

SOUTH AFRICAN SUGAR INDUSTRY

AGRONOMISTS' ASSOCIATION

Code: NK 1/81/RSW MHL. ZWD

Cat. No.: 1268

TITLE: Levels of N and K for ratoon cane on a Zwide series soil

1. Particulars of project

This crop : 2nd Ratoon
Site : Mhlume Range 23
Region : Northern irrigated
Soil system : Komatipoort
Soil set : 'Z'
Design : 6 x 3 factorial with 2 reps
Plot size : 5 rows x 9 m, 1,5m spacing
Variety : NCo 376
Fertilizer : See treatments

Soil analysis: Date: 3 February 1981

pH Clay %
6,4 20

ppm
P K Ca Mg
17 147 978 >220

Age: 11,8 m (9.10.80-30.09.81)

Irrigation: 546 mm (cycles 4-39 av. 11 days)

Rainfall: 496 mm (eff) Total: 1 042 mm

2. Objectives

- 2.1 To determine the optimum levels of N and K required by ratoon cane growing in a Zwide series soil (S.A. Estcourt form).
- 2.2 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 = 100

K2 = 200

3.1 Notes on treatment

Date and age when fertilizer applied: 1) 15.01.81 - 3 months
2) 16.02.81 - 4 months

Condition of cane when fertilized: Some cane height differences due to soil variation. Average height \pm 1,2 m (TVD).

Sampling technique: 12 stalks taken at random in each plot (equal spacing between samples) prior to harvesting.

4. Results4.1 Yields

Tons cane/ha

K kg/ha \ N kg/ha	N kg/ha						Mean
	Nil	80	120	160	100	240	
Nil	76	97	108	117	101	105	101
100	72	74	95	97	99	101	90
200	82	117	74	95	90	112	95
Mean	77	96	92	103	97	106	95
C.V.% 19,1 L.S.D. (0,05) Main effects N 22,8; K 16,1							

Sucrose % cane

K kg/ha \ N kg/ha	N kg/ha						Mean
	Nil	80	120	160	200	240	
Nil	15,0	14,6	13,3	13,7	14,2	13,8	14,1
100	14,6	14,5	13,7	13,8	13,6	12,2	13,7
200	14,7	13,0	14,6	13,4	14,1	13,4	13,9
Mean	14,8	14,0	13,9	13,6	14,0	13,1	13,9
C.V. % 5,4 L.S.D. (0,05) Main effects N 0,93; K 0,66							

Tons sucrose/ha

K kg/ha \ N kg/ha	N kg/ha						Mean
	Nil	80	120	160	200	240	
Nil	11,4	14,1	14,3	16,0	14,3	14,6	14,1
100	10,5	11,0	13,0	13,3	13,5	11,6	12,1
200	12,1	15,1	10,9	14,7	12,8	15,0	13,4
Mean	11,3	13,4	12,7	14,7	13,5	13,7	13,2
C.V. % 21,4 L.S.D (0,05) Main effects N 3,5; K 2,5							

5. Comments

5.1 Nitrogen

- 5.1.1 There was a substantial response to N indicating a low rate of N mineralization in this soil.
- 5.1.2 The overall response to N tends to be curvilinear peaking at + 160 kg/ha; ie. c 1,6 kg N per ton cane produced. N5 levels also appear to give good yields.
- 5.1.3 Analysis of third leaf samples taken at six months after harvest in March showed N values to be adequate. There was an increase in third leaf N values with increasing N levels. At eight months after harvest (June) the third leaf values dropped below threshold only in the N0 treatments.
- 5.1.4 Pol % cane was adversely affected by increasing N and showed a linear trend.
- 5.1.5 The rate of stalk elongation was slightly greater at the N2, N3 and N5 levels and was markedly lower at the N0 level. Stalk populations were also depressed at the N0 level.

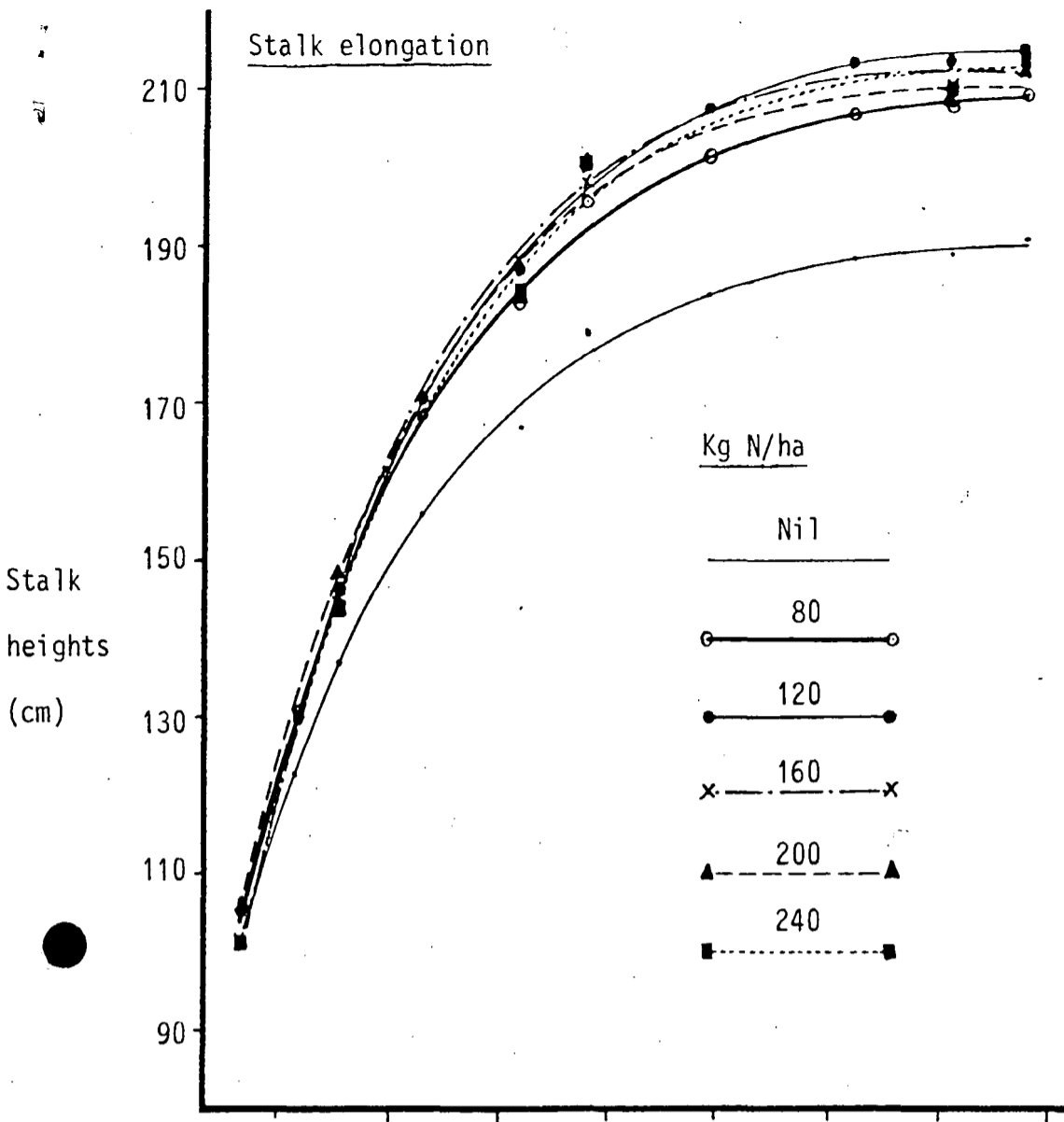
5.2 Potassium

- 5.2.1 Soil analysis showed the average soil K to be only slightly above the threshold value with Ca and Mg being exceptionally high. Yields were not increased with the addition of K and may have been slightly (n.s.) depressed.
- 5.2.2 No K deficiencies were found in the third leaf data when sampled at six months of age in March. Later sampling at eight months showed the expected low levels with only the high K rate above the threshold value.
- 5.2.3 Increasing K had no consistent effect on cane quality and growth patterns were not affected by K applications.

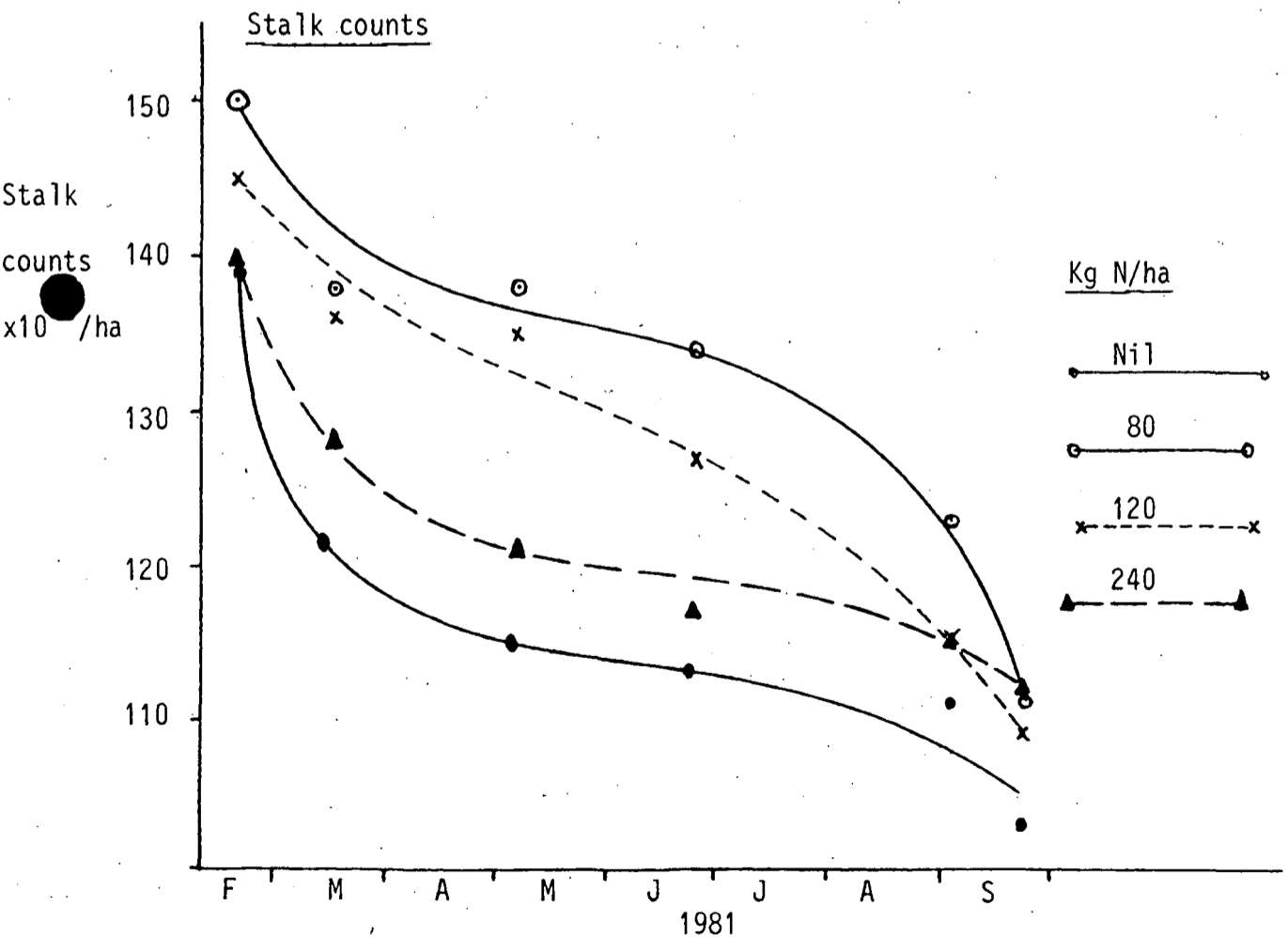
5.3 Phosphorus

- 5.3.1 Third leaf P levels were above threshold at six months but had fallen below at eight months.

Stalk elongation



Stalk counts



SOUTH AFRICAN SUGAR ASSOCIATION

AGRONOMISTS' ASSOCIATION

Code: NK 1/81/R Sw Mh1 ZWD

Cat: 1268

Title:

Levels of N and K for ratoon cane
on a Zwide series soil

<p>1. <u>Particulars of project</u></p> <p><u>This crop:</u> 3rd Ratoon</p> <p><u>Site:</u> Mhlume range 23</p> <p><u>Region:</u> Northern irrigated (Swaziland)</p> <p><u>Soil system:</u> Komatipoort</p> <p><u>Soil set:</u> 'Z' (Zwide)</p> <p><u>Design:</u> 6 x 3 Factorial with 2 reps.</p> <p><u>Plot size:</u> 5 rows x 9 m (whole) 1,5m spacing</p> <p><u>Variety:</u> NCo 376</p> <p><u>Fertilizer:</u> See treatments</p>	<p><u>Soil analysis:</u> Date: 20.11.1981</p> <table border="1"> <tr> <td></td> <td align="center"><u>pH</u></td> <td align="center"><u>Clay %</u></td> </tr> <tr> <td></td> <td align="center">6,16</td> <td align="center">20-30</td> </tr> <tr> <td></td> <td align="center" colspan="2">ppm</td> </tr> <tr> <td></td> <td align="center">P</td> <td align="center">K</td> <td align="center">Ca</td> <td align="center">Mg</td> </tr> <tr> <td></td> <td align="center">18</td> <td align="center">137</td> <td align="center">1052</td> <td align="center">7220</td> </tr> </table> <p><u>Age:</u> 8,4 months (30/9/81-10/6/82)</p> <p><u>Irrigation:</u> 378 mm</p> <p><u>Rainfall:</u> 705 mm</p> <p><u>Total:</u> 1083 mm</p>		<u>pH</u>	<u>Clay %</u>		6,16	20-30		ppm			P	K	Ca	Mg		18	137	1052	7220
	<u>pH</u>	<u>Clay %</u>																		
	6,16	20-30																		
	ppm																			
	P	K	Ca	Mg																
	18	137	1052	7220																

2. Objectives:

- 2.1 To determine the optimum levels of N and K for ratoon cane growing in a Zwide series soil (SA Escourt form).
- 2.2 To test the availability of potassium
- 2.3 To compare results and optimum nutrient levels with those obtained for the previous ratoon crop.

3. Treatments

N kg/ha

No = Nil
 N1 = 80
 N2 = 120
 N3 = 160
 N4 = 200
 N5 = 240

K kg/ha

Ko = Nil
 K1 = 100
 K2 = 200

Notes on treatments:

- . Nitrogen as ammonium nitrate (34,5% N) and potassium as muriate of potash (50% K) were used.
- . Phosphorus applied at 40 kg P/ha as single superphosphate (10,5 % P) to all plots.
- . N & K were applied by hand over the row as split applications at 8 and 14 weeks after harvesting. P was applied 17 weeks after harvest.

- Sucrose samples were taken three days before harvest. Twelve stalks were taken at random from each plot.

4. Results

4.1 Harvest data

tons cane/ha

Treatment	No	N1	N2	N3	N4	N5	Mean
Ko	57	75	110	106	90	77	86
K1	54	57	79	81	84	89	74
K2	57	103	79	85	74	95	82
Mean	56	78	90	91	83	87	81

CV % 14,6

LSD Treatment means (0,05) N: 14,4 K: 10,2
(0,01) N: 19,7 K: 13,9

Sucrose % cane

Treatment	No	N1	N2	N3	N4	N5	Mean
Ko	12,3	11,9	11,3	10,7	11,3	11,5	11,5
K1	12,8	10,3	10,9	11,2	11,2	10,5	11,2
K2	12,0	11,0	11,1	10,2	10,9	11,3	11,1
Mean	12,4	11,1	11,1	10,7	11,1	11,1	11,2

CV% 9,8

LSD Treatment means: (0,05) N: 1,3 K: 0,9
(0,01) N: 1,8 K: 1,3

tons sucrose/ha

Treatment	No	N1	N2	N3	N4	N5	Mean
Ko	6,9	8,8	12,5	11,4	10,2	8,8	9,8
K1	6,9	6,4	8,6	9,1	9,4	9,4	8,3
K2	7,0	11,4	8,8	8,8	8,2	10,7	9,2
Mean	6,9	8,9	10,0	9,8	9,3	9,6	9,1

CV % 19,0

LSD treatment means (0,05) N: 2,1 K: 1,5
(0,01) N: 2,9 K: 2,0

Tons cane/ha/month at the N3 level is 10,8
Tons cane/ha/100 mm at the N3 level is 8,4
At this level the ratio of kg N per ton cane produced is 1,8.

4.2 Third leaf data

	Age in months	
	5 months (Feb)	6 months (March)
<u>Nitrogen % dm</u>		
No	1,59	1,28
N1	1,68	1,44
N2	1,78	1,39
N3	1,84	1,39
N4	1,96	1,53
N5	1,89	1,50
<u>Potassium % dm</u>		
Ko	1,31	1,18
K1	1,37	1,22
K2	1,44	1,25

5. Comments

5.1 The trial had to be harvested prematurely to prevent deterioration of the cane due to excessive hail damage.

5.2 Nitrogen

5.2.1 As in the previous ratoon crop the response to N was substantial, indicating the low rate of nitrogen mineralization in this soil.

5.2.2 The response was again curvilinear peaking at the N2 and N3 levels (ie 1,8 kg N per ton cane produced (N3) and 1,3 kg N per ton cane produced (N2)).

5.2.3 Analysis of third leaf samples taken at 5 months of age in February indicated low nitrogen levels in the No and N1 treatments. There was however an overall increase in third leaf N values with increasing N levels. All values had dropped below the threshold level at six months of age when sampled in March. N levels at this stage were below those of the previous crop (ie 8 months sampled in June).

5.2.4 The sucrose % cane was again adversely affected by increasing N levels. The most pronounced suppression appeared between the No and N1 levels and higher rates caused little differences.

5.3 Potassium

5.3.1 Soil K values indicate that very little change in the

potassium status has occurred since the establishment of the trial. The average soil K is still only slightly above threshold.

- 5.3.2 The yield response to applied K is quadratic with a minimum tons cane and tons sucrose/ha obtained with the intermediate level of potassium. A similar yet significant trend was found in the previous ratoon indicating some N-K interaction.
- 5.3.3 No K deficiencies were found in the third leaf data when sampled at five and six months of age.
- 5.3.4 Increasing levels of applied K had no effect on cane quality.

5.4 Phosphorus

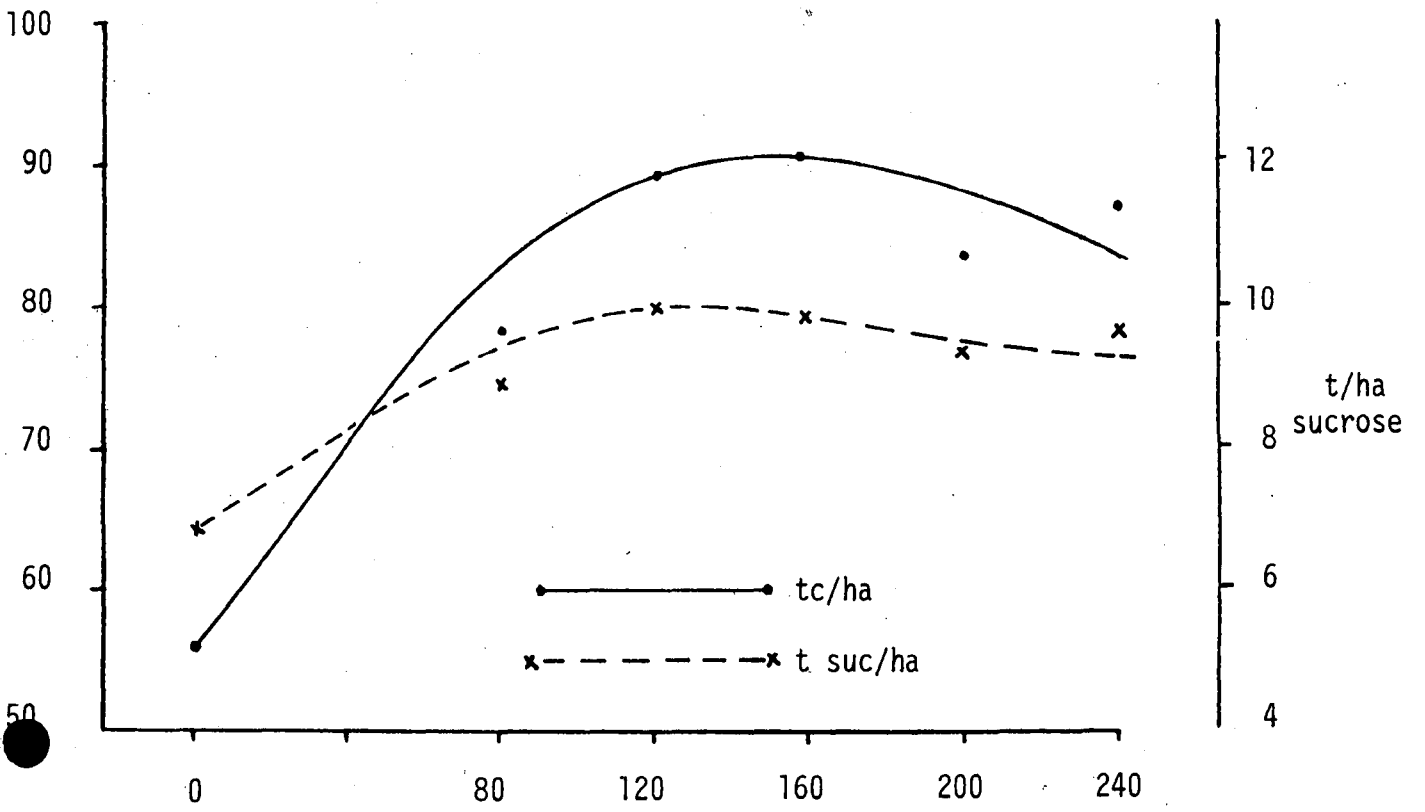
Third leaf P levels were above threshold at five months (Feb) but had fallen below at six months (March)

5.5 Zinc

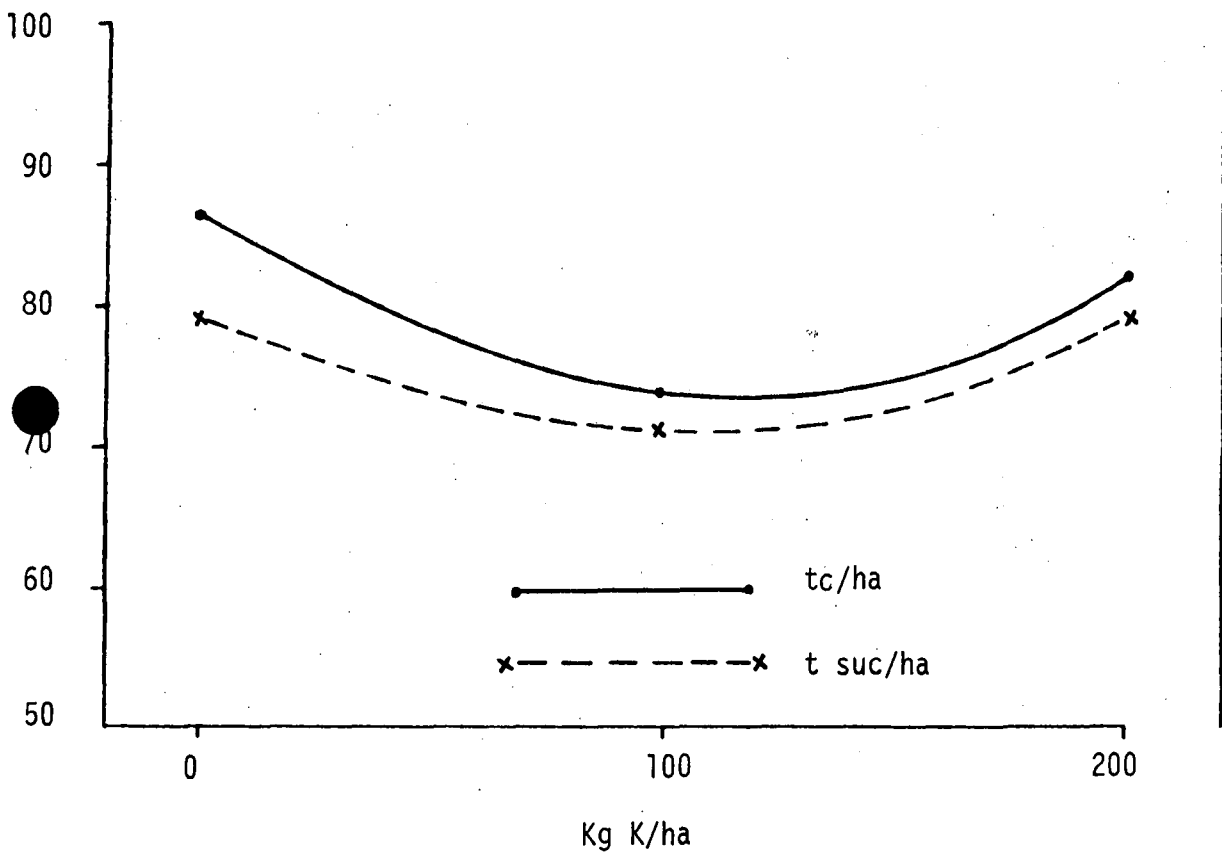
Although soil zinc levels were found to be generally low, third leaf values were adequate.

NITROGEN AND POTASSIUM RESPONSE CURVES (TONS CANE AND TONS SUCROSE/HA)

NITROGEN



POTASSIUM



SOUTH AFRICAN SUGAR INDUSTRY

AGRONOMISTS' ASSOCIATION

Code: NK 1/81/R Sw.Mh1.Zwd.

Cat.No.1268

TITLE: Rates of N and K for ratoon cane on a Zwide series soil.

1. Particulars of project:

This crop: 4th ratoon

Site: Mhlume Range 23

Region: Northern Irrigated
(Swaziland)

Soil system: Komatipoort

Soil Set/Series: 'Z'/Zwide

Design: 6 x 3 factorial with
2 reps.

Plot size: 5 rows x 9 m (whole)
1,5 m spacing

Variety: NCo 376

Fertilizer: See treatments

Soil Analysis: Date 28/6/82

pH	OM%	Clay%	PDI
6,07	-	20	-

ppm				
P	K	S	Ca	Mg
22	122	19	1005	> 220

K0: 116
K1: 116
K2: 134

Age: 10/6/1982 - 18/7/1983
13,3 months

Irrigation: 851 mm (nett)

Rainfall: 626 mm (nett)

Total: 1477 mm

2. Objectives:

2.1 To determine the optimum levels of N and K for ratoon cane growing in a Zwide series soil. (S.A. Estcourt form).

2.2 To test the availability of exchangeable potassium.

2.3 To compare results obtained from the 2nd and 3rd ratoon.

3. Treatments:

<u>N kg/ha</u>	<u>K kg/ha</u>
N0 = Nil	K0 = Nil
N1 = 80	K1 = 100
N2 = 120	K2 = 200
N3 = 160	
N4 = 200	
N5 = 240	

Notes on treatments:

- Nitrogen as ammonium nitrate (34,5 % N) and potassium as muriate of potash (50 % K) were used.

- Phosphorus applied at 40 kg P/ha as single superphosphate (10,5 % P).
- N and K were applied by hand over the row as split applications at 4,5 and 16 weeks after harvesting. P was applied 8 weeks after harvesting.
- Sucrose samples were taken at harvest, each sample comprised twelve stalks taken from three pre-selected sites in each plot.

4. Results:

4.1 Harvest data

Tons cane/ha

Treatment	N0	N1	N2	N3	N4	N5	Mean
K0	52	64	84	88	80	59	71
K1	56	59	75	81	82	99	75
K2	60	95	73	80	71	95	79
Mean	56	73	77	83	77	84	75

C.V. % 14,3

LSD Treatment means (0,05) N : 13,1 K : 9,2
(0,01) N : 17,9 K : 12,7

Sucrose % cane

Treatment	N0	N1	N2	N3	N4	N5	Mean
K0	12,9	12,4	11,9	11,9	11,3	12,5	12,1
K1	11,9	12,5	12,8	11,6	12,5	11,3	12,1
K2	12,5	12,2	12,2	13,3	12,5	12,0	12,5
Mean	12,4	12,4	12,3	12,3	12,1	11,9	12,2

C.V. % 6,8

LSD Treatment means (0,05) N : 1,0 K : 0,7
(0,01) N : 1,4 K : 1,0

Tons Sucrose/ha

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

C.V. % 15,0

LSD Treatment means (0,05) N : 1,7 K : 1,2
(0,01) N : 2,3 K : 1,6

Tons cane/ha/month at the N3 level is 6,2

Tons cane/ha/100 mm at the N3 level is 5,6

At this level the ratio of kg N per ton cane produced is 1,9.

4.2 Third leaf data.

	Age in months						8 m S % d.m.
	2,5 m Aug.	3,5 m Sept.	4,5 m Oct.	5,5 m Nov.	7,0 m Jan.	8 m Feb.	
<u>Nitrogen % d.m.</u>							
N0	2,36	1,97	1,68	1,40	1,29	1,30	0,12
N1	2,54	2,15	2,07	1,71	1,54	1,49	0,13
N2	2,51	2,30	2,12	1,75	1,55	1,44	0,13
N3	2,61	2,43	2,13	1,95	1,62	1,52	0,14
N4	2,58	2,39	2,24	1,99	1,84	1,69	0,14
N5	2,59	2,42	2,21	1,98	1,82	1,74	0,14
<u>Potassium % d.m.</u>							
K0	1,15	0,92	0,92	0,96	1,24	1,29	0,15
K1	1,29	1,06	1,08	1,09	1,37	1,42	0,13
K2	1,40	1,18	1,21	1,28	1,49	1,52	0,13

5. Comments:

Yields were lower in the 4th ratoon than in the previous two crops due to water shortages.

5.1 Nitrogen

- As in the previous two ratoons the response to the low level of nitrogen (N1) was substantial for this low N mineralizing soil.
- Cane yield responses to applied N peaked at the N3 level (P = 0,01) as in the earlier two crops. The N5 level also produced high yields.
- Increasing levels of nitrogen tended to suppress the sucrose % cane (n.s.)
- Sucrose yields peaked at the N3 level (P = 0,01).
- All N treatments showed third leaf N % d.m. to be well above threshold for the first two samplings (2,5 m August - 3,5 m September). With increasing age the N % d.m. declined for all treatments and at + 6 months of age the N3 level became deficient. The response to N was clearly indicated by the third leaf N % d.m. data.
- The three ratoon crops harvested have indicated that a Zwide series soil is capable of producing acceptable yields when 160 kg N/ha is applied to ratoon crops.

5.2 Potassium

- Soil K values at this site have declined during the last three years although up to 900 kg K has been applied to some plots over this period.
- Results for the 4th ratoon showed a slight (n.s.) linear increase in tons cane/ha with increasing potassium levels.
- There was no real influence on sucrose % cane from applying K and hence the sucrose yield followed a similar linear and n.s. trend to cane yield. Unlike the previous crops there was no N, K interaction and the K2 level produced a significant ($P = 0,05$) sucrose yield increase.
- Due to the varied responses to applied K for the three ratoon crops, it is difficult to decide on optimum potassium requirements for this soil, but at current prices of K fertilizer and sucrose the application of the high rate of K is likely to be economic.
- A second trial has been established on a similar soil in an attempt to gain a clearer indication of optimum K requirements for the Zwide series.

6. Sulphur:

Soil S values were adequate but third leaf S values were usually low for plots that received no nitrogen. At 8 months of age S values fell below threshold for samples taken from those plots.

7. This trial has been terminated.

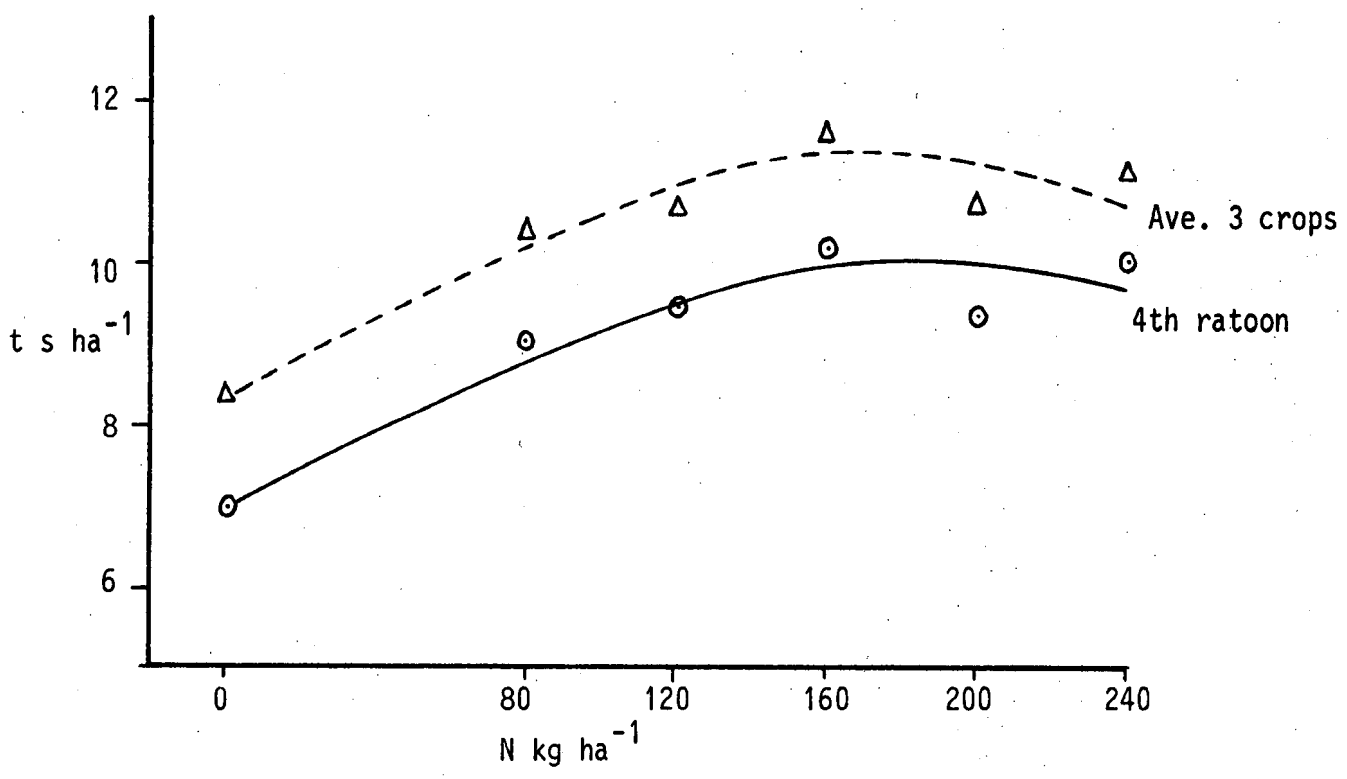
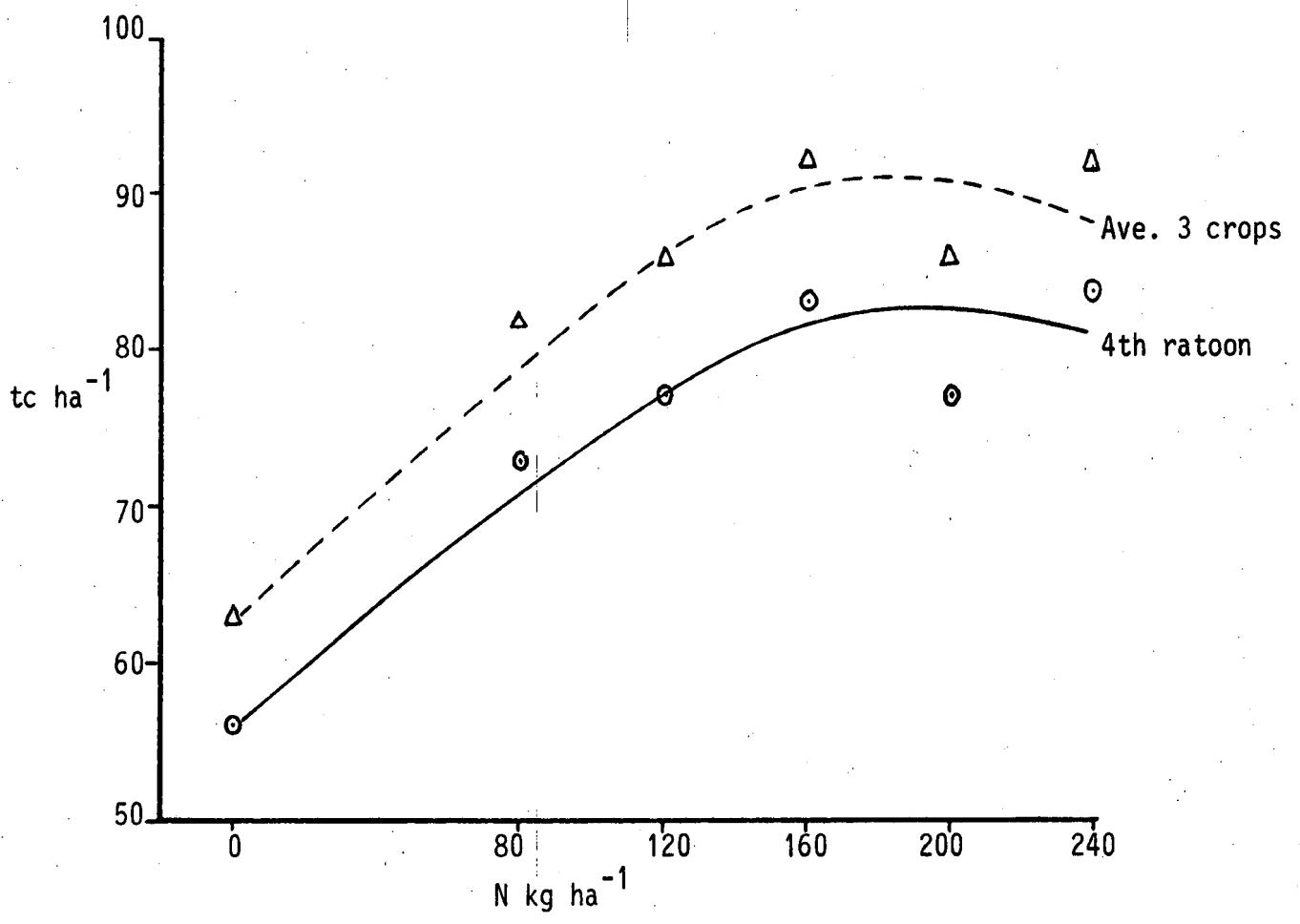


Fig 1. Nitrogen response curves (t cane and t suc ha⁻¹) average for three crops and 4th ratoon.

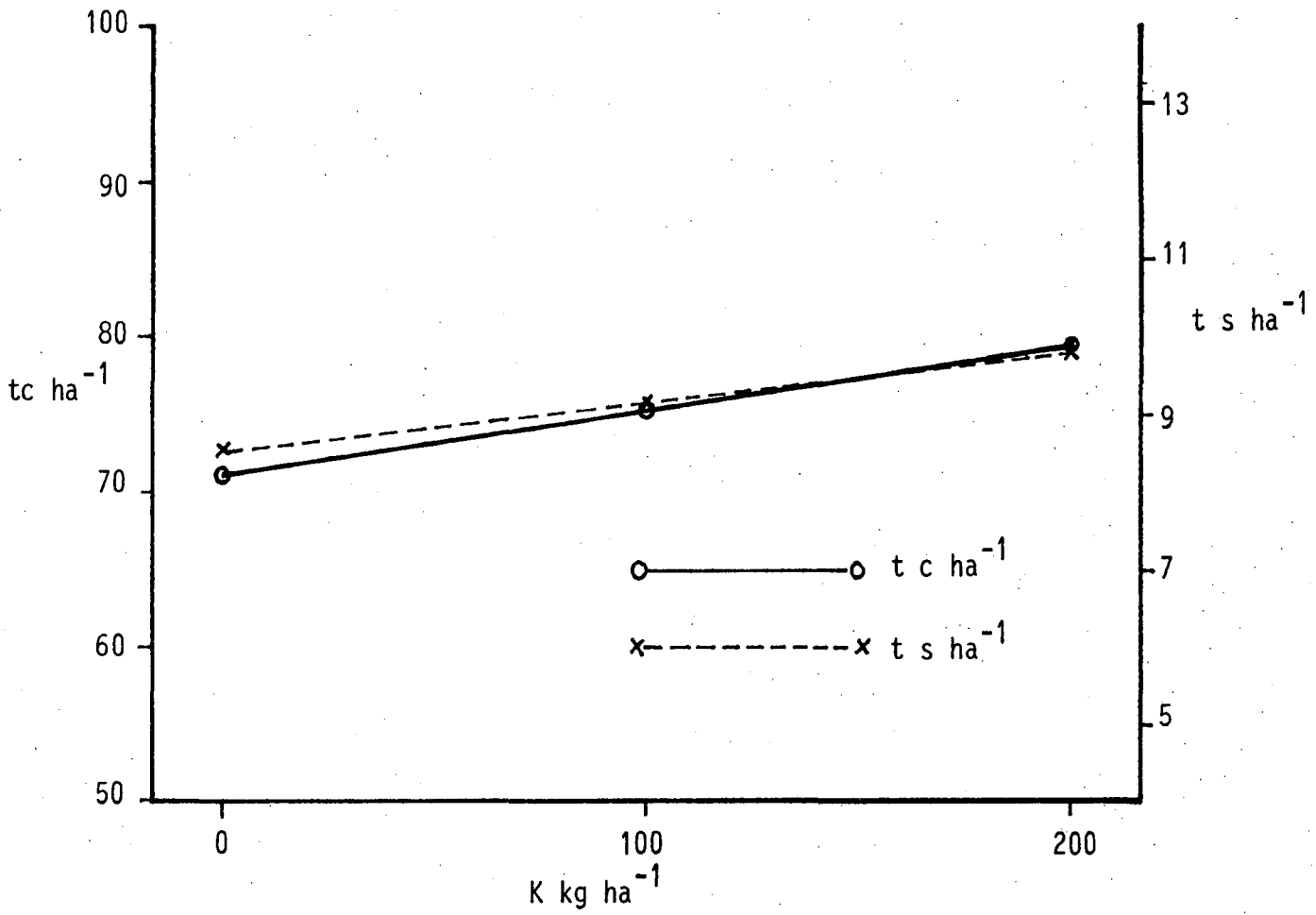


Fig 2. Potassium response curves (tc and t suc ha^{-1}) 4th ratoon.