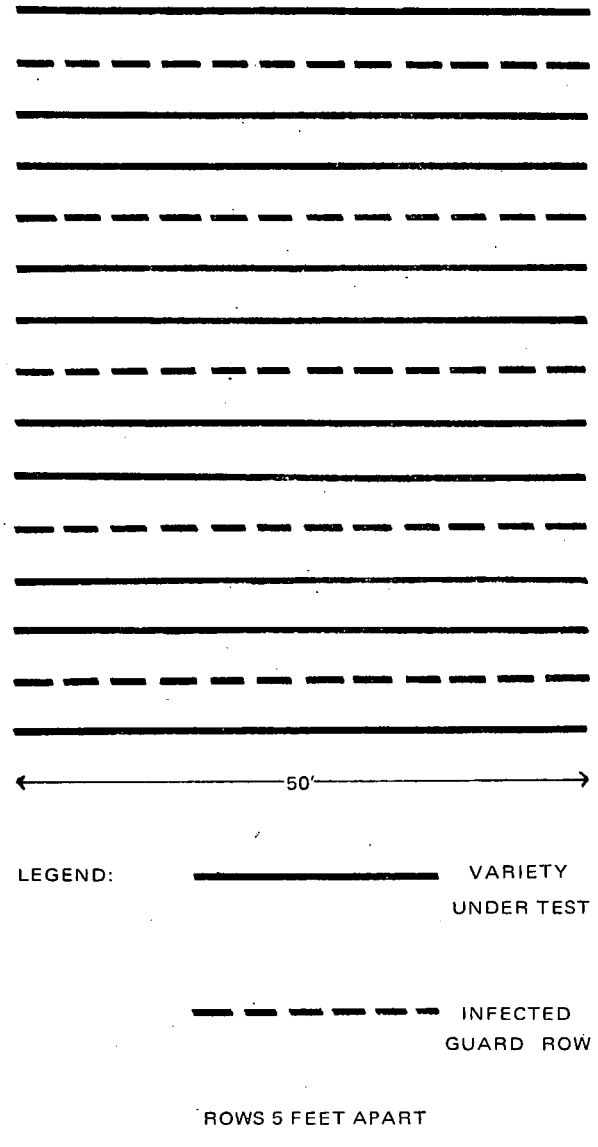

FIGURE 2: Field exposure trial-experimental design

Varieties under test were planted either side of rows of a susceptible variety (N:Co.310), which had a high level of smut infection (Figure 2). This infection of the guard rows was achieved by immersing the setts in a freshly prepared, highly concentrated, spore suspension immediately prior to planting.

At two weekly intervals, counts were then made of the number of tillers and smut whips in the rows of varieties under test. The infection level for each variety was finally expressed as a percentage:

$$\frac{\text{Number of whips}}{\text{Total number of tillers plus whips}} \times 100$$

Trial 1

Records are shown of the amount of smut developing in the plant crop (9½ months) and six months of the ratoon crop (Table XIV).

TABLE XIV

Percentage infection and number of whips per acre in plant and first ratoon crops*—trial 1

Variety	Ratoon			
	Plant		First ratoon	
	Percentage infection	No. of whips per acre	Percentage infection	No. of whips per acre
B.3439	0	0	0.8	697
B.37172	0	0	0	0
B.42231	1.2	523	0.2	261
B.4362	0.5	174	0.4	523
C.B.36/14	0.5	348	0.7	958
C.B.38/22	0	0	0	0
Co.462	0	0	0	0
Co.527	0.6	348	3.2	4703
Co.678	0	0	0	0
Co.775	0	0	0	0
Co.957	0.1	87	0	0
Co.976	0	0	0.1	174
C.P.43/47	0	0	0.9	1045
Ebene 1/37	0	0	0	0
Ebene 50/47	0	0	0.2	174
M.134/32	0	0	0.2	261
M.383/41	0	0	0	0
M.31/45	0.4	261	0	0
N.50/93	1.3	697	0.6	784
N.52/219	0	0	0	0
N.53/216	1.2	523	1.1	1132
PINDAR	0.5	174	0.5	523
Q.63	0	0	0.1	174
Q.70	0	0	0.1	87

(*Calculated on the totals of 2 replicates)

Comments

From the plant crop results B.42231, N.50/93 and N.53/216 were shown to be very susceptible to smut infection as they each produced over 500 whips per acre. C.B.36/14 is known to be susceptible to smut in the field, and this was confirmed by the plant and ratoon crops data. Smut incidences were high in B.4362, Co.527 and PINDAR in plant cane, and in all three varieties the disease increased significantly during the first ratoon. Comparing the plant and first ratoon crop, smut incidence decreased in B.42231, Co.957 and M.31-/45 — in the last two

varieties no smut was observed in the ratoon; however, in general, smut was shown to increase in intensity with time, if no control measures were implemented.

Trial 2

Results

Records are shown of the amount of smut developing in nine months in the plant cane crop (Table XV).

TABLE XV
Percentage infection and number of whips per acre*—trial 2

Variety	Plant crop	
	Percentage infection	No. of whips per acre
Co.684	0	0
Co.1001	0	0
Co.S.109	0	0
C.B.40/77	0	0
M.202/46	0	0
N.51/168	0.7	480
N.51/539	10.0	7543
Q.58	0.1	44

(*Calculated on the totals of 4 replicates)

Comments

From these initial results both N.51/168 and N.51/539 were shown to be smut susceptible — the latter variety highly so.

(c) Germination and bud morphology trial

An investigation was made on the hypothesis that smut resistance of varieties is related to the degree of tightness with which bud scales clasp the germinating bud. Setts of four varieties: N:Co.310, N:Co.376, C.P.29/116 and Co.462 were germinated at 31°C in a humid atmosphere, and the morphology of the buds was observed daily.

Results and comments

Though C.P.29/116 has a relatively good resistance to smut in the Rhodesian Lowveld, the bud scales in this variety remained loose during the period of germination observed, whilst in N:Co.376, a susceptible variety, the scales were tight (Figure 3). Such differences that did occur could not be correlated with the field incidence of smut in the four varieties chosen. Thus the hypothesis was not substantiated.

(d) Summary of resistance of varieties to smut

Comments

The scorings of varieties in Table XVI are based on the system proposed for standardizing disease resistance ratings (Hutchinson[2]); and the scores allotted are based upon the trials reported in this paper and other trials on Hippo Valley and Triangle plus experience with commercial varieties in the field. The scores for certain varieties have been assessed on only one or two trials; therefore the ratings for such varieties may change with the accumulation of more data.

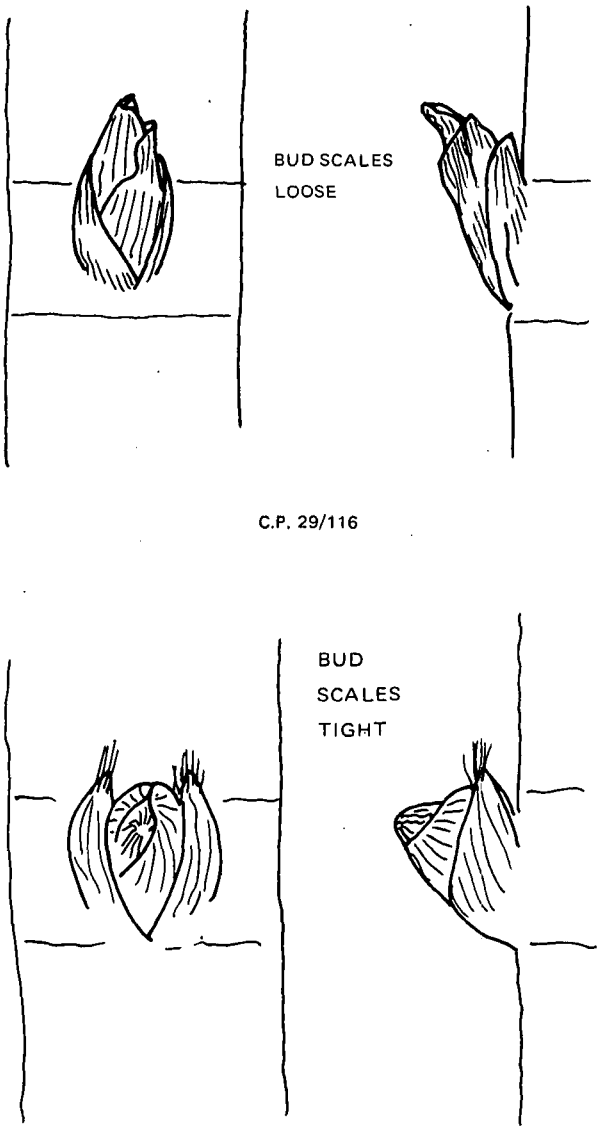

FIGURE 3: Bud development after 3 days germination

TABLE XVI

Summary—Resistance of varieties to smut

Variety	Score
B.3439 ..	5
B.4362 ..	4
B.37172 ..	5
B.42231 ..	6
C.B.36/14 ..	6
C.B.38/22 ..	2
C.B.40/77 ..	1
Co.421 ..	6
Co.462 ..	1
Co.527 ..	7
Co.617 ..	6
Co.678 ..	1
Co.684 ..	1
Co.775 ..	2
Co.911 ..	9
Co.957 ..	1
Co.976 ..	2
Co.1001 ..	1
Co.S.109 ..	1
Co.S.443 ..	9 (9)
C.P.29/116 ..	4 (9)
C.P.43/47 ..	6
Ebene 1/37 ..	1
Ebene 50/47	4
M.134/32 ..	5
M.383/41 ..	1
M.31/45 ..	2
M.202/46 ..	1
N.50/93 ..	6
N.50/211 ..	5
N.51/168 ..	5
N.51/539 ..	8
N.52/219 ..	1
N.53/216 ..	6
N:Co.79 ..	8
N:Co.293 ..	9
N:Co.310 ..	8 (3)
N:Co.334 ..	7
N:Co.339 ..	5
N:Co.376 ..	6
PINDAR ..	4
P.R.1000 ..	4
Q.57	8
Q.58	2
Q.63	4
Q.70	3

Ratings:

0=Immune
1=Very highly resistant
2=Highly resistant
3=Resistant
4=Intermediate—resistant
5=Intermediate—average
6=Intermediate—susceptible
7=Susceptible
8=Highly susceptible
9=Very highly susceptible

Method of scoring:

0		Whips per acre			=0
1–	25	,,	,,	,,	=1
25–	50	,,	,,	,,	=2
50–	100	,,	,,	,,	=3
100–	250	,,	,,	,,	=4
250–	750	,,	,,	,,	=5
750–	2000	,,	,,	,,	=6
2000–	6000	,,	,,	,,	=7
6000–	12000	,,	,,	,,	=8
>12000		,,	,,	,,	=9

The ratings in brackets for Co.S.443, C.P.29/116 and N:Co.310 are calculated from data presented by Waller[4] in 1967. A comparison between the two scores for these three varieties shows a complete contrast in disease resistance estimations for C.P.29/116 and N:Co.310, and an agreement in the very high susceptibility of Co.S.443 to smut.

Discussion and conclusions

In the first inoculation experiment, N:Co.376 was shown to be more susceptible to smut than N:Co.310. This was also found by Whiteside[5] and Johnson and Koenig[3] using the same inoculation technique. Such results are the converse of field observations; and, therefore, the artificial inoculation technique used cannot be fully depended on as a quick method for determining the true susceptibilities of varieties to smut. The reasons for the higher level of smut in N:Co.376 when compared with N:Co.310 are not known; however, it is not due to differences in the degree of tightness of the bud scales. Artificial inoculation is successful only in distinguishing between highly resistant and susceptible varieties.

When the inoculum levels were higher, in the second inoculation experiment, smut intensity was shown to be directly proportional to inoculum concentration. A positive correlation between percentage stools infected and the number of smut whips was also revealed. Therefore, either method for assessment of disease level counts of infected stools or number of whips — can be used when smut incidence is high.

In general, data from the eight variety trials and Trial 1 of the field exposure experiments show that, when no control measures are implemented, smut intensity increases from ratoon to ratoon. However, certain varieties in variety trial 2, Triangle, and B.42231, Co.957 and M.31/45 in the first field exposure trial showed a drop in smut intensity — as estimated by the number of whips per acre. A similar decrease in the number of smut whips was also found in the first inoculation experiment from plant to ratoon crops.

The contrast between the disease resistance ratings for C.P.29/116 and N:Co.310 in Kenya and Rhodesia (Table XVI) is interesting, and it is postulated that the differences are due to the presence of different races of sugarcane smut in the two countries.

Natural infection, as a technique for assessing varietal susceptibility to smut, is undoubtedly a slow process of evaluation; however, the eventual results are more dependable than those produced by the artificial inoculation method. Therefore, if smut exposure trials, involving as many commercially promising varieties as possible, are conducted in conjunction with the enforcing of a strict rogueing policy in all commercial plantings, a "crash programme" for smut susceptibility testing by artificial inoculation techniques is no longer necessary.

Acknowledgements

The author wishes to express his gratitude to Triangle Ltd., for making land available at their Research Station for the smut exposure trials.

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Discussion

Dr. Roth: Do you think the increase in smut in the first ratoon was from latent infection or from natural infection?

Regarding varietal resistance is it a question of susceptibility of varieties or the virulence of the different strains of smut?

Dr. James: The infection in the first ratoon could be either latent or natural.

We have not yet investigated the mechanism of varietal resistance to smut, nor yet determined how many strains of the disease are present in Rhodesia.

Dr. Gosnell: It has been suggested in Kenya that variety susceptibility to smut is related to the tightness of closing of the bud scales.

Varieties have been selected based on the tightness of the scales.

Maybe our strain of smut is not the same as that in Kenya or maybe conditions are so different that the method cannot be used.

In Kenya N:Co310 is found to be resistant and CP 29/116 to be susceptible which is completely opposite to our findings.

Referring to Table XVI it is distressing to see how many Natal varieties are highly or moderately susceptible to smut, the notable exception being N:52/219.

Dr. Roth: How long after the leaves of the setts were stripped did inoculation take place? Damage to tissue round the bud could be a critical factor so the inoculation should be delayed to allow the tissue to recover.

Dr. James: The setts were prepared in the field and then transported to the laboratory some three miles away where they were incubated 16-18 hours prior to inoculation.

Dr. Dodds: Some years ago a field manager who was transferred from Natal to Rhodesia took some new Natal varieties with him. All except Co301 were free of smut in Natal but when they were planted in Rhodesia all became infected.

Dr. Brett: Has it been established that infection takes place through the buds and not through the cut ends, particularly in ratoon cane?

Dr. James: No. For the bud inoculation experiments I was working from data produced by Dr. Bock, however, in other experiments we have found that infection can take place from spores in the soil—the pathway of such infection was not investigated. Such spores can remain viable in dry soil for over 64 days in the Lowveld, whilst if the soil is well irrigated, smut spores only remain viable for a week.

Mr. du Toit (in the chair): How far will smut spores travel in the air?

Dr. James: This is being investigated at present. Initially a spore trap has been set up about 50 feet away from cane.

Dr. Roth: It has been found in Europe and America that rust and smut spores can be carried as far as 100 miles by wind.

When soil is wet smut spores are destroyed by organisms in the soil.