A. VII

SOUTH AFRICAN SUGAR INDUSTRY

AGRONOMISTS' ASSOCIATION

Code : SOIL REC/SITE 1
Cat. No.: 1385

TITLE: Soil reclamation: Mtunzini

1. Particulars of the project

This crop : Plant

Site : Mtunzini

Region : North Coast

Soil system : Umzinto/Coast Lowlands

Soil form/series: Katspruit

Design : Non Statistical

Variety : See Treatments

Fertilizer : N 130 P 36 K 217

Soil analysis: Date: 23.9.81

pH	O.M.%	Clay%	P.D.I
6,19	-	13	-

ppm

P	K	Ca	Mg	Zn	Al
60	44	901	216	1,1	-

Age: 12.2 Dates: 22.9.81-27.9.82

Rainfall: 1015 mm L.T.M.: 1482

Irrigation: Nil

Soil Description: Grey sandy loam overlying a heavy mottled clay at 0,5 m depth. A valley bottom soil which has proved very difficult to drain in the conventional way (low hydraulic conductivity) and has tended to be saline sodic at depth (see 4.2) Cane yields have been very poor and hence vulnerable to eldana damage in an area where eldana is endemic.

2. Objectives:

2.1 To test two methods of drainage and the application of gypsum.

2.2 To test the feasibility of early cutting (about 12 months) of varieties which elongate rapidly (N11) or which are less susceptible to eldana (N8).

3. Treatments

3.1 Varieties: NCo 376, N11 and N 8 as whole plots (2); 66 m x 9 rows and 60 m x 6 rows.

3.2 Drains : In one area of the field No 4 c, mole drains were drawn from the waterway diagonally across the slope at a spacing of 1,6 m and at a depth of 0,5 - 0,6 m A Ford County 4 was used to pull the moling equipment.

In the second part of the field where subsurface 50 mm (PVC) drainage pipes had been installed 20 m apart some years earlier, the drains were re-excavated, checked for gradient and relaid with a backfill of riversand up to the A horizon of the profile to ensure a free flow of water into the drains.

3.3 Gypsum : was broadcast at 3t/ha after planting and hand hoed into the topsoil of half the block which had been drained.

4. Results

4.1 Yield and crop characteristics at harvest (Group means)

Treatment	t/ha cane	Suc % cane	t/ha suc	Stalk counts X 10^{-3}/ha	Stalk length (cm)	Stalk mass (kg)	% Stalks eldana damaged
Sub surface drains	79	12,3	9,9	128	174	0,62	16
Mole drains with gypsum	69	12,3	8,6	128	160	0,54	20
Mole drains without gypsum	79	13,6	10,8	133	168	0,60	13
Mean	76	12,7	9,8	130	167	0,59	
NCo 376	69	13,6	9,4	136	146	0,51	11
N8	67	11,4	7,7	133	177	0,51	5
N11	86	13,9	11,9	123	171	0,70	34

4.2 The trial continues into the first ratoon with new mole drains being drawn across the cane rows (with a coulter in front of the shank) and in between the original mole drains.

4.3 Comments on results

- Rainfall recorded was 68% of the long term mean. The mean cane yield was 6,2 t/ha/m and 7,9 tc/ha 100 mm of rainfall.

- Soil amelioration: there was no difference in yield between the plots that were mole drained and those with sub-surface drains. The addition of gypsum tended to reduce cane yield and this is reflected in reduced stalk heights and mass. The dry season was not a fair test of the effectiveness of the drains and suprisingly good yields were obtained despite the low rainfall.

- Varieties: N11 outyielded the other varieties in terms of tons cane and sucrose despite the greater number of eldana damaged stalks. NCo 376 and N8 yielded similarly in tc/ha but the characteristically low quality of N8 resulted in the sucrose yield being substantially lower than that of NCo 376. The trial was harvested when the cane was only 12 months old in order to reduce the eldana damage; despite the young age N11 was still clearly more susceptible to damage.

PKM/IS
30 September 1983

4.2: **Changes in the pH, EC and SAR at Mtunzini drainage trial (Site 1) between 4/10/78 and 30/9/82**

Sampling Position	Depth (cm)	4/10/78			14/2/79			11/3/81			1/7/81			30/9/82		
		pH	EC mS/m	SAR	pH	Ec mS/m	SAR	pH	EC mS/m	SAR	pH	EC mS/m	SAR	pH	Ec mS/m	SAR
1	0-30	6,1	485	9,2	6,4	551	9,6	6,6	133	4,0	5,9	292	1,0	6,8	65	3,6
	30-60	7,1	127	12,6	7,0	194	9,7	6,7	191	10,7	6,7	182	3,4	7,0	106	5,9
	60-90	7,3	90	10,1	7,3	79	9,4	7,3	137	10,8	7,6	114	7,5	6,9	120	8,8
2	0-30	6,2	952	12,6	6,0	1215	12,8	6,8	99	5,7	7,0	94	4,8	6,8	73	7,6
	30-60	7,5	561	18,4	6,7	923	19,7	7,8	229	14,5	8,2	195	12,1	7,9	121	9,6
	60-90	7,9	242	18,8	7,6	391	21,1	8,1	253	18,9	8,5	202	17,3	8,6	106	11,6
3	0-30	7,1	395	3,6	7,2	253	5,0	6,4	315	0,6	6,7	307	0,8	6,8	226	1,5
	30-60	7,5	59	5,9	7,4	91	5,0	6,2	273	3,3	6,1	209	3,2	6,8	252	3,1
	60-90	7,5	36	6,0	7,5	59	5,0	6,8	135	5,0	7,3	149	4,4	7,3	95	5,6
4	0-30	7,1	384	15,0	7,0	420	16,3	7,1	60	3,4	7,1	87	3,7	7,0	56	5,5
	30-60	7,6	154	18,7	7,4	239	19,5	7,7	144	13,8	7,8	138	11,8	7,5	111	9,2
	60-90	7,8	70	12,0	7,7	102	14,3	7,9	119	13,4	8,1	134	12,9	7,5	146	15,4
5	0-30	6,5	509	4,1	6,5	462	3,1	6,2	315	0,5	6,4	182	1,5	6,4	331	1,8
	30-60	7,1	73	4,8	6,8	250	4,5	6,8	146	3,3	7,0	97	2,4	6,6	356	3,3
	60-90	7,2	40	4,8	7,2	62	2,9	6,7	106	3,3	7,1	90	2,9	7,0	110	3,9
6	0-30	6,5	778	10,2	6,7	702	8,7	7,3	69	4,3	7,3	72	2,3	7,4	99	6,0
	30-60	7,4	295	18,4	7,4	322	15,1	7,7	163	13,7	7,8	117	8,5	7,4	218	12,0
	60-90	7,7	82	14,1	7,8	142	14,3	7,7	156	12,7	7,8	161	11,9	7,5	160	12,9
7	0-30	7,2	167	5,9	7,1	224	5,9	7,0	78	4,3	7,3	151	5,0	7,3	112	5,8
	30-60	7,3	57	5,2	7,3	74	3,7	7,3	69	3,6	6,9	206	5,8	6,9	100	5,5
	60-90	7,5	29	4,9	7,4	51	3,8	7,2	38	2,2	7,1	108	3,5	7,4	40	7,8
8	0-30	6,8	432	11,7	6,4	642	6,6	7,0	145	7,7	7,3	105	4,9	7,1	177	8,6
	30-60	7,7	209	15,0	7,0	383	12,5	7,9	168	11,2	8,1	114	8,5	7,8	173	12,5
	60-90	7,8	52	9,4	7,7	158	12,8	7,7	124	11,9	8,1	90	8,6	7,7	141	10,9
9	0-30	6,6	680	4,8	6,8	883	6,4	7,0	161	5,4	7,5	76	3,3	7,0	146	3,2
	30-60	7,0	198	5,5	7,1	320	6,2	7,4	114	5,9	7,9	71	4,0	7,2	130	4,6
	60-90	7,5	55	5,6	7,4	90	4,9	7,5	97	5,3	7,9	79	3,9	7,5	80	5,7
10	0-30	6,5	617	5,0	6,5	284	4,8	6,7	110	3,7	6,9	104	3,4	6,7	116	3,4
	30-60	7,7	285	4,8	7,2	124	5,0	7,2	77	4,4	7,6	67	3,2	7,2	129	4,4
	60-90	7,4	109	4,0	7,6	57	3,9	7,3	41	2,9	7,4	56	3,3	7,4	50	4,6
11	0-30	-	-	-	-	-	-	-	-	-	6,4	456	3,1	6,6	214	2,9
	30-60	-	-	-	-	-	-	-	-	-	7,5	339	5,7	6,8	208	5,3
	60-90	-	-	-	-	-	-	-	-	-	7,8	144	6,3	7,6	118	7,8
12	0-30	-	-	-	-	-	-	-	-	-	6,6	414	2,5	6,9	248	4,8
	30-60	-	-	-	-	-	-	-	-	-	7,7	171	7,3	7,6	112	10,0
	60-90	-	-	-	-	-	-	-	-	-	7,9	96	7,7	7,6	74	13,5
13	0-30	-	-	-	-	-	-	-	-	-	6,6	101	4,9	6,7	126	4,3
	30-60	-	-	-	-	-	-	-	-	-	7,5	137	10,2	7,3	184	13,4
	60-90	-	-	-	-	-	-	-	-	-	7,9	182	14,1	7,9	129	14,0
14	0-30	-	-	-	-	-	-	-	-	-	6,8	129	5,8	7,1	336	6,3
	30-60	-	-	-	-	-	-	-	-	-	7,4	196	11,8	7,9	183	14,4
	60-90	-	-	-	-	-	-	-	-	-	7,8	141	12,5	7,9	126	14,8
15	0-30	-	-	-	-	-	-	-	-	-	-	-	-	6,9	95	5,1
	30-60	-	-	-	-	-	-	-	-	-	-	-	-	7,3	57	5,0
	60-90	-	-	-	-	-	-	-	-	-	-	-	-	7,4	36	4,7
16	0-30	-	-	-	-	-	-	-	-	-	-	-	-	6,2	211	1,3
	30-60	-	-	-	-	-	-	-	-	-	-	-	-	6,7	161	3,8
	60-90	-	-	-	-	-	-	-	-	-	-	-	-	7,3	129	4,4
17	0-30	-	-	-	-	-	-	-	-	-	-	-	-	6,5	112	2,2
	30-60	-	-	-	-	-	-	-	-	-	-	-	-	6,8	101	3,3
	60-90	-	-	-	-	-	-	-	-	-	-	-	-	7,4	73	5,2

CODE: MTUNZINI RECLAMATION - SITE I : PROJECT NO. 2653

MTUNZINI FARM: Saline area

Site 1 - Field 4C

SUB SURFACE DRAINAGE SITE

Treatments: 1) NCo 376
2) N11
3) N8

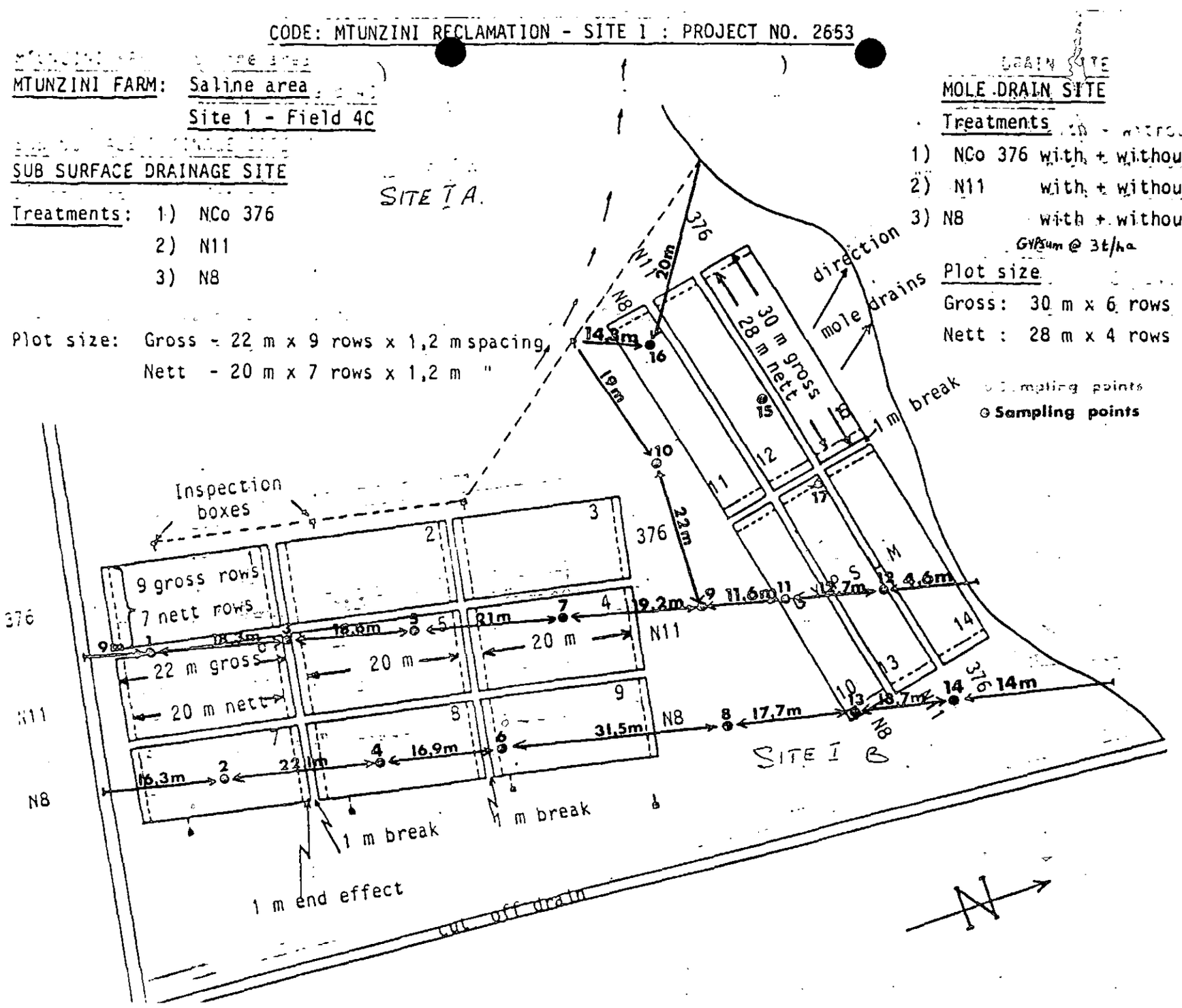
Plot size: Gross - 22 m x 9 rows x 1,2 m spacing
Nett - 20 m x 7 rows x 1,2 m "

MOLE DRAIN SITE

Treatments
1) NCo 376 with + without gypsum
2) N11 with + without gypsum
3) N8 with + without gypsum
Gypsum @ 3t/ha

Plot size
Gross: 30 m x 6 rows x 1,2 m
Nett : 28 m x 4 rows x 1,2 m

⊙ Sampling points



A VII

SOUTH AFRICAN SUGAR INDUSTRY

AGRONOMISTS' ASSOCIATION

Code: Soil Rec/Site 1

Cat. No.: 1385

Title: Mtunzini reclamation trial site 1 (Lower site)

1. Particulars of trial

This crop	:	1st Ratoon		
Site	:	Field 4c Mtunzini		
Region	:	North Coast		
Soil system	:	Umzinto - Coast Lowlands		
Soil form/series	:	Katspruit		
Design	:	Non statistical		
Variety	:	See treatments		
Fertilizer (kg/ha)	:	N	P	K
		141	0	141

Date & age at harvest:
14 months (Sep 82 - Nov 83)

Rainfall: 1 024

LTM: 1 568

Irrigation: Nil

2. Objectives

2. 1 To continue testing the efficiency and lifespan of mole drains and to compare moledrain efficiency with that of pipe drains plus permeable backfill.

2. 2 To continue testing the site for changes in EC and SAR values.

2. 3 To observe the performance of three cane varieties on this site.

3. Treatments

3. 1 Subsurface drainage system at 20 m spacing with sand backfill.

3. 2 Mole drains drawn at 1,5 m spacing.

3. 3 Three varieties N8, N11 and NCo 376.

4. Results

Table 1 A summary of yield data for the plant and first ratoon crops - Mtunzini Site 1

		Sub-surface drains				Mole drains							
						With gypsum				Without gypsum			
Crop	Unit	NCo 376	N11	N8	Mean	NCo 376	N11	N8	Mean	NCo 376	N11	N8	Mean
Plant	tc/ha/y	86	84	67	79	65	79	63	69	73	93	71	79
	ts/ha/y	10,1	12,0	7,5	9,9	8,1	10,6	7,0	8,6	10,7	13,2	8,4	10,8
1R	tc/ha/y	90	81	45	72	46	39	50	45	68	62	70	67
	ts/ha/y	9,7	8,8	3,8	7,4	4,0	2,6	3,6	3,4	6,7	4,9	6,7	6,1
Mean	tc/ha/y	88	83	56	76	56	59	57	57	71	78	71	73
	ts/ha/y	9,9	10,4	5,7	8,7	6,1	6,6	5,3	6,0	8,7	9,1	7,6	8,5

Table 2 A summary of the soil salinity/sodicity results for the subsurface drained area - Mtunzini Site 1

Depth (mm)	Pre-plant 4-10-78			Plant crop 30-09-82			1R 12-12-83		
	pH	EC mS/m	SAR	pH	EC mS/m	SAR	pH	EC mS/m	SAR
0-300	6,7	524	8,7	6,9	137	2,7	6,7	135	2,9
300-600	7,4	189	12,0	7,1	180	6,9	6,7	170	6,6
600-900	7,6	84	10,1	7,5	111	9,4	6,9	171	7,7

Table 3 A summary of the soil salinity/sodicity results for the mole drained area - Mtunzini Site 1

Treatments	Depth (cm)	Plant crop 30-09-82			1R 12-12-83		
		pH	EC mS/m	SAR	pH	EC mS/m	SAR
Gypsum	0-300	6,7	175	3,6	6,6	119	3,7
	300-600	7,1	151	8,0	7,1	158	6,1
	600-900	7,6	99	10,1	7,4	160	9,3
No Gypsum	0-300	6,5	153	3,2	6,1	251	2,8
	300-600	7,0	109	4,4	6,7	219	4,4
	600-900	7,1	83	4,6	7,1	172	4,6

5. Yield results

Table 1 shows that compared with the plant crop the first ratoon sucrose yields had on average declined by 25% in the subsurface drain treatment, by 45% on the moled treatments without gypsum and by 60% where gypsum was applied with mole drains.

Initially it was thought that the low yields of the gypsum treated plots were due to a salinity effect caused by the gypsum, but in fact the plots without gypsum had higher EC values in the plant crop and currently most EC values are well below the critical 200 mS/m value. A possible reason for the lower yields may be the higher SAR values in the subsoil (300-900 mm) of these plots. Pre-plant results show that the area with gypsum originally had a high SAR level in the subsoil. As the mole drains are only 350-400 mm deep the soil below this depth has not been drained so causing a build-up of sodium salts just below mole drain depth.

Mean yields for the different varieties are also given in Table 1. These show that N11 yielded best in the plant crop for all treatments but during the dry first ratoon both N8 and NCo 376 outyielded N11 in the mole drained area. NCo 376 yielded best of all treatments during the first ratoon.

During the plant crop there was little difference in mean sucrose yield between the subsurface and mole drained treatments. However the first ratoon sucrose yield results indicated that subsurface drainage was superior to mole drainage.

6. Salinity/sodicity analysis results - subsurface drained area

Table 2 summarises changes in pH, EC and SAR between pre-plant sampling and that done at the end of the plant and first ratoon crops for the subsurface drained area. The data show clearly that the once saline sodic condition in the topsoil had improved considerably by the end of the plant crop. Mean topsoil EC values declined from 524 to 137 mS/m and topsoil SAR values from 8,7 to 2,7. EC values in the 300-600 mm soil depth were never critical and showed little change, while SAR values at this depth as in the topsoil, showed an encouraging decline from 12 to 6,9 in the four years to the end of the plant crop. Changes in EC and SAR values from September 1982 to December 1983 were negligible other than in the 600 to 900 mm depth where EC increased from 111 to 171 and SAR decreased from 9,4 to 7,7.

7. Salinity/sodicity analysis results - mole drained area

In the mole drained area where gypsum was applied (see Table 3) EC values in the topsoil (0-300 mm) decreased on average between the plant and first ratoon crop from 175 to 119 mS/m but increased in the subsoil (600-900 mm) from 99 to 160 mS/m. SAR values at the 300-600 and 600-900 mm soil depths decreased from 8,0 to 6,1 and 10,1 to 9,3 respectively. These results indicate that in spite of rather shallow mole drains (350 mm) there has been some leaching of salts.

In the mole drained area where no gypsum was applied EC values have increased significantly at all depths and the topsoil values are now above the critical limit of 200 mS/m. SAR values in this area remained constant over the past year.

8. Third leaf data

When the area was leaf sampled in January the K values were on average just below threshold in the mole drained area but by the end of February were mostly well above threshold. All other nutrients were above threshold in January. However the February sampling showed the N values to be marginally deficient in both areas.

Table 4 Third leaf data - Mtunzini Site 1

Date sampled	Drain type	N %	P %	K %	Ca %	Mg %	Zn ppm
4.01.83	Sub surface	2,01	0,31	1,09	0,30	0,24	23
	Mole drains	1,94	0,30	1,03	0,37	0,25	24
24.02.83	Sub surface	1,58	0,24	1,23	0,28	0,23	22
	Mole drains	1,58	0,22	1,15	0,33	0,26	22

JMS/VSJ
18 December 1984

SOUTH AFRICAN SUGAR INDUSTRY

AGRONOMISTS' ASSOCIATION

Code: Soil Rec/Site 1
Cat. No.: 1385

Title: Mtunzini reclamation trial site 1 (Lower site)

1. Particulars of trial

This crop	:	2nd ratoon		
Site	:	Field 4C Mtunzini		
Region	:	North Coast		
Soil System	:	Umzinto Coast Lowlands		
Soil form/series	:	Katspruit		
Design	:	Non statistical		
Variety	:	See treatments		
Fertilizer (kg/ha)	:	N	P	K
Site 1A 4/1/84		68	0	68
2/2/84		73	0	73
Site 1B 4/1/84		47	0	47
2/2/84		94	0	94

Date and age at harvest:
10,8 months (Nov.83-Oct.84)

Rainfall : 1538,9 mm
LTM : 1175,7 mm
Irrigation : Nil

2. Objectives

2.1 To continue testing the efficiency and lifespan of mole drains and to compare mole drain efficiency with that of pipe drains plus permeable backfill.

2.2 To continue testing the site for changes in EC and SAR values.

2.3 To observe the performance of three cane varieties on this site.

3. Treatments

3.1 Subsurface drainage system at 20 m spacing with sand backfill.

3.2 Mole drains drawn at 1,5 m spacing.

3.3 Three varieties N8, N11 and NCo 376.

4. Results

Table 1 : A summary of yield data for a plant and two ratoon crops at Mtunzini site 1.

		Sub-surface drains				MOLE DRAINS							
						With gypsum				Without gypsum			
Crop	Yield	NCo 376	N11	N8	Mean	NCo 376	N11	N8	Mean	NCo 376	N11	N8	Mean
Plant	tc/ha/a	86	84	67	79	65	79	63	69	73	93	71	79
	ts/ha/a	10,1	12,0	7,5	9,9	8,1	10,6	7,0	8,6	10,7	13,2	8,4	10,8
1R	tc/ha/a	90	81	45	72	46	39	50	45	68	62	70	67
	ts/ha/a	9,7	8,8	3,8	7,4	4,0	2,6	3,6	3,4	6,7	4,9	6,7	6,1
2R	tc/ha/a	98	89	61	82	88	86	61	78	106	89	59	84
	ts/ha/a	11,9	11,2	7,0	10,0	11,1	10,0	6,7	9,2	14,2	11,7	6,9	10,9
Mean	tc/ha/a	91	85	58	78	66	68	58	64	82	81	67	77
	ts/ha/a	10,6	10,7	6,1	9,1	7,7	7,7	5,8	7,1	10,5	9,9	7,3	9,3

Table 2 : A summary of the soil salinity/sodicity results for the sub-surface drained area. Mtunzini site 1A

Depth (mm)	Pre-plant 4/10/78			End of plant crop 30/9/82			End of 1st ratoon 12/12/83			End of 2nd ratoon 8/11/84		
	pH	EC mS/m	SAR	pH	EC mS/m	SAR	pH	EC mS/m	SAR	pH	EC mS/m	SAR
0-300	6,7	524	8,7	6,9	137	2,7	6,7	135	2,9	6,8	166	4,3
300-600	7,4	189	12,0	7,1	180	6,9	6,7	170	6,6	7,0	169	7,4
600-900	7,6	84	10,1	7,5	111	9,4	6,9	171	7,7	7,4	139	8,5

Table 3 : A summary of the soil salinity/sodicity results for the mole drained area.

Treatments	Depth (mm)	End of plant crop			End of 1st ratoon			End of 2nd ratoon		
		pH	EC mS/m	SAR	pH	EC mS/m	SAR	pH	EC mS/m	SAR
Gypsum	0-300	6,7	175	3,6	6,6	119	3,7	6,9	144	3,9
	300-600	7,1	151	8,0	7,1	158	6,1	7,4	180	7,4
	600-900	7,6	99	10,1	7,4	160	9,3	7,7	146	9,6
No Gypsum	0-300	6,5	153	3,2	6,1	251	2,8	6,5	147	3,8
	300-600	7,0	109	4,4	6,7	219	4,4	6,9	167	4,0
	600-900	7,1	83	4,6	7,1	172	4,6	7,4	134	4,8

4.1 Yield results

Table 1 summarises the yield results for the plant and two ratoons harvested to date. Yields of the subsurface and mole drained areas were also compared. Above average rainfall in 1984 ensured that the second ratoon crop yielded as well as the plant crop which was on average about 40% higher than the first ratoon yield.

A comparison of the subsurface and mole drained areas showed that with the exception of the first ratoon crop both treatments yielded similarly. This is encouraging as it suggests that the mole drains were able to drain the soil sufficiently to allow good cane growth during the year of above average rainfall.

Comparing the areas in the mole drained section 'with' and 'without' gypsum again shows the gypsum treated area to be lower yielding than the area which received no gypsum. However, the difference was found to be greater during the first ratoon (+45%) when compared to the plant (+20%) and the wet second ratoon crops (+15%).

Mean variety yields for the mole drained area show that as for the plant crop N11 outyielded N8 in the second ratoon crop whilst in the first ratoon crop N8 was better than N11. Average yields over the three crops indicated that both NCo 376 and N11 performed better than N8 although during the first ratoon crop NCo 376 clearly outyielded the other two varieties.

4.2 Salinity/sodicity analysis results - subsurface drained area.

Changes in pH, EC and SAR at the pre-plant sampling and that done at the end of the plant and two ratoon crops are summarised in Table 2. Clearly there was a considerable decline in EC and SAR values at pre-plant sampling compared to those obtained at the end of the plant crop suggesting that the drains functioned well.

Other than EC at the 600-900 mm depth increasing from 111 to 171 mS/m and SAR at the same depth dropping from 9,4 to 7,7 there was little change in the chemical status of the soil between the plant and first ratoon crops. The recent data show that at all three depths both pH and SAR increased from the end of the first ratoon to the end of the second ratoon. However, the increases in pH and SAR were not sufficient to have had any adverse affect on the growth of sugarcane. EC for the duration of the second ratoon increased at the surface, remained constant at the 300-600 mm depth and declined slightly in the subsoil, none of the values being high enough to have had any adverse effect on the cane growth.

4.3 Salinity/sodicity analysis results - mole drained area.

In the mole drained area where gypsum was applied there was an increase in pH, EC and SAR at both the 0-300 mm and 300-600 mm depths between the end of the first ratoon and the end of the second ratoon. In the 600-900 mm depth pH and SAR also increased but EC values dropped slightly. Although increases in EC and SAR were evident they were similar to those in the subsurface drained area and not great enough to significantly affect growth of sugarcane.

During the past year the pH of the mole drained area without gypsum, increased slightly at all three depths, but not enough to cause any damage. There was an encouraging decline in EC to below the critical 200 mS/m value at all three depths. The SAR values of the topsoil increased a little whilst the subsoil (300-600 mm and 600-900 mm) values remained almost constant over the past year.

4.4 Third leaf data

When the area was leaf sampled in March 1984 the Zn values were marginal but no additional zinc fertilizer was considered necessary. All other nutrient values were well above threshold.

Table 4 : Third leaf data - Mtunzini Site 1

DATE SAMPLED	DRAIN TYPE	N%	P%	K%	Ca%	Mg%	Zn ppm
14/3/84	Sub-surface	2,00	0,25	1,17	0,28	0,20	12
14/3/84	Mole drains	1,96	0,26	1,13	0,28	0,21	12

5. Future work

The trial is to continue unchanged for the third ratoon. At the beginning of the third ratoon mole drains were re-drawn after modifying the mole plough by fitting a round foot instead of the previous rectangular foot. It is believed that this change will help improve the life of mole drains. These mole drains are to be monitored for collapsing to establish their life at the site. Visits will also be made to ensure that the mole drain outlets are kept free from any blockages that may occur.

JMS/SN
14 March 1985

AVII

SOUTH AFRICAN SUGAR INDUSTRY
AGRONOMISTS' ASSOCIATION

Code: Soil Rec/Site 1
Cat.No: 1385

Title: MTUNZINI RECLAMATION TRIAL SITE 1 (LOWER SITE)

1. Particulars of trial

This crop : 3rd ratoon

Site : Field 4C, Mtunzini

Region : North Coast

Soil system : Umzinto Coastal Lowlands

Soil form : Katspruit

Design : Non statistical

Variety : See Treatments

Fertilizer :

	N	P	K
Site 1A 3/1/85	141	0	141
Site 1B 3/1/85	141	0	141

Date and age at harvest:

12 months (Oct '84-Oct '85)

Rainfall : 1 117 mm

LTM : 1 322 mm

Irrigation: Nil

2. Objectives

- To continue testing the efficiency and lifespan of mole drains and to compare mole drain efficiency with that of pipe drains plus permeable backfill.
- To continue testing the site for changes in EC and SAR values.
- To observe the performance of three cane varieties on this site.

3. Treatments

- Subsurface drainage system at 20 m spacing with sand backfill.
- Mole drains drawn at 1,5 m spacing.
- Three varieties N8, N11 and NCo376.

4. Results

Table 1: A summary of yield data for a plant and three ratoon crops at Mtunzini Site 1

Crop	Yield	Subsurface drains				Mole drains							
						Gypsum				No gypsum			
		NCo 376	N11	N8	Mean	NCo 376	N11	N8	Mean	NCo 376	N11	N8	Mean
Plant	tc/ha/a	86	84	67	79	65	79	63	69	73	93	71	79
	ts/ha/a	10,1	12,0	7,5	9,9	8,1	10,6	7,0	8,6	10,7	13,2	8,4	10,8
1R	tc/ha/a	90	81	45	72	46	39	50	45	68	62	70	67
	ts/ha/a	9,7	8,8	3,8	7,4	4,0	2,6	3,6	3,4	6,7	4,9	6,7	6,1
2R	tc/ha/a	98	89	61	82	88	86	61	78	106	89	59	84
	ts/ha/a	11,9	11,2	7,0	10,0	11,1	10,0	6,7	9,2	14,2	11,7	6,9	10,9
3R	tc/ha/a	69	59	48	59	66	56	49	57	75	84	57	72
	ts/ha/a	9,3	7,6	6,0	7,6	9,1	7,6	5,5	7,4	10,0	12,2	7,1	9,8
Mean	tc/ha/a	86	78	55	73	66	65	56	62	81	82	64	76
	ts/ha/a	10,3	9,9	6,1	8,7	8,1	7,7	5,7	7,2	10,4	10,5	7,3	9,4

Table 2: A summary of the soil salinity/sodicity results for the subsurface drained area at Mtunzini Site 1A

Depth (mm)	Pre-plant			Plant crop			1st ratoon			2nd ratoon			3rd ratoon		
	pH	EC (mS/m)	SAR	pH	EC (mS/m)	SAR	pH	EC (mS/m)	SAR	pH	EC (mS/m)	SAR	pH	EC (mS/m)	SAR
0-300	6,7	524	8,7	6,9	137	2,7	6,7	135	2,9	6,8	166	4,3	6,8	197	5,1
300-600	7,4	189	12,0	7,1	180	6,9	6,7	170	6,6	7,0	169	7,4	7,1	225	8,4
600-900	7,6	84	10,1	7,5	111	9,4	6,9	171	7,7	7,4	139	8,5	7,5	165	8,9

Table 3: A summary of the soil salinity/sodicity results for the mole drained area at Mtunzini Site 1B

Treatments	Depth (mm)	Plant crop 30/9/82			1st ratoon 12/12/83			2nd ratoon 8/11/84			3rd ratoon 29/10/85		
		pH	EC (mS/m)	SAR	pH	EC (mS/m)	SAR	pH	EC (mS/m)	SAR	pH	EC (mS/m)	SAR
Gypsum	0-300	6,7	175	3,6	6,6	119	3,7	6,9	144	3,9	7,0	156	5,3
	300-600	7,1	151	8,0	7,1	158	6,1	7,4	180	7,4	7,6	207	9,7
	600-900	7,6	99	10,1	7,4	160	9,3	7,7	146	9,6	7,7	173	11,6
No gypsum	0-300	6,5	153	3,2	6,1	251	2,8	6,5	147	3,8	6,4	170	3,4
	300-600	7,0	109	4,4	6,7	219	4,4	6,9	167	4,0	6,9	227	4,6
	600-900	7,1	83	4,6	7,1	172	4,6	7,4	134	4,8	7,3	176	5,6

- **Yield results**

The yield results for the plant and three ratoon crops are summarised in Table 1. Rainfall during the 1984/85 season was about 15% lower than that in the previous season, and yields in the third ratoon crop were on average between 15 and 20% lower than those of the previous ratoon. A comparison of the subsurface and mole drained areas showed that, on average, the mole drained area outyielded the subsurface drained area. These results support those obtained during the plant and second ratoon crops which also indicated that mole drains were able to drain the soil sufficiently.

As with all preceding crops, the mole drained area without gypsum yielded about 25% more than the area with gypsum. This may be due to the lower subsoil SAR values measured there.

As previously, mean yields of the different varieties showed that NCo376 and N11 performed better than N8. An interesting result was that, as in the previous crop, NCo376 outyielded N11 in the subsurface drained area and the moled area with gypsum, but the reverse was true in the moled area without gypsum. The reason for this difference is not known.

- **Salinity/sodicity analysis results**

Subsurface drained area: Table 2 summarises the changes in pH, EC and SAR values from the time of planting until the end of the third ratoon. On average, the pH values changed little at all three sampling depths throughout the duration of the trial. Since the previous sampling, EC and SAR values at all three sampling depths increased. SAR values in the subsoil (below the 300 mm depth) exceeded the 200 mS/m threshold value.

Mole drained area: these results are summarised in Table 3. As with the subsurface drained area, EC and SAR values increased at all depths and in the gypsum treated area, values were above threshold at the 300 to 600 and 600 to 900 mm soil depths. In plots which received no gypsum, all EC and SAR values except the EC value at the 300 to 600 mm depth were below the threshold value.

Increases in EC and SAR values that have occurred over the past year were not surprising considering the dry winter in 1985.

5. **Mole drains**

At the beginning of the third ratoon, an improved mole plough-foot was used which appeared to help extend mole channel life. Previously, mole channels at this site generally did not remain open for longer than about six months, whereas after 12 months some of the channels drawn with the improved foot were still open. On account of the number of times this site has been moled at an inadequate depth over the past few years, it was decided not to re-mole at the end of the third ratoon. This will allow time for all or most of the channels to collapse by the end of the fourth ratoon, at which time the trailed mole plough can be used to draw mole drains at an acceptable depth (500 to 600 mm).

JHS/HDN
6 February 1986

SOUTH AFRICAN SUGAR INDUSTRY
AGRONOMISTS' ASSOCIATION

Cat No: 1385

Code: Soil Rec/Site 1

Title: MTUNZINI RECLAMATION TRIAL - SITE 1

Particulars of project:

This crop	: 5th ratoon
Site	: Field 4c, Mtunzini
Region	: North Coast
Soil system	: Umzinto Coast Lowlands
Soil form/series:	Katspruit/Longlands
Design	: Non-statistical
Varieties	: See treatments

Fertilizer/ Ameliorants :	N	P	K
	164	33	164

Date and age at harvest:

Age	: 12 months
Dates	: 22/10/86 - 27/10/87
Rainfall	: 2 233,4
LTM	: 1 297,3
Irrigation	: Nil

Objectives:

- To continue testing the efficiency and lifespan of mole drains and to compare mole drain efficiency with that of pipe drains plus permeable backfill.
- To continue testing the site for changes in EC and SAR values
- To observe the performance of three cane varieties on this site.

Treatments:

(a) Subsurface drainage system at 20 m spacing with sand backfill.

(b) Mole drains drawn at 1,5 m spacing at the beginning of the 3rd ratoon.

(c) Three varieties: N8, N11 and NCo376.

Results:

Table 1: A summary of yield data for the fourth and fifth ratoon crops at Mtunzini Site 1

Crop	Yield	Subsurface drains				Mole drains							
						No gypsum				Gypsum			
		NCo376	N11	N8	Mean	NCo376	N11	N8	Mean	NCo376	N11	N8	Mean
4R	tc/ha/a	91,0	70,0	62,0	74,0	72,0	71,0	69,0	71,0	94,0	87,0	83,0	88,0
	ts/ha/a	11,1	8,8	7,7	9,2	9,4	9,9	8,6	9,3	12,4	11,8	10,7	11,6
5R	tc/ha/a	73,8	87,8	61,2	74,1	56,3	64,7	63,8	61,6	70,1	72,2	58,8	67
	ts/ha/a	10,0	11,3	7,7	9,7	7,4	7,5	8,3	7,7	9,3	8,8	7,4	8,5

Table 2: A summary of the soil salinity/sodicity results for the sub-surface drained area at Mtunzini Site 1A (mean of 10 values

Depth (mm)	4th ratoon			5th ratoon		
	pH	EC (mS/m)	SAR	pH	EC (mS/m)	SAR
0-300	7,0	171	5,0	6,7	158	3,3
300-600	7,0	231	8,3	7,2	161	6,9
600-900	7,5	194	9,8	7,4	194	8,3
Mean	7,2	199	7,7	7,1	171	6,2

Table 3: A summary of the soil salinity/sodicity results for the mole drained area at Mtunzini Site 1B (mean of 10 values)

Treatment	Depth (mm)	4th ratoon			5th ratoon		
		pH	EC (mS/m)	SAR	pH	EC (mS/m)	SAR
No gypsum	0-300	6,9	110	4,2	6,9	117	3,6
	300-600	7,5	165	7,9	7,5	193	7,6
	600-900	7,5	158	4,8	7,7	149	9,6
	Mean	7,3	144	5,6	7,4	153	6,9
Gypsum	0-300	6,5	104	3,2	6,4	177	2,3
	300-600	6,6	197	4,0	7,0	140	3,1
	600-900	7,0	158	4,6	7,4	121	4,3
	Mean	6,7	153	3,9	6,9	146	3,2

Yield results:

Yields during the 5th ratoon were, on average, 10% lower than those of the fourth ratoon. The reason for this may be due to insufficient drainage during periods of very high rainfall, the total rainfall for the season being 936 mm higher than that of the previous season. In addition, the rainfall was unevenly distributed, over 400 mm falling in the month prior to harvesting. Waterlogged conditions would almost certainly have resulted in the poorer yields. On average, the mole drained plots yielded less than those in the sub-surface drained area. On inspection, all the mole drains were found to have collapsed, resulting in poor drainage. Yields were slightly better on mole drained plots where gypsum had been applied, perhaps due to the lower SAR values, when compared to those where no gypsum had been applied.

Varietal yield differences were also noted between the fourth and fifth ratoon. In the fifth ratoon, N11 showed an improved yield of 25% over NCo376 and N8. This can probably be explained by N11 being better suited to wetter valley bottom conditions than either of the other two varieties.

Salinity/Sodicity results:

Subsurface drainage areas

EC and SAR values showed a decline when compared with the fourth ratoon values, possibly due to more effective leaching caused by the higher rainfall conditions (Table 2). A sodicity rating above the critical value of 6 for these soils, was only found at depths below 300 mm.

Mole drained area

Where no gypsum was applied, the EC values increased during the 5th ratoon, although they did not exceed the threshold limit of 200 mS/m. The lack of drainage in these plots could well have increased the existing salinity problem at this site. Sub-soil SAR's (600-900 mm depth) have also increased since the 4th ratoon and now exceed the threshold value of 6.

Where gypsum had been applied, the EC and SAR values generally declined with depth during the fourth ratoon.

Three attempts were made to re-mole this site at a depth of 500 mm, in the gleyed sub-soil. All attempts failed due to unsatisfactory moisture conditions at depth. On two occasions conditions were too dry and on the third occasion too wet. It appears that the moisture conditions for moling these soils are highly unpredictable and pose an even greater problem for drainage than was initially thought.

Note: It is recommended that this trial in its present form be discontinued but that the site be considered for a second vertical mulching trial. The performance of vertical mulching with sand may be compared with the existing area which is sub-surface drained.

FJD/RAW/MG
28 March, 1988

SOUTH AFRICAN SUGAR INDUSTRY
AGRONOMISTS' ASSOCIATION

Code: Soil Rec/Site 1
Cat.No: 1385

Title: MTUNZINI RECLAMATION TRIAL - SITE 1

1. Particulars of the project:

This crop : 4th ratoon

Site : Field 4C, Mtunzini

Region : North Coast

Soil system : Umzinto Coastal Lowlands

Soil form/series: Katspruit

Design : Non-statistical

Variety : See Treatments

Fertilizer/ Ameliorants	N	P	K
Site 1A 3/1/85	164	33	164
Site 1B 3/1/85	164	33	164

Date and age at harvest:

Age : 12 months

Dates : Oct 1985-Oct 1986

Rainfall : 1 031 mm

LTM : 1 296 mm

Irrigation: Nil

2. Objectives

- To continue testing the efficiency and lifespan of mole drains and to compare mole drain efficiency with that of pipe drains plus permeable backfill.
- To continue testing the site for changes in EC and SAR values.
- To observe the performance of three cane varieties on this site.

3. Treatments

a) Subsurface drainage system at 20 m spacing with sand backfill.

b) Mole drains drawn at 1,5 m spacing.

c) Three varieties: N8, N11 and NCo376.

4. Results

Table 1: A summary of yield data for a plant and three ratoon crops at Mtunzini Site 1

Crop	Yield	Subsurface drains				Mole drains							
						No gypsum				Gypsum			
		NCo 376	N11	N8	Mean	NCo 376	N11	N8	Mean	NCo 376	N11	N8	Mean
Plant	tc/ha/a	86,0	84,0	67,0	79,0	65,0	79,0	63,0	69,0	73,0	93,0	71,0	79,0
	ts/ha/a	10,1	12,0	7,5	9,9	8,1	10,6	7,0	8,6	10,7	13,2	8,4	10,8
1R	tc/ha/a	90,0	81,0	45,0	72,0	46,0	39,0	50,0	45,0	68,0	62,0	70,0	67,0
	ts/ha/a	9,7	8,8	3,8	7,4	4,0	2,6	3,6	3,4	6,7	4,9	6,7	6,1
2R	tc/ha/a	98,0	89,0	61,0	82,0	88,0	86,0	61,0	78,0	106,0	89,0	70,0	67,0
	ts/ha/a	11,9	11,2	7,0	10,0	11,1	10,0	6,7	9,2	14,2	11,7	6,9	10,9
3R	tc/ha/a	69,0	59,0	48,0	59,0	66,0	56,0	49,0	57,0	75,0	84,0	57,0	72,0
	ts/ha/a	9,3	7,6	6,0	7,6	9,1	7,6	5,5	7,4	7,4	10,0	7,1	9,8
4R	tc/ha/a	91,0	70,0	62,0	74,0	72,0	71,0	69,0	71,0	94,0	87,0	83,0	88,0
	ts/ha/a	11,1	8,8	7,7	9,2	9,4	9,9	8,6	9,3	12,4	11,8	10,7	11,6
Mean	tc/ha/a	87,0	77,0	57,0	73,0	67,0	66,0	58,0	64,0	83,0	83,0	68,0	76,0
	ts/ha/a	10,4	9,7	6,4	8,8	8,3	8,1	6,3	7,6	10,8	10,8	8,0	10,0

Table 2: A summary of the soil salinity/sodicity results for the sub-surface drained area at Mtunzini Site 1A (mean of 10 values)

Depth (mm)	Pre-plant			Plant crop			1st ratoon			2nd ratoon			3rd ratoon			4th ratoon		
	pH	EC (mS/m)	SAR	pH	EC (mS/m)	SAR	pH	EC (mS/m)	SAR	pH	EC (mS/m)	SAR	pH	EC (mS/m)	SAR	pH	EC (mS/m)	SAR
0-300	6,7	524	8,7	6,9	137	2,7	6,7	135	2,9	6,8	166	4,3	6,8	197	5,1	7,0	171	5,0
300-600	7,4	189	12,0	7,1	180	6,9	6,7	170	6,6	7,0	169	7,4	7,1	225	8,4	7,0	231	8,3
600-900	7,6	84	10,1	7,5	111	9,4	6,9	171	7,7	7,4	139	8,5	7,5	165	8,9	7,5	194	9,8
Mean	7,2	266	10,3	7,2	143	6,3	6,8	159	5,7	7,1	158	6,7	7,1	196	7,5	7,2	199	7,7

Table 3: A summary of the soil salinity/sodicity results for the mole drained area at Mtunzini Site 1B (mean of 10 values)

Treatment	Depth (mm)	Plant crop 30/9/82			1st ratoon 12/12/83			2nd ratoon 8/11/84			3rd ratoon 29/10/85			4th ratoon 13/11/86		
		pH	EC (mS/m)	SAR	pH	EC (mS/m)	SAR	pH	EC (mS/m)	SAR	pH	EC (mS/m)	SAR	pH	EC (mS/m)	SAR
No gypsum	0-300	6,7	175	3,6	6,6	119	3,7	6,9	144	3,9	7,0	156	5,3	6,9	110	4,2
	300-600	7,1	151	8,0	7,1	158	6,1	7,4	180	7,4	7,6	207	9,7	7,5	165	7,9
	600-900	7,6	99	10,1	7,4	160	9,3	7,7	146	9,6	7,7	173	11,6	7,5	158	4,8
Gypsum	0-300	6,5	153	3,2	6,1	251	2,8	6,5	147	3,8	6,4	170	3,4	6,5	104	3,2
	300-600	7,0	109	4,4	6,7	219	4,4	6,9	167	4,0	6,9	227	4,6	6,6	197	4,0
	600-900	7,1	83	4,6	7,1	172	4,6	7,4	134	4,8	7,3	176	5,6	7,0	158	4,6

Yield results

A summary of yield results is given for all ratoon crops in Table 1. Although rainfall for the 1985/86 season was lower than in the previous season, overall yields were on average 11% higher than those of the third ratoon. The mole drained areas again yielded on average higher tonnage of cane than the subsurface drained area.

These results substantiate the trend shown by the two previous crops which indicated that mole drains can function equally well and are able to drain the soil as efficiently as subsurface drains.

For some time there has been concern that the 'gypsum' and 'no gypsum' treatments within the mole drained area were originally incorrectly labelled because SAR values in the topsoil were showing trends which were the reverse of what was expected. Following harvesting of the fourth ratoon crop extensive soil sampling was carried out to a depth of 90 cm. Traces of gypsum were found in the plots marked as 'no gypsum'. Further results based on extractable Ca and S measurements and SAR values confirmed that a mistake must have been made when the treatments were being labelled. A re-assessment of previous yield data now indicates that on average yields have increased by 25% where gypsum was applied, probably due to the reduction in SAR values.

In the subsurface drained area, mean yields for the different varieties showed large increases in the fourth ratoon, as compared with the third ratoon. NCo376 outyielded N11 and N8, and showed an improved yield of 14% in the fourth ratoon as compared with 1985. Under subsurface drain conditions, cane yields were higher than those in the mole drained areas without gypsum, but similar to those obtained where gypsum had been applied to mole drained plots. In all, the ameliorated mole drained plots yielded the highest mean tc/ha and ts/ha.

Salinity/sodicity analysis results

Subsurface drained area: Table 2 shows the changes in pH, EC and SAR values for plant and all subsequent ratoon crops since 1981; pH values showed little change with depth throughout the duration of the trial. EC values decreased steadily until the third ratoon, when samples between 600-900 mm depth showed values above the critical threshold value of 200 mS/m.

This trend continued in the fourth ratoon analyses, indicating a build-up of salts at depth due to leaching from the topsoil horizon. SAR values also showed an increase in the lower soil horizons, where values for all crops were above the critical value of 6. An increase in the salinity/sodicity status of these soils may be correlated with the dry winters of 1985 and 1986, and the lower average rainfall of the past season.

Mole drained area: results are given in Table 3. As with the subsurface drained plots, in mole drained plots where no gypsum was applied, the EC and SAR values decreased during the fourth ratoon. All EC values were below the threshold value of 200 mS/m, while the

only SAR value exceeding the critical value of 6 was found at the 300-600 mm depth. Values in these plots are, on average, lower than those in all previous ratoon crops. Mole drained plots which had been treated with gypsum had slightly higher EC values than plots not treated with gypsum, which could be expected but the SAR values were on average 27% lower where gypsum had been applied. In the fourth ratoon, EC and SAR values were below threshold for all depths. Gypsum appears to have prevented any sodicity build-up in these soils during successive ratoons.

5. Mole drains

Mole drains were not re-drawn at the beginning of the fourth ratoon, as the trial may be terminated after harvest of the fifth ratoon. This decision will be made once more drain inspections have been carried out early in 1987.

FJD/HDN
15 January 1987