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SOUTH AFRICAN SUGAR INDUSTRY
AGRONOMISTS' ASSOCIATION

Code: NK2/80/RSw.Tab.Vim

CAT. No.: 1288

Title: Rates of nitrogen and potassium for ratoon cane on a Vimy Series Soil

1. Particulars of the Project

This crop : 6th Ratoon
Site : Tambankulu Estate
Field R
Region : Northern Irrigated
(Swaziland)
Soil set/Series : 6 x 3 factorial
with 2 reps.
Variety : NCo 376
Fertilizer : See treatments

Soil Analysis: Date 30th Jan. 1981

<u>pH</u>	<u>O M %</u>	<u>Clay%</u>	<u>P.D.I.</u>
7,11		33	

<u>ppm</u>			
<u>P</u>	<u>K</u>	<u>Ca</u>	<u>Mg</u>
67	193	>1800	>220

Age: 12,3 months Dates 2/11/80-14/11/81

Rainfall: 586 mm

Irrigation: 666 mm (Av. cycle 4 days.
Stand time 8 hrs.
Application 32 mm
effective).

2. Objectives:

- 2.1 To determine the optimum levels of N and K on a Vimy Series soil (S.A. Bonheim Form).
- 2.2 To test the effect of Polado on sugarcane which had received different amounts of nitrogen.
- 2.3 To test the availability of exchangeable potassium.

3. Treatments:

N kg/ha

N0 = Nil

N1 = 80

N2 = 120

N3 = 160

N4 = 200

N5 = 240

K kg/ha

K0 = Nil

K1 = 150

K2 = 300

Notes on treatments:

Nitrogen was applied as ammonium nitrate (34,5 % N) and potassium as muriate of potash (50 % K).

Phosphorus was applied at 40 kg/ha as single superphosphate (11,3 % P) to all plots.

N and K were applied by hand over the row seven weeks after harvest. P was applied at 12 weeks after harvest in the same way.

Polado was applied to half of all the plots at a rate of 500 gm. product/ha eight weeks before harvest.

Sucrose samples comprising 12 random stalks from each half plot, were taken two weeks before harvest ie. 6 weeks after spraying.

4. Results:

Table 1

YieldTons cane/ha

	N0	N1	N2	N3	N4	N5	MEAN
K0	72	80	80	78	81	72	77
K1	77	81	81	87	84	75	81
K2	75	77	75	75	85	86	79
MEAN	75	79	79	80	84	78	79

C.V. % 5,6

L.S.D. Mean effects (0,05) (0,01)

N 5,39 7,40

K 3,81 5,23

Sucrose % cane

	N0	N1	N2	N3	N4	N5	MEAN
K0	14,2	12,7	13,3	12,8	12,7	12,7	13,1
K1	14,8	13,0	14,5	13,5	13,0	13,3	13,7
K2	14,3	13,8	13,2	13,5	13,5	12,5	13,4
K3	14,4	13,2	13,7	13,3	13,0	12,8	13,4

C.V. % 5,5

L.S.D. Main effects (0,05) (0,01)

N 1,07 1,47

K 0,76 1,04

Tons sucrose/ha

	N0	N1	N2	N3	N4	N5	MEAN
K0	10,2	10,2	10,7	10,0	10,3	9,2	10,1
K1	11,4	10,5	11,8	11,7	10,9	10,0	11,0
K2	10,7	10,6	9,9	10,1	11,5	10,7	10,6
MEAN	10,8	10,4	10,8	10,6	10,9	10,0	10,6

C.V. % 9,1

L.S.D. Mean effects (0,05) (0,01)

N 1,17 1,61

K 0,83 1,14

Tons cane/ha/m at the N4 level = 6,83

Tons cane/ha/100 mm water at the N4 level = 6,71

At the N4 level the ratio is 2,38 kg N per ton cane produced

Table 2

Treatment effects on growth measurements (m) to T.V.D.)

Age (months)	3	4	6	7,5
N0	0,65	1,14	1,49	1,64
N1	0,61	1,20	1,61	1,75
N2	0,66	1,22	1,63	1,76
N3	0,65	1,21	1,61	1,72
N4	0,65	1,24	1,69	1,81
N5	0,64	1,20	1,64	1,77
K0	0,62	1,17	1,58	1,72
K1	0,67	1,23	1,64	1,77
K2	0,65	1,20	1,62	1,74

Treatment effects on harvested stalk mass

Stalk Mass (kg)	
N0	0,62
N1	0,64
N2	0,65
N3	0,62
N4	0,64
N5	0,55
K0	0,61
K1	0,65
K2	0,60

Third leaf analysis

	Age (m)	4,3	6,2
<u>Nitrogen (% dm)</u>		<u>March</u>	<u>May</u>
N0		1,72	1,58
N1		1,76	1,65
N2		1,89	1,60
N3		1,74	1,72
N4		1,87	1,77
N5		1,98	1,84
<u>Potassium (% dm)</u>			
K0		1,02	0,84
K1		1,08	0,90
K2		1,16	0,90

All third leaf K values were below the threshold at the second sampling.

5. Comments:

5.1 The yield level in the experiment was low and the responses small indicating that some factor other than nutrition may be limiting growth. Evidence of surface run-off on this gently sloping site indicated inefficient utilization of irrigation water due to slow permeability through the profile.

6. Nitrogen :

6.1 The yield response to nitrogen was small but attained the 5% level of significance at the N4 level.

6.2 There was no clear indication of an optimum N level although the highest yield was obtained on plots receiving 200 kg N/ha.

6.3 Third leaf samples taken during May at 6 months of age showed deficiencies of N in cane that received 120 kg N/ha or less.

6.4 There was a significant ($P = 0,05$) linear decline in pol % cane of the order of 0,3 units per increment of N of 40 kg/ha

6,5 Before four months of age there were no stalk height differences between N levels. Small differences were recorded at 7,5 months with the most noticeable being between the N0 and N4 levels.

7. Potassium:

7.1 Soil K levels were very variable ranging from 95 to 367 ppm. The soils in most plots had levels of exchangeable K above the threshold value with the average being 193 ppm. The intermediate level of applied K (150 kg/ha) resulted in a response of 5% in tc/ha ($P = 0,05$) and 9% in ts/ha (n.s.).

7.2 Third leaf K values showed a response at four months of age. This trend was still evident at 6 months (May) but all levels were below the threshold value.

7.3 Cane quality was not significantly affected by applied K.

8. Phosphorus:

P levels in the soil were high and 3rd leaf P levels were above the threshold at 4 and 6 months of age.

9. Polado:

9.1 The effects of Polado on cane yield were not measured but the mean sucrose % cane was increased by 0,61%.

9.2 No ratoon chlorosis appeared in the subsequent ratoon.

10. Sulphur:

Although S values ranged between 12 and 19 ppm, there were some 3rd leaf levels that fell below threshold at 4 months.

11. The trial has been continued into the 7th ratoon using the same fertilizer rates.

NBL/PMO
9.6.82

7

SOUTH AFRICAN SUGAR INDUSTRY
AGRONOMISTS' ASSOCIATION

Code: NK2/80/R SW Tab.Vim
Cat No: 1288

Title: Rates of nitrogen and potassium for ratoon cane on a Vimy series soil

1. Particulars of project:

This crop : 7th ratoon
Site : Tambankulu Estate
Field R
Region : Northern irrigated
(Swaziland)
Soil Set/Series : V/Vimy
Design : 6 x 3 factorial
with 2 reps.
Variety : NCo 376
Fertilizer : See treatments

Soil analysis: Date: 2/12/81
pH O.M.% Clay % P.D.I.
7,25 - > 30 -

ppm
P K Ca Mg
64 189 > 1 800 > 220

Age: 12,2 months Dates 14/11/81 -
19/11/82

Rainfall: 377 mm

Irrigation: 704 mm

Ave. cycle 6 days, stand time
6 hrs, application 32 mm effective

2. Objective:

- 2.1 To determine the optimum levels of N and K on a Vimy series soil (S.A. Bonheim Form) and to compare results obtained from the 6th ratoon.
- 2.2 To test the effect of Polado on sugarcane which has received different amounts of nitrogen.
- 2.3 To test the availability of exchangeable potassium.

3. Treatments

<u>N kg/ha</u>		<u>K kg/ha</u>	
N0	- Nil	K0	- 0
N1	- 80	K1	- 150
N2	- 120	K2	- 300
N3	- 160		
N4	- 200		
N5	- 240		

Notes on treatments:

- Nitrogen was applied as ammonium nitrate (34,5% N) and potassium as muriate of potash (50% K).
- Phosphorus was applied at 40 kg/ha as single superphosphate (11,3% P) to all plots.
- N and K were applied by hand over the row three and a half weeks after harvest.
- Polado was applied to half of all the plots at a rate of 500 gm product/ha nine weeks before harvest.
- Sucrose samples were taken from each half plot at harvest

4. Results

Table 1

Yield

tons cane/ha

TREATMENTS	N0	N1	N2	N3	N4	N5	MEAN
K0	78	100	96	104	100	96	95
K1	89	99	100	104	109	106	101
K2	88	97	94	103	100	111	99
MEAN	85	99	96	104	103	104	99

CV % 7,9

LSD Main effects (0,05) (0,01)

N 9,4 13,0

K 6,7 9,2

Sucrose % cane

TREATMENTS	N0	N1	N2	N3	N4	N5	MEAN
K0	13,9	14,0	13,4	13,2	13,6	13,3	13,6
K1	14,5	14,1	13,4	14,1	12,8	13,2	13,7
K2	13,3	14,0	13,2	13,2	13,6	12,9	13,4
MEAN	13,9	14,0	13,3	13,5	13,3	13,2	13,5

CV % 4,8

LSD Main effects (0,05) (0,01)

N 0,8 1,1

K 0,6 0,8

Tons sucrose/ha

TREATMENTS	N0	N1	N2	N3	N4	N5	MEAN
K0	10,9	13,9	12,8	13,7	13,6	12,8	12,9
K1	12,8	14,0	13,3	14,6	14,0	14,1	13,8
K2	11,7	13,6	12,4	13,7	13,6	14,4	13,2
MEAN	11,8	13,8	12,8	14,0	13,7	13,7	13,3

CV % 7,8

LSD Main effects

(0,05)

(0,01)

N

1,3

1,7

K

0,9

1,2

Tons cane/ha/month at the N1 level = 8,14

Tons cane/ha/100 mm water at the N1 level = 9,16

At the N1 level the ratio is 0,8 kg N per ton of cane produced

Table 2

Treatment effects on stalk height (cm) to TVD and stalk population (x 1000/ha). Separate half plot data recorded to observe possible residual stunting effects of Polado.

Treatment	5,5 months of age					
	Cane height			Population		
	Sprayed	Unsprayed	Mean	Sprayed	Unsprayed	Mean
N0	160	153	157	146	137	142
N1	175	175	175	166	178	172
N2	179	177	178	170	174	172
N3	186	186	186	165	163	164
N4	189	189	189	181	168	175
N5	190	186	188	166	165	166
MEAN	180	178		166	164	
K0	175	176	176	163	161	162
K1	181	176	179	166	160	163
K2	182	180	181	159	164	162
MEAN	179	177		163	162	

Third Leaf Analysis

	Age (m)	2,5	4,5	6,0
Nitrogen (% dm)		Jan	Apr	May
N0		1,67	1,50	1,38
N1		1,99	1,53	1,57
N2		2,09	1,59	1,58
N3		2,19	1,64	1,60
N4		2,30	1,71	1,63
N5		2,26	1,63	1,60
Potassium (% cm)				
K0		1,14	1,09	1,01
K1		1,34	1,25	1,14
K2		1,43	1,24	1,19

5. Comments:

Yields from this 7th ratoon crop were higher than those obtained from the previous crop. The amount of water that this crop received was approximately 200 mm less than that applied to the 6th ratoon. In spite of this the yields of the 7th ratoon were greater, possibly due to the poor early growing conditions experienced during the summer of 1981.

6. Nitrogen:

6.1 The yield response to nitrogen from the N0 to the N1 level was substantial ($P = 0,01$), with the response to higher nitrogen levels being small and inconsistent with an apparent peak at N3.

6.2 Sucrose % cane was depressed at N levels greater than 80 kg/ha.

6.3 Third leaf samples taken during January at 2,5 months of age showed the N0 level to be below threshold. Samples taken during April and May indicated deficiencies in all plots that received less than 160 kg N/ha.

6.4 Stalk heights at 5,5 months of age indicated large differences between the N0 and N1 level with smaller effects due to the higher rates of N.

7. Potassium:

7.1 The soil K status has altered with a slight increase in K for those plots treated previously with KCl. Plots that received no KCl show a decline in exchangeable K from 193 ppm to 150 ppm.

- 7.2 As in the previous ratoon there was an indication of response to applied K which did not attain a level of statistical significance as it did in the previous crop. However, the response in ts/ha to the K1 level was statistically significant ($P = 0,05$).
- 7.3 Applied K increased stalk length marginally but did not effect population.
- 7.4 Third leaf potassium levels declined from January to May but only became deficient for those plots that received no K.

8. Phosphorus:

P levels in the soil have increased markedly (+ 64 ppm) and no values below threshold were recorded for the three leaf samplings.

9. Zinc:

Although some low soil zinc levels exist at this site, all 3rd leaf analyses have indicated adequacy.

10. Sulphur:

At 6 months of age (May), third leaf values showed S to be below the current threshold value. Soil S levels were above threshold.

11. Polado:

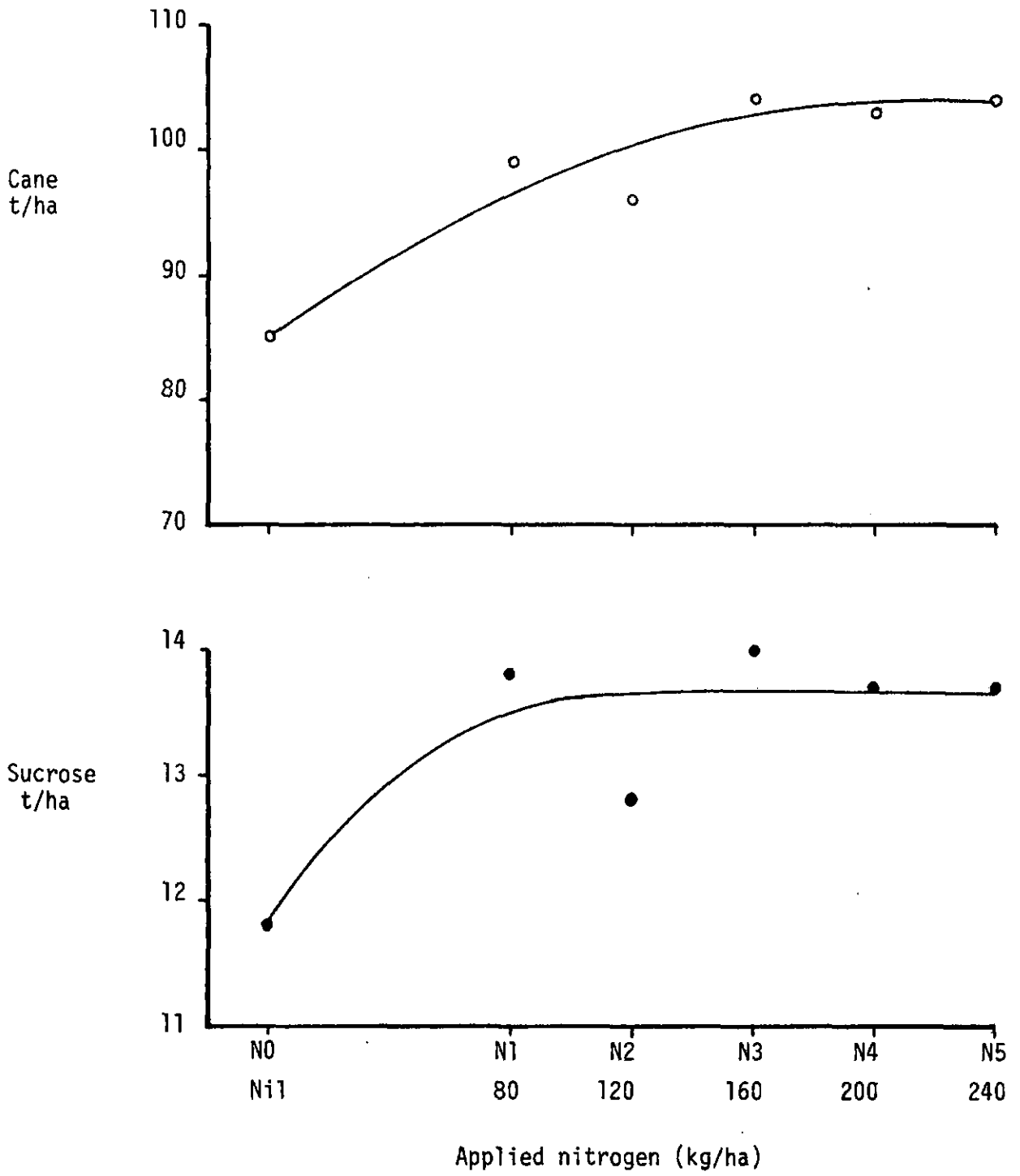
11.1 Cane height measurements and population counts taken at 5,5 months showed no evidence of a residual effect of spraying the previous crop.

11.2 Suc % cane was increased on average by 0,5 units.

11.3 Although cane yields were slightly reduced by the chemical (n.s.) there was an increase of 0,32 ts/ha (n.s.) for the sprayed cane.

12. The trial has been re-established and treated as before with the same amounts of fertilizer.

YIELD RESPONSES TO APPLIED NITROGEN





SOUTH AFRICAN SUGAR INDUSTRY
AGRONOMISTS' ASSOCIATION

Code : NK2/80/ Sw Tab Vim
Cat. No.: 1288

TITLE: Rates of nitrogen and potassium for ratoon cane on a Vimy series soil.

1. Particulars of the project.

<p><u>This crop</u> : 8th ratoon</p> <p><u>Site</u> : Tambankulu Estate Field R</p> <p><u>Region</u> : Northern irrigated (Swaziland)</p> <p><u>Soil set/Series</u> : V/Vimy</p> <p><u>Design</u> : 6 x 3 factorial with 2 reps</p> <p><u>Variety</u> : NCo 376</p> <p><u>Fertilizer</u> : See Treatments</p>	<p><u>Soil analysis:</u> Date: 7.12.1982</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="text-align: left;"><u>pH</u></th> <th style="text-align: left;"><u>OM%</u></th> <th style="text-align: left;"><u>Clay%</u></th> <th style="text-align: left;"><u>PDI</u></th> </tr> <tr> <td>7,19</td> <td>-</td> <td>32</td> <td>-</td> </tr> </table> <hr/> <table style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="6" style="text-align: center;">ppm</th> </tr> <tr> <th style="text-align: left;">P</th> <th style="text-align: left;">K</th> <th style="text-align: left;">Ca</th> <th style="text-align: left;">Mg</th> <th style="text-align: left;">Zn</th> <th style="text-align: left;">S</th> </tr> <tr> <td>60</td> <td>136</td> <td>> 1800</td> <td>> 220</td> <td>2,3</td> <td>20</td> </tr> </table> <p><u>Age</u> : 11,2 months</p> <p><u>Dates</u> : 19.11.1982-25.10.1983</p> <p><u>Rainfall</u> : 461 mm</p> <p><u>Irrigation:</u> 592 mm</p> <p><u>Total</u> 1053 mm 18,5 cycles @ 32 mm/cycle</p>	<u>pH</u>	<u>OM%</u>	<u>Clay%</u>	<u>PDI</u>	7,19	-	32	-	ppm						P	K	Ca	Mg	Zn	S	60	136	> 1800	> 220	2,3	20
<u>pH</u>	<u>OM%</u>	<u>Clay%</u>	<u>PDI</u>																								
7,19	-	32	-																								
ppm																											
P	K	Ca	Mg	Zn	S																						
60	136	> 1800	> 220	2,3	20																						

2. Objective

- To determine the optimum levels of N & K on a Vimy series soil (SA Bonheim form) and to compare results with the previous two crops.
- To test the effect of Polado especially on cane that received high rates of nitrogen.
- To test the availability of exchangeable potassium.

3. Treatments.

<u>N kg/ha</u>		<u>K kg/ha</u>	
N0	- 0	K0	- 0
N1	- 80	K1	- 150
N2	- 120	K2	- 300
N3	- 160		
N4	- 200		
N5	- 240		

Notes on treatments

- Nitrogen was applied as urea (46%N) and potassium as muriate of potash (50%K).
- Phosphorus was applied at 40 kg/ha as single superphosphate (10,5%P) to all plots.
- N & K were applied by hand over the cane row at 3 and 4 weeks after harvesting respectively.
- Polado was applied to half of all the plots at a rate of 500 gm product/ha eleven weeks before harvest. (Cutting schedules were interrupted and this extended the delay between spraying and harvesting).

4. ResultsTable 1 Yield

Tons cane/ha

Treatment	N0	N1	N2	N3	N4	N5	Mean
K0	54	60	57	55	59	58	57
K1	56	56	60	54	54	70	59
K2	51	58	55	54	54	65	56
Mean	54	58	57	54	56	64	57

CV% 8

LSD (0,05) : N 6 K 4

(0,01) : N 8 K 5

Sucrose % Cane

Treatment	N0	N1	N2	N3	N4	N5	Mean
K0	13,4	13,0	13,2	13,4	13,4	13,1	13,3
K1	13,7	13,6	14,1	14,4	13,5	14,4	13,9
K2	14,4	14,2	14,6	13,9	13,7	13,4	14,0
Mean	13,8	13,6	14,0	13,9	13,5	13,6	13,7

CV% 3,3

LSD (0,05) N 0,5 K 0,4

(0,01) N 0,7 K 0,5

Tons Sucrose/ha

Treatment	N0	N1	N2	N3	N4	N5	Mean
K0	7,3	7,8	7,6	7,3	7,9	7,6	7,6
K1	7,7	7,6	8,4	7,8	7,4	10,1	8,2
K2	7,4	8,2	8,0	7,5	7,4	8,6	7,9
Mean	7,5	7,8	8,0	7,6	7,6	8,8	7,9

LSD (0,05) N 0,9 K 0,6

(0,01) N 1,2 K 0,9

Tons cane/ha/month at the N1 level = 5,2

Tons cane/ha/100 mm water at the N1 level = 5,5,

At the N1 level the ratio is 1,38 kg N per ton cane produced.

Table 2 Third leaf analysis

	Age (m) Month	2,0 Jan	2,8 Feb	3,5 Mar	4,3 Mar	5,3 Apr
<u>Nitrogen (% dm)</u>						
N0		1,66	1,46	1,50	1,44	1,52
N1		1,91	1,57	1,53	1,48	1,62
N2		2,02	1,69	1,55	1,53	1,60
N3		2,12	1,77	1,67	1,59	1,67
N4		2,13	1,79	1,71	1,61	1,68
N5		2,20	1,88	1,76	1,64	1,79
<u>Potassium (% dm)</u>						
K0		0,84	0,95	1,09	1,14	1,09
K1		0,97	1,08	1,22	1,19	1,21
K2		1,08	1,11	1,23	1,20	1,24

5. Comments

Yields from the 8th ratoon crop were exceptionally low and were well below the yields of the previous two crops. The crop suffered from water stress as irrigation water was severely restricted due to the drought.

Nitrogen:

- Although differences in yield at the N0 and N5 levels were significant ($P=0,01$) it is doubtful whether this response is real as yields at the other N rates were very similar.
- Sucrose % cane was not affected by increasing nitrogen levels; cane quality was relatively high due to inadequate irrigation water.
- Sucrose yield followed similar trends to cane yields.
- Average yields from the three crops appear to peak at about 160 kg N/ha. Responses however were small and erratic on this poorly drained soil and applications of high rates of N could be wasteful under these conditions.
- Third leaf sampling commenced in January at 2 months of age and showed the N0 rate to be below threshold. At 4,3 months of age in March only rates above N3 showed adequate N in the third leaf. Values increased during April at 5,3 months of age possibly due to warm conditions.

Potassium:

- As in the previous crop, there was a slight (ns) yield increase at the intermediate level of applied K. A greater response was expected as the soil K status was low for this clay soil.
- There was a highly significant ($P=0,01$) increase in cane quality from K0 to the K1 level. This positive response (in cane quality) to applied K has only been recorded in one other instance in the current NK trials - on a similar C set soil.
- The intermediate level of K resulted in a sucrose yield response ($P=0,05$) and this has been recorded in each of the three consecutive crops.
- Third leaf K% (dm) values show a strong response to applied K with the K0 level being below threshold up to 3,5 months of age in March. Values for all levels peaked in March/April and were possibly influenced by unusually warm conditions during this period.

Sulphur:

- Soil S levels were high. Third leaf S values were all above threshold except at 3,5 months of age where some were marginal at 0,13%.

Polado:

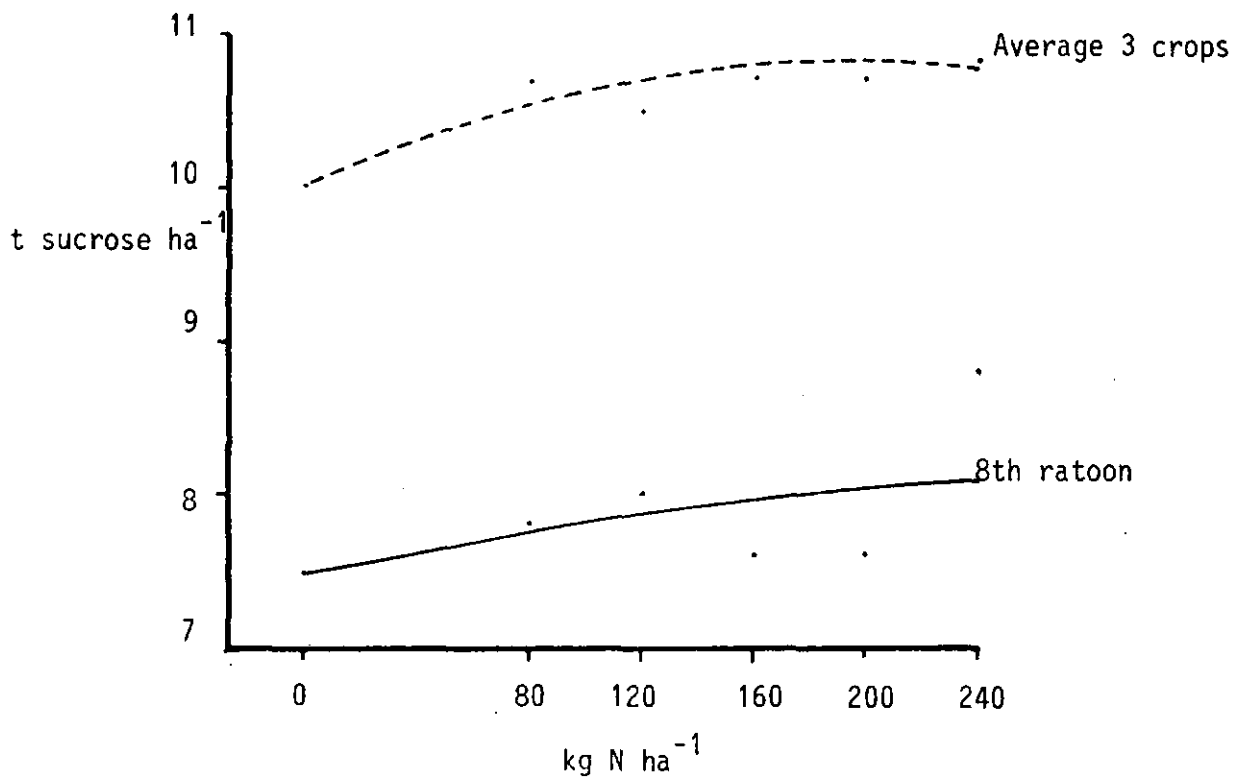
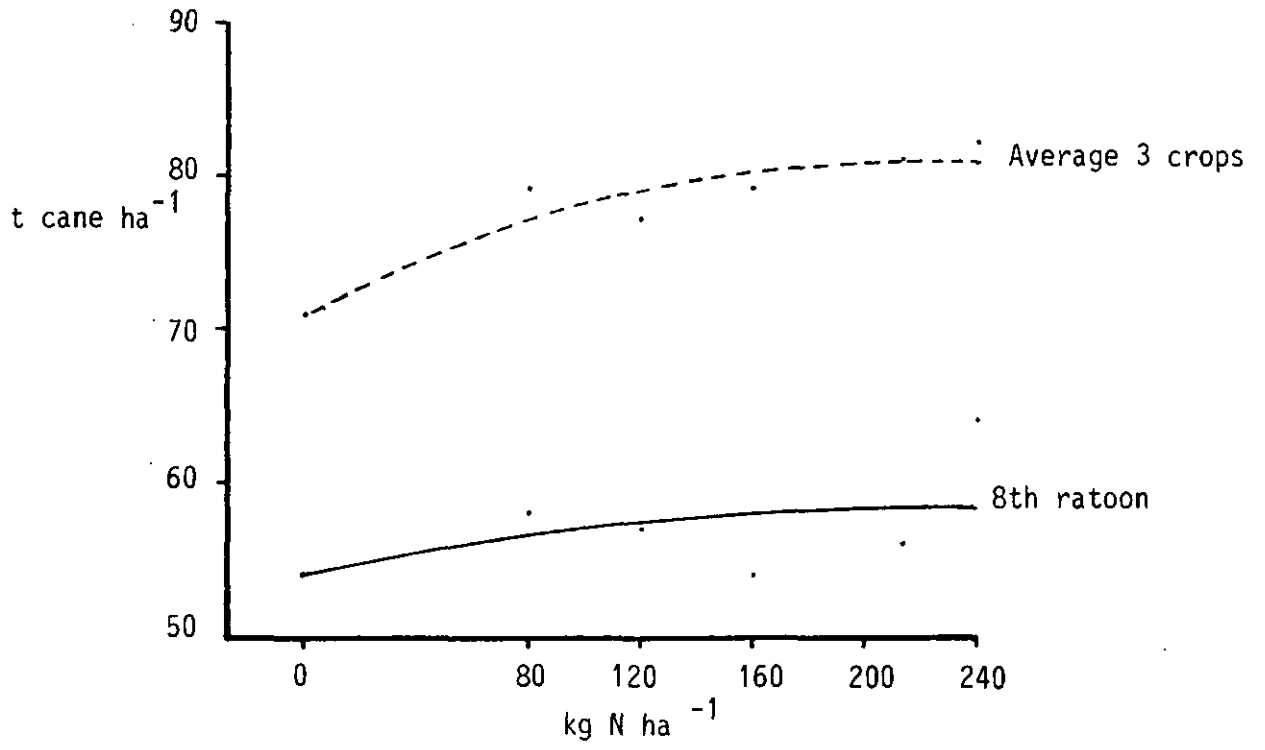
- Polado treatment reduced yields slightly and non-significantly by two tons cane/ha at 11 weeks after spraying; a slight increase of 0,34 S%C resulted but this did not offset the slight loss in cane yield.

6. General

The trial has now been terminated after harvesting three crops.

NBL/IS
4 April 1984

YIELD RESPONSES TO APPLIED NITROGEN



YIELD RESPONSES t SUCROSE ha⁻¹ TO APPLIED POTASSIUM

