

SOUTH AFRICAN SUGAR INDUSTRY
AGRONOMISTS' ASSOCIATION

EXPERIMENT RESULT

CODE: SMUT 3/85/Sw MHL

CAT: 1632

TITLE: LEVELS OF SMUT ROGUING IN NCo 376

1. PARTICULARS OF PROJECT

This crop : 4th ratoon
Site : Mhlume Sugar Company
Field 526
Region : Northern Irrigated
(Swaziland)
Design : 6 x 6 Latin square
Soil Set : 'T' and 'S'
Variety : NCo 376
Fertilizer : N P K
 170 25 75
Dates : 29/8/85 - 9/9/86
Age : 12,5 months
Rainfall : 554 mm
Irrigation : 880 mm
Total : 1434

2. OBJECTIVES

- * To determine the effects of differing levels of roguing on the expression of smut in sugarcane.
- * To assess the effects of roguing on yield.
- * To obtain information on the cost of roguing.

3. TREATMENTS

Six levels of roguing were used over various periods to assess the effects of roguing.

Treatment 1 : No roguing
Treatment 2 : One roguing at 6 weeks
Treatment 3 : Two roguings at 6 weeks and 12 weeks
Treatment 4 : Four roguings at 6, 9, 12 and 15 weeks
Treatment 5 : Four roguings at 6, 12, 18 and 24 weeks
Treatment 6 : Eight roguings at 6, 9, 12, 15, 18, 21, 24 and 27 weeks.

Notes on Treatments

- * During the tillering phase the roguing of all infected stools (or part of) was done by digging out the infected tillers.
- * Once stalk elongation commenced, roguing was done by complete removal of whips and incipient whips.
- * Field 526 had a 1984/85 smut infection level of less than 1.0%.

4. RESULTS (ROGUING PERIOD)

4.1 Table 1. Levels of infected stools (%) between 6 and 27 weeks.

TREATMENT	NOV 11 6 WKS	NOV 28 9 WKS	DEC 19 12 WKS	JAN 9 15 WKS	JAN 30 18 WKS	FEB 20 21 WKS	MAR 13 24 WKS	APR 8 27 WKS
1	1.8	2.6	3.1	2.9	3.7	1.9	1.1	1.3
2	1.7	1.2	2.6	2.0	3.3	1.7	0.9	1.3
3	1.6	1.3	2.6	0.7	1.6	1.0	0.2	1.1
4	1.7	1.0	1.2	0.5	1.3	1.2	0.6	0.7
5	1.6	1.5	2.6	1.3	2.3	1.1	0.5	0.9
6	1.6	1.5	1.8	1.4	1.9	1.3	0.5	0.8
LSD (P= 0.05)*	1.0	0.9	1.5	0.8	1.2	0.8	0.6	0.8
(P= 0.01)**	1.3	1.2	2.1	1.1	1.7	1.2	0.8	1.1
SIGNIFICANCE	NS	**	NS	**	**	NS	NS	NS
MEAN	1.7	1.5	2.3	1.5	2.4	1.4	0.6	1.0
SE MEAN	0.3	0.3	0.5	0.3	0.4	0.3	0.2	0.2
CV %	49.2	48.4	55.4	44.1	43.4	50.5	82.2	68.8

4.2 Table 2. Levels of infected whips (%) between 6 and 27 weeks.
(based on 155 000 millable stalks/ha).

TREATMENT	NOV 11 6 WKS	NOV 28 9 WKS	DEC 19 12 WKS	JAN 9 15 WKS	JAN 30 18 WKS	FEB 20 21 WKS	MAR 13 24 WKS	APR 8 27 WKS
1	0.41	0.68	0.77	0.88	0.90	0.45	0.21	0.30
2	0.62	0.29	0.54	0.42	0.68	0.38	0.13	0.28
3	0.42	0.21	0.47	0.12	0.32	0.19	0.03	0.16
4	0.44	0.21	0.16	0.08	0.21	0.22	0.09	0.06
5	0.52	0.29	0.49	0.21	0.46	0.19	0.10	0.14
6	0.40	0.30	0.33	0.23	0.35	0.27	0.08	0.09
LSD (P= 0.05)*	0.37	0.22	0.40	0.20	0.28	0.29	0.12	0.20
(P= 0.01)**	0.51	0.30	0.54	0.27	0.38	0.39	0.17	0.27
SIGNIFICANCE	NS	**	NS	**	**	NS	NS	NS
MEAN	0.47	0.33	0.46	0.32	0.49	0.28	0.11	0.17
SE MEAN	0.13	0.07	0.13	0.07	0.09	0.10	0.04	0.07
CV %	66.3	54.9	71.2	50.7	47.6	83.4	95.6	94.1

4.3 Table 3. Shoot (stalk) counts (x 1000ha) at 6, 12, 18 and 24 weeks.

TREATMENT	NOV 4 6 WEEKS	DEC 19 12 WKS	JAN 30 18 WKS	MAR 13 24 WKS
1	340	311	249	154
2	359	307	258	156
3	385	341	287	158
4	350	337	286	170
5	338	325	251	159
6	348	293	252	157
MEAN	353	321	264	159

5. RESULTS (HARVEST)

5.1 Table 4. Cane yield, cane quality and sucrose yield.

TREATMENT	CANE YIELD (TC/HA)	CANE QUALITY (SUC % CANE)	SUCROSE YIELD (T SUC/HA)
1 <i>no mowing</i>	115.5	15.25	17.58
2 <i>mowing x 6 weeks</i>	114.3	15.11	17.26
3 <i>2x mow x 6 weeks</i>	114.6	15.37	17.57
4 <i>4x mow @ 6, 12, 18, 24 weeks</i>	115.9	15.16	17.58
5 <i>4x mow @ 6, 12, 18, 24 weeks</i>	114.2	15.45	17.61
6 <i>8x mow @ 6, 9, 12, 15, 18, 21, 24 weeks</i>	116.7	15.24	17.71
LSD (P= 0.05)*	9.0	0.42	1.39
(P= 0.01)**	12.3	0.57	1.90
SIGNIFICANCE	NS	NS	NS
MEAN	115.2	15.27	17.55
SE MEAN	3.1	0.14	0.47
CV %	6.5	2.3	6.6

6. COMMENTS

6.1 Roguing Period

- * Roguing was carried out by estate roguing teams to ensure that standard commercial cane disease control practices occurred.
- * The high CVs (See Tables 1 and 2) resulted from the difficulty of obtaining uniformity of growth and disease incidence around a trial area of 11 hectares.
- * Shoot counts (see Table 3) taken during the period of roguing at 6, 12, 18 and 24 weeks showed no treatment differences. Shoot numbers declined continually after the first measurement at 6 weeks.
- * The first inspection, at 6 weeks, before roguing treatments commenced showed a uniform spread of smut infection of about 1.7% infected stools (about 0.5% infected shoots).
- * See Tables 1 and 2 for the effects of roguing treatment on the expression of smut:
 - Treatment 1 (Control) showed a steady increase in smut infection levels up to 18 weeks after which time the smut infection declined.
 - The pattern of treatment response was similar to that found in SMUT 1/85 and SMUT 2/85 with declining smut levels occurring with more frequent roguing during the pre-canopy stage of growth.
 - The indications of smut control became less apparent after 18 weeks due possibly to the moderate levels of infection and the 'masking' effect of a fully canopied crop.
- * A good linear correlation exists between stool and shoot (whip) infection levels ($r = 0.94$ (linear)) and ($r = 0.95$ (power)). This relationship can be expressed as :
 - a) $Y = 0.065 \times 0.257X$
 - b) $Y = 0.18 \times X^{1.26}$Where $X = \%$ stools infected (pop 13330/ha)
 $Y = \%$ whips infected (pop 155000/ha)
- * Records of labour utilization were incomplete and no measure of labour costs can be correctly established.

6.2 Harvest Results

- * The CVs for the harvest data were good considering the expansiveness of the trial area.
- * There were no cane yield differences which may reflect the lower level of roguing required in this trial (refer to SMUT 1/85 and SMUT 2/85).
- * There were no cane quality differences.
- * Sucrose yield reflected the absence of any cane yield difference.

7. SUMMARY

7.1 Roguing

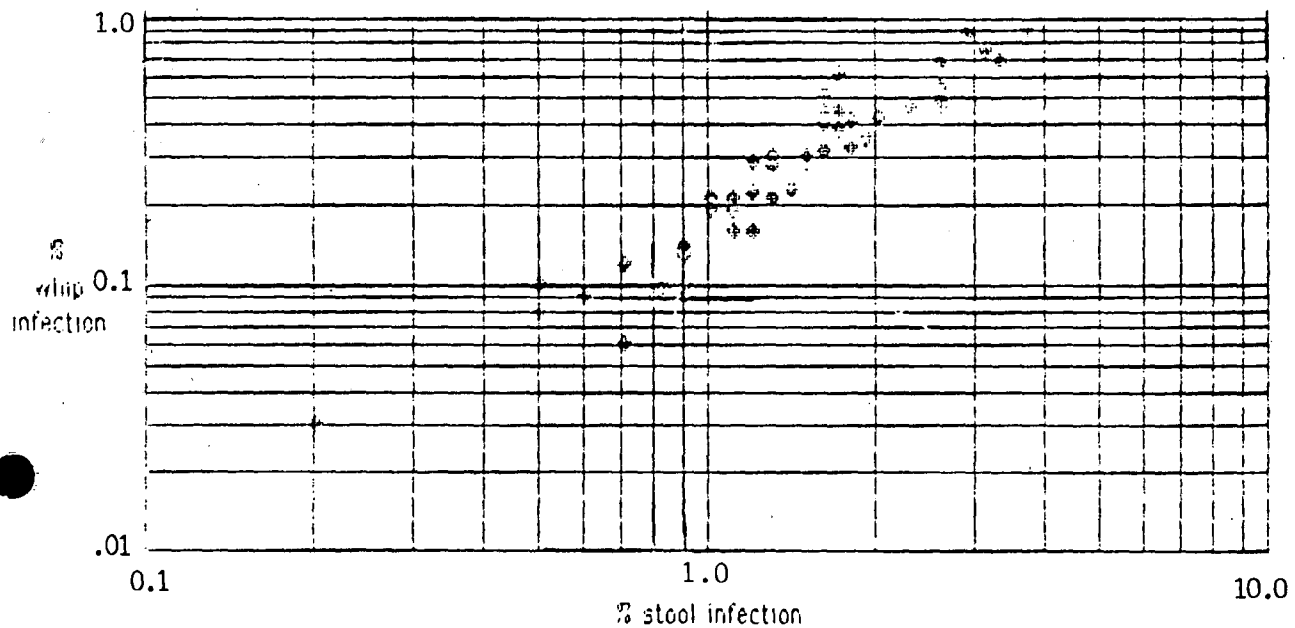
- * Despite the overall lower smut levels there was clear evidence (Treatment 1) that NCo 376 must be rogued regularly (Treatment 4) to ensure a sustained reduction in smut levels.
- * Maximum smut expression in the control plots was reached at about 18 weeks and declined to about 1/3 of maximum at 27 weeks. This trend between 18 and 27 weeks was evident in all treatments and shows the benefits of roguing early to reduce the peak level.
- * Best control was achieved by frequent early roguings followed thereafter by less frequent roguing.

7.2 Harvest

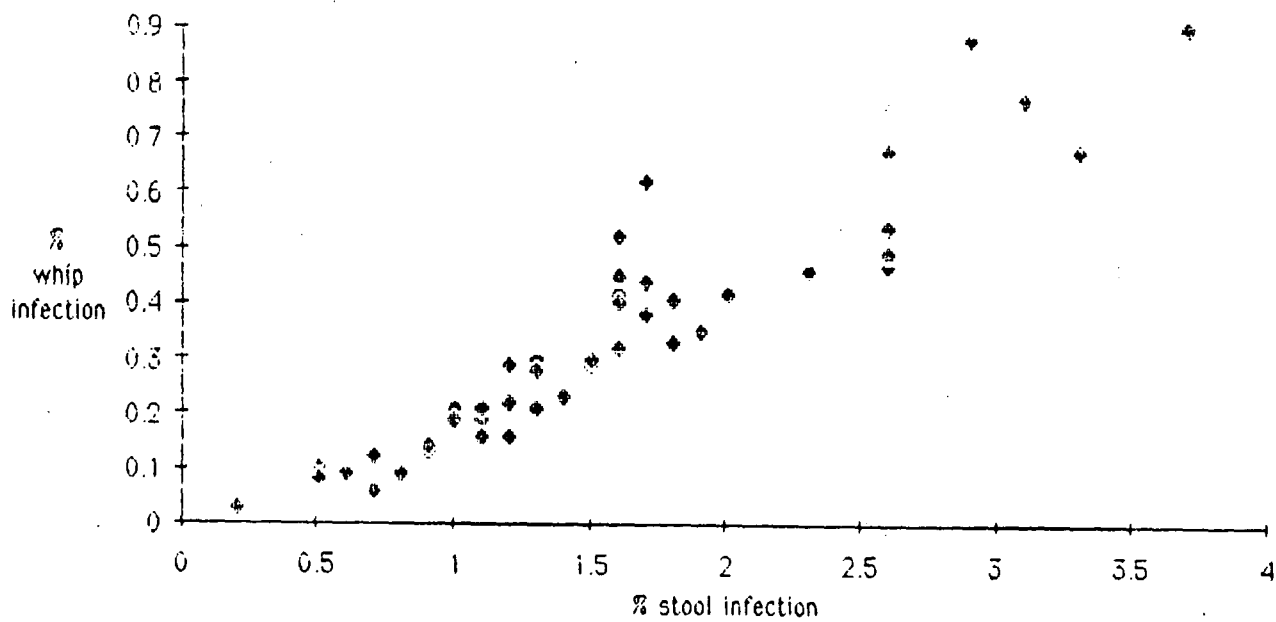
- * At these lower levels of smut infection there was no affect on cane and sucrose yields by any of the roguing treatments.

TLP/cg
15/7/88

Smut 3/85
 Regression line - Loglog transformation
 % stool infection vs % whip infection



Smut 3/85
 Regression line
 % stool infection vs % whip infection



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CODE: SMUT 3/85/Sw MHL

CAT. NO.: 1632

TERMINAL REPORT

TITLE: LEVELS OF SMUT ROGUING IN NCo376

1. PARTICULARS OF PROJECT

This crop : 6th Ratoon
Site : Mhlume Sugar Company
Region : Northern Irrigated (Swaziland)
Design : 6 x 6 Latin Square
Soil Set : 'T' and 'S'
Variety : NCo376
Fertilizer : N P K
(kg/ha) 170 25 75 (kgs/ha)
Dates : 28/7/87 - 7/6/88
Age : 10.3 months

2. OBJECTIVES

- 2.1 To determine the effects of different levels of roguing on the expression of smut in NCo376.
- 2.2 To assess the effects of roguing on yield.

3. TREATMENTS

Six levels of roguing were applied to the plots.

- Treatment 1 : No roguing
- Treatment 2 : One roguing at 6 weeks
- Treatment 3 : Two roguings at 6 and 12 weeks
- Treatment 4 : Four roguings at 6, 9, 12, and 15 weeks
- Treatment 5 : Four roguings at 6, 12, 18, and 24 weeks

Treatment 6 : Eight roguing at 6, 9, 12, 15, 18, 21, 24 and 27 weeks

Notes on treatments

- * The gross plot area was a 54 metre square area comprising 9 sprinkler plots each 18 metres square.
- * The nett plot for measurement of smut incidence was the center 18 metre square plot.
- * Measurement of smut incidence was carried out 2 days before the roguing treatments. No post-roguing measurement was carried out as the trial theme was to assess the effectiveness of commercial roguing practice.
- * Measurement of smut incidence was assessed as whips (exposed and incipient) infected and stools infected.
- * Total shoot counts were carried out at 6 week intervals.
- * The first roguing was carried out at about knee height (six weeks) and was done by 'chipping out' infected plant material. Subsequent roguing were done by 'pulling' infected material away from the stool.

4. RESULTS (ROGUING)

4.1 Table 1. Levels of infected stools (%) between 6 and 27 weeks.

TREATMENT	OCT 13 6 wks	NOV 3 9 wks	NOV 25 12 wks	DEC 15 15 wks	JAN 5 18 wks	JAN 26 21 wks	FEB 16 24 wks	MAR 83 27 wks
1	9.1	8.6	14.1	14.9	12.7	8.9	5.9	3.4
2	6.9	5.4	8.1	8.3	9.5	7.0	6.1	3.0
3	8.0	5.3	9.9	8.0	6.4	6.2	5.2	3.0
4	7.1	3.7	5.8	5.2	4.9	3.5	4.1	2.5
5	8.0	4.0	7.8	7.1	8.3	6.6	4.8	2.4
6	6.1	4.1	6.1	4.4	4.3	4.5	3.1	1.7
LSD(P=0.05)*	1.8	1.9	3.5	2.7	2.4	2.7	1.6	1.2
(P=0.01)**	2.5	2.5	4.8	3.6	3.3	3.6	2.3	1.6
SIGNIFICANCE	**	**	**	**	**	**	**	*
TRIAL MEAN	7.5	5.2	8.6	8.0	7.7	6.1	4.9	2.7
S E MEAN	0.6	0.6	1.2	0.9	0.8	0.9	0.6	0.4
CV %	20.0	29.7	33.9	27.8	26.3	36.3	28.2	35.3

4.2 Table 2 Levels of infected whips (%) between 6 and 27 weeks (based on 155 000 millable stalks/ha)

TREATMENT	OCT 13 6 wks	NOV 3 9 wks	NOV 25 12 wks	DEC 15 15wks	JAN 5 18 wks	JAN 26 21 wks	FEB 16 24 wks	MAR 8 27 wks
1	2.9	2.3	3.6	4.6	3.8	2.2	1.2	0.5
2	2.1	1.1	1.5	1.8	2.2	1.5	0.9	0.4
3	2.3	1.0	1.7	1.6	1.4	1.4	0.9	0.4
4	2.2	0.7	0.9	1.0	0.9	0.6	0.6	0.3
5	2.4	0.8	1.6	1.4	1.5	1.3	0.8	0.3
6	1.8	0.7	0.8	0.8	0.8	0.7	0.4	0.2
LSD(P=0.05)*	0.8	0.5	0.9	0.9	0.7	0.6	0.5	0.2
LSD(P=0.01)**	1.1	0.6	1.3	1.2	1.0	0.8	0.7	0.3
SIGNIFICANCE	**	**	**	**	**	**	**	*
TRIAL MEAN	2.3	1.1	1.7	1.9	1.8	1.3	0.8	0.4
S E MEAN	0.3	0.2	0.3	0.3	0.3	0.2	0.2	0.1
CV %	30.4	34.5	46.0	37.9	35.2	39.6	52.6	44.2

4.3 TABLE 3 Shoot (stalk) counts (x 1000/ha) at 6, 12, 18 and 24 weeks.

TREATMENT	OCT 13 6 wks	NOV 25 12 wks	JAN 5 18 wks	FEB 16 24 wks	JUN 7 Harvest
1	326	352	233	182	166
2	355	333	212	169	170
3	372	342	231	176	163
4	325	338	243	160	161
5	333	299	235	184	165
6	340	329	226	165	162
MEAN	342	332	230	173	165

5. RESULTS (HARVEST)

5.1 Table 4. Cane yield, sucrose % cane and sucrose yield.

TREATMENT	TONNES CANE/HA	SUCROSE % CANE	TONNES SUCROSE/HA
1	102.4	14.2	14.5
2	101.4	14.6	14.8
3	100.0	14.7	14.9
4	103.1	14.0	14.4
5	99.8	14.4	14.4
6	100.1	14.0	14.1
LSD (P=0.05)*	10.0	0.7	1.4
(P=0.01)**	13.6	1.0	1.9
SIGNIFICANCE	N.S	N.S	N.S
TRIAL MEAN	101.4	14.3	14.5
S E MEAN	3.4	0.2	0.5
CV %	8.2	4.2	7.9

6. COMMENTS6.1 Roguing Period

- * Roguing was carried out by estate teams using recommended practices.
- * CV's were somewhat lower. This is probably due to the overall lower infection levels compared to SMUT/1 and SMUT/2.
- * Shoot counts during the early spring months were lower than expected due to the cold, wet, overcast conditions.
- * The first inspection on October 13 seemed to indicate a slight carryover response of the previous seasons roguing treatments on the expression of smut.
- * Tables 1 and 2 show the effects of roguing treatments on the expression of smut. Note that levels shown are those occurring 2 days before roguing and do not indicate the efficiency of actual roguing (ie. the day after inspection) :-
 - Treatment 1 (Control) indicated the maximum level of smut occurring at about 15 weeks after harvest.
 - Treatment 2, one roguing at 6 weeks was initially effective but levels approached control at 24 weeks.

- Treatment 3, followed a similar pattern to treatment 2 with somewhat lower levels later.
- Treatment 4, showed an early suppression which appeared to be sustained when roguing stopped after 15 weeks.
- Treatment 5, with 6 week intervals was not as effective at achieving reductions in smut during the early phases of roguing.
- Treatment 6, did maintain an overall lower level of smut expression.

* A comparison of % stool and % whip infection resulted in the following correlation:-

$$\text{Linear } Y = 0.29X - 0.44 \quad (r = 0.91)$$

$$\text{Power } Y = 0.113X^{1.30} \quad (r = 0.95)$$

Where X = % stools infected (pop 13 333/ha)
Y = % whips infected (pop 155 000/ha)

6.2 Harvest Results

- * There were no differences in cane yield that could be attributed to the roguing treatments.
- * There were no cane quality differences.
- * Sucrose yield per hectare reflected the absence of any differences in cane yield and quality.
- * There was no effect on stalk counts from the different levels of roguing.

7. SUMMARY

7.1 Roguing

- * This trial showed an increase in the inherent smut levels as shown by the levels of smut in Treatment 1 with the result that significant responses to roguing were achieved by the various treatments throughout the inspection period.
- * The results appear to show that when smut levels reach a certain level (possibly about 15% stool infection) that sustained roguing is necessary to maintain a downward trend in smut expression.

- * The frequent early roguing appear to be more effective in allowing easier later control - see results of Treatments 4 and 6.

7.2 Harvest

- * The results do not show the trend towards improved yields seen in SMUT 1/85 and SMUT 2/85. This is probably due to the lower latent infection in this field.

8. 3 SEASON SUMMARY

8.1 Roguing Period

- * The results in Table 5 clearly illustrate that in the 2 seasons following the establishment of the trial that the roguing treatments had little effect on the initial expression of smut prior to the commencement of roguing.
- * The 4 fold increase in smut infection levels from 86/87 to 87/88 cannot be explained but does serve to indicate the high susceptibility of NCo376 to smut infection and the importance and influence of sustained roguing.
- * The results in Table 6 show the effects of roguing treatments 12 weeks after commencement of roguing when smut expression is likely to be approaching maximum expression. Indications are that early and sustained roguing (Treatment 4 and 6) will reduce smut levels considerably.
- * A very good correlation exists between % stool and % whip infection which will allow for some comparison to be made between smut levels in NCo376 in this industry and those of other industries where assessments are made on % whip infection.

8.2 Harvest results

- * Concern that intensive roguing would reduce millable stalks at harvest was not evident in this trial (see Table 7).
- * Indications from this trial are that at smut levels which are below 10-15% stool infection that there is unlikely to be a response in cane yield to varying levels of roguing.

8.3 General

- * This trial when viewed in conjunction with SMUT 1/85 and SMUT 2/85 emphasizes the point that maintaining smut levels below a certain threshold will ensure that cane yield losses due to high smut levels will be avoided.

* This trial has confirmed the high susceptibility of NCo376 to smut infection and notably that the intensive roguing of Treatment 6 did not significantly lower the overall increase in smut levels (see Table 5).

Table 5 Initial levels of smut expression prior to the commencement of roguing treatments at 6 weeks.

TREATMENT	% STOOL INFECTION				% WHIP INFECTION			
	85/86	86/87	87/88	MEAN	85/86	86/87	87/88	MEAN
1	1.8	2.1	9.1	4.3	0.4	0.4	2.9	1.2
2	1.7	1.9	6.9	2.3	0.6	0.6	2.1	1.1
3	1.6	1.7	8.0	3.8	0.4	0.4	2.3	1.0
4	1.7	1.4	7.1	3.4	0.4	0.4	2.2	1.0
5	1.6	1.5	8.0	3.7	0.5	0.4	2.4	1.1
6	1.6	2.2	6.1	3.3	0.4	0.6	1.8	0.9

Table 6 Levels of smut expression at 18 weeks (following 12 weeks of roguing treatments)

TREATMENT	% STOOL INFECTION				% WHIP INFECTION			
	85/86	86/87	87/88	MEAN	85/86	86/87	87/88	MEAN
1	3.7	4.5	12.7	7.0	0.9	1.1	3.8	1.9
2	3.3	3.0	9.5	5.3	0.7	0.6	2.2	1.2
3	1.6	3.0	6.4	3.7	0.3	0.6	1.4	0.8
4	1.3	2.2	4.9	2.8	0.2	0.4	0.9	0.5
5	2.3	2.2	8.3	4.3	0.5	0.4	1.5	0.8
6	1.9	1.6	4.3	2.6	0.4	0.3	0.8	0.5

Table 7 Correlation and regression between % stool and % whip infection (Linear - $Y = a + bX$ and Power - $Y = aX^b$)

TREATMENT	LINEAR RELATIONSHIP				POWER RELATIONSHIP			
	1986	1987	1988	MEAN	1987	1987	1988	MEAN
a	0.07	-0.05	-0.44	-0.14	0.176	0.157	0.113	0.149
b	0.257	0.224	0.289	0.257	1.26	1.16	1.30	1.24
r	0.94	0.90	0.91	0.92	0.95	0.93	0.95	0.94

Table 8 Stalk populations (1000/ha) at harvest

TREATMENT	85/86	86/87	87/88	MEAN
1	154	-	166	160
2	156	-	170	163
3	158	-	163	161
4	170	-	161	166
5	159	-	165	162
6	157	-	162	160
MEAN	159	-	165	162

Table 9 Yield at harvest (Tons cane per hectare)

TREATMENT	1986	1987	1988	MEAN
1	115.5	-	102.4	109.0
2	114.3	-	101.4	107.9
3	114.6	-	100.0	107.3
4	115.9	-	103.1	109.5
5	114.2	-	99.8	107.0
6	116.7	-	100.1	108.4
MEAN	115.2	-	101.4	108.3

TLP/cg
January 1989