SOUTH AFRICAN SUGAR INDUSTRY
AGRONOMISTS' ASSOCIATION

Code: NK1/80/RSw Ubo. Som.
Cat.No.: 1272

Title: Rates of nitrogen and potassium for ratoon cane on a Somerling Series soil

1. Particulars of the project:

| | | |
|---|---|---|
| This crop | : | 2nd ratoon |
| Site | : | Ubombo Ranches Field Mbabala B. |
| Region | : | Northern irrigated (Swaziland) |
| Soil set/series | : | S. Set/Somerling |
| Design | : | 6 x 3 Factorial with 2 reps. |
| Variety | : | NCo 376 |
| Fertilizer | : | See treatments |

Soil analysis: Date 19th January 1981

| pH | O.M.% | Clay % | P.D.I. |
|---|---|---|---|
| 6,6 | - | 40 | - |

ppm

| P | K | Ca | Mg |
|---|---|---|---|
| 19 | 382 | >1800 | >220 |

Age: 11,8 months Dates 10/11/80 - 4/11/81

Rainfall: 649 mm

Irrigation: 960 mm

2. Objectives:

2.1 To determine the optimum levels of N and K on a Somerling series soil (S.A. Mayo Form)

2.2 To test the ability of a ripener to increase cane quality, especially on plots receiving high rates of nitrogen.

2.3 To test the availability of exchangeable potassium.

3. Treatments:

| N kg/ha | | | K kg/ha | | |
|---|---|---|---|---|---|
| N0 | = | Nil | K0 | = | Nil |
| N1 | = | 80 | K1 | = | 100 |
| N2 | = | 120 | K2 | = | 200 |
| 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).

Fertilizer was applied by hand over the cane row as a split application at 5 and 12 weeks after harvest.

Polado was applied (by hand-operated knapsack) to half of each plot at a rate of 500 gm product/ha.

Sucrose samples were taken a few days prior to harvest, 12 stalks being taken at random from each sub plot.

## 4. Results:

### 4.1 Yield results

Tons cane/ha

| K kg/ha \ N kg/ha | Nil | 80 | 120 | 160 | 200 | 240 | Mean |
|---|---|---|---|---|---|---|---|
| Nil | 80 | 102 | 109 | 106 | 115 | 100 | 102 |
| 100 | 84 | 105 | 108 | 95 | 100 | 112 | 101 |
| 200 | 82 | 102 | 101 | 107 | 96 | 108 | 99 |
| Mean | 82 | 103 | 106 | 103 | 104 | 107 | |

C.V.% 7,5
L.S.D. Treatment Means (0,05) 15,9 (0,01) 21,8
L.S.D. N. Means (0,05) 6,5 K Means (0,05) 4,6
(0,01) 8,9 (0,01) 6,3

Sucrose % cane

| K kg/ha \ N kg/ha | Nil | 80 | 120 | 160 | 200 | 240 | Mean |
|---|---|---|---|---|---|---|---|
| Nil | 15,4 | 14,5 | 15,3 | 15,3 | 15,0 | 15,7 | 15,2 |
| 100 | 15,6 | 15,1 | 13,9 | 14,8 | 15,8 | 15,2 | 15,0 |
| 200 | 14,8 | 15,4 | 15,3 | 15,4 | 15,3 | 14,8 | 15,2 |
| Mean | 15,3 | 15,0 | 14,8 | 15,2 | 15,4 | 15,2 | |

Tons sucrose/ha

| K kg/ha \ N kg/ha | Nil | 80 | 120 | 160 | 200 | 240 | Mean |
|---|---|---|---|---|---|---|---|
| Nil | 12,2 | 14,7 | 16,7 | 16,0 | 17,2 | 15,7 | 15,4 |
| 100 | 13,0 | 15,8 | 15,2 | 14,1 | 15,8 | 17,0 | 15,2 |
| 200 | 12,0 | 15,7 | 15,3 | 16,4 | 14,7 | 15,9 | 15,0 |
| Mean | 12,4 | 15,4 | 15,8 | 15,5 | 15,9 | 16,2 | |

C.V.% 7,5
L.S.D. Treatment Means (0,05) 2,4 (0,01) 3,3
L.S.D. N. Means (0,05) 0,9 K Means (0,05) 0,7
(0,01) 1,4 (0,01) 0,9

Tons cane/ha/m at the N5 level was 9,1 (N1 = 8,7)
Tons cane/ha/100 mm at the N5 level was 6,7

4,2 Third leaf analysis (N & K)

| Age (m) | 4,3 March | 7,0 June |
|---|---|---|
| | Nitrogen % d.m. | |
| N kg/ha | | |
| Nil | 1,56 | 1,40 |
| 80 | 1,71 | 1,59 |
| 120 | 1,66 | 1,69 |
| 160 | 1,66 | 1,72 |
| 200 | 1,69 | 1,68 |
| 240 | 1,76 | 1,72 |
| | Potassium % d.m. | |
| K kg/ha | | |
| Nil | 1,46 | 1,21 |
| 100 | 1,41 | 1,24 |
| 200 | 1,43 | 1,27 |

4.3 Polado spray

There was no positive response to Polado but a trend towards a slight depression in cane quality. Sub-plots were not randomised so no statistical analysis was carried out.

5. COMMENTS

5.1 Results show that this shallow soil is capable of producing good yields if fertilized at the correct rates. Sucrose % cane was very high.

5.2 NITROGEN

5.2.1 There was a marked increase in yield (P = 0,01) from the N0 to the N1 level and yet 82 tc/ha/an were produced with no fertilizer N being applied indicating that a reasonable quantity of N was mineralised by the soil. There was very little response to nitrogen at levels greater than 80 kg/ha.

5.2.2 Surprisingly sucrose % cane was not depressed by high rates of N therefore the response in ts/ha tends to be similar to that of tc/ha, although the N level of 120 kg/ha would appear to be better than 80 kg/ha (n.s.)

5.2.3 Third leaf N showed adequacy (just) at all levels of applied N but a deficiency where no N was applied.

6. POTASSIUM

6.1 Some exchangeable K levels in this soil are extremely high (>500 ppm.) and all plots have good reserves. It is therefore not surprising to find no response to applied K with the indication of a slight yield depression at the high rates (n.s.)

6.2 Third leaf K values were well above the threshold level for all three rates including a winter sampling at 7 months of age.

6.3 Cane quality was not affected by increasing K rates.

7. PHOSPHORUS

7.1 Third leaf P levels were marginal only in the absence of nitrogen fertilizer.

8. POLADO

8.1 Surprisingly the sucrose % cane was depressed by 0,2% in sprayed cane.

8.2 No real differences in yield were found between treated and untreated cane.

8.3 Ratoon chlorosis was evident in sprayed plots soon after germination.

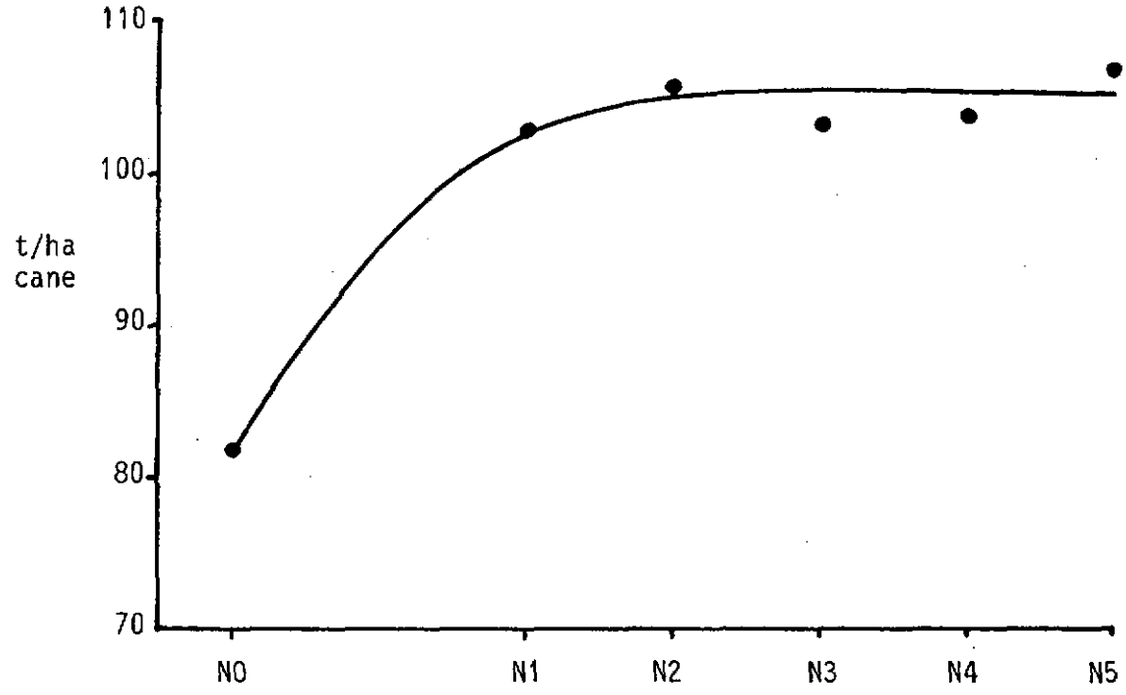
9. SULPHUR

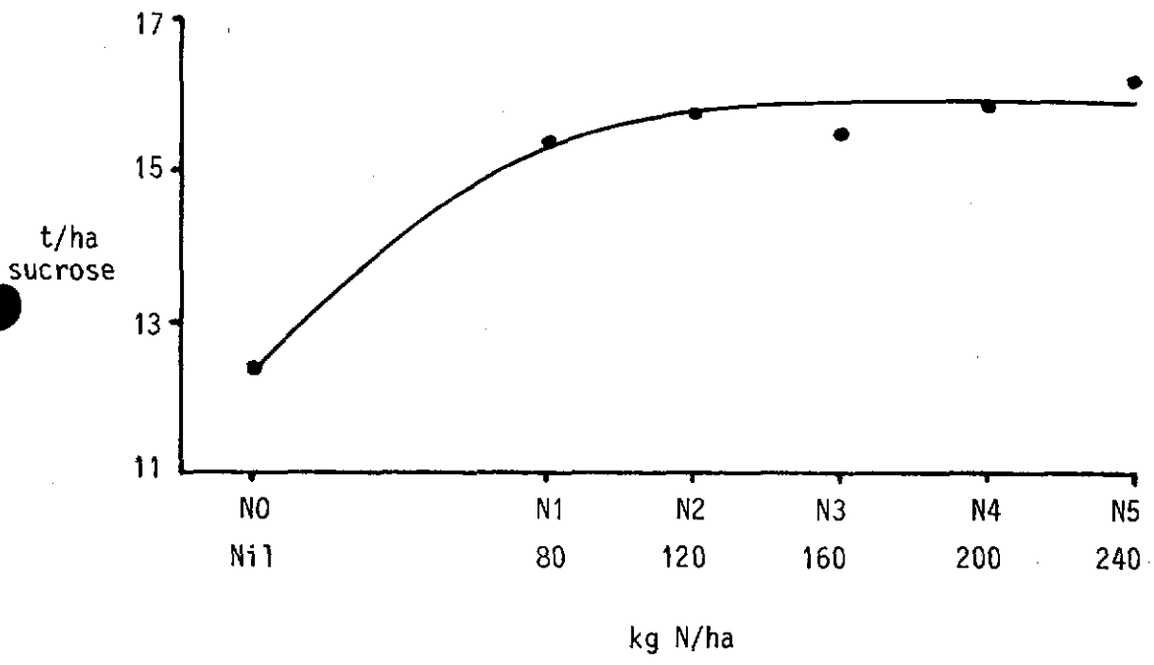
9.1 Soil S varied between 18 and 25 ppm and third leaf levels ranged between 0,13 and 0,15% d.m. with the N:S ratios being 10 to 14:1. These are marginal but not deficient.

10. The trial will continue into the third ratoon and with the same levels of N, P & K.

NBL/PMO
31.3.82

NITROGEN RESPONSE CURVES (tons cane and sucrose/ha)



4

SOUTH AFRICAN SUGAR INDUSTRY

AGRONOMISTS' ASSOCIATION

Code : NK1/80/R-Sw Som

Cat. No.: 1272

TITLE: Rates of Nitrogen and Potassium for ratoon cane on a Somerling series soil

1. Particulars of project

This crop : 3rd ratoon

Site : Ubombo Ranches Field Mbabala B

Region : Northern Irrigated (Swaziland)

Soil set/series: S/Somerling

Design : 6 x 3 factorial with 2 reps

Variety : NCo 376

Fertilizer : See treatments

Soil analysis: Date: 11/11/1982

| pH | O.M.% | Clay% | P.D.I. |
|---|---|---|---|
| 6,4 | | 40 | |

ppm

| P | K | Ca | Mg | Zn | | |
|---|---|---|---|---|---|---|
| 19 | 379 | >1800 | >220 | 1,1 | K0 | 324 |
| | | | | | K1 | 392 |
| | | | | | K2 | 421 |

Age: 10,8 months Dates 4/11/81-29/ 9 /82

Rainfall: 326 mm

Irrigation: 1440 mm

Total Water: 1766 mm

2. Objectives:

2.1 To determine the optimum levels of N & K for ratoon cane in a Somerling series soil (SA Mayo form) and to compare results with those of the previous crop.

2.2 To test the ability of Polado to increase cane quality, especially on plots receiving high rates of nitrogen.

2.3 To test the availability of exchangeable soil potassium.

3. Treatments

| N kg/ha | | K kg/ha | |
|---|---|---|---|
| N0 | NIL | K0 | NIL |
| N1 | 80 | K1 | 100 |
| N2 | 120 | K2 | 200 |
| 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)
- Fertilizer was applied by hand over the cane row as a single application 6 weeks after harvesting.
- Polado was applied (by hand operated knapsack) to half of each plot at a rate of 500 g product/ha five weeks before harvest.
- Sucrose samples were taken at harvest; 12 stalks being taken from each sub plot.

4. Results

4.1 Yield results

Tons cane/ha

| N kg/ha / k kg/ha | Nil | 80 | 120 | 160 | 200 | 240 | Mean |
|---|---|---|---|---|---|---|---|
| Nil | 65 | 95 | 110 | 112 | 117 | 105 | 101 |
| 100 | 64 | 103 | 107 | 92 | 113 | 112 | 99 |
| 200 | 71 | 94 | 98 | 120 | 111 | 116 | 102 |
| Mean | 67 | 97 | 105 | 108 | 114 | 111 | 100 |

CV % 7,2
LSD Treatment Means: (0,05) N: 8,8 K: 6,2
(0,01) N: 12,1 K: 8,6

Sucrose % cane

| N kg/ha / k kg/ha | Nil | 80 | 120 | 160 | 200 | 240 | Mean |
|---|---|---|---|---|---|---|---|
| Nil | 14,6 | 14,4 | 14,8 | 14,1 | 13,8 | 14,8 | 14,4 |
| 100 | 14,6 | 14,5 | 14,2 | 14,1 | 14,3 | 13,7 | 14,2 |
| 200 | 14,9 | 14,2 | 14,3 | 14,2 | 13,9 | 13,9 | 14,2 |
| Mean | 14,7 | 14,4 | 14,4 | 14,1 | 14,0 | 14,1 | 14,3 |

CV % 4,0

Tons sucrose/ha

| N kg/ha / k kg/ha | Nil | 80 | 120 | 160 | 200 | 240 | Mean |
|---|---|---|---|---|---|---|---|
| Nil | 9,4 | 13,7 | 16,3 | 15,8 | 16,2 | 15,6 | 14,5 |
| 100 | 9,4 | 15,0 | 15,3 | 13,0 | 16,2 | 15,4 | 14,0 |
| 200 | 10,5 | 13,3 | 13,9 | 17,1 | 15,4 | 16,2 | 14,4 |
| Mean | 9,8 | 14,0 | 15,2 | 15,3 | 15,9 | 15,7 | 14,3 |

CV % 9,8
LSD Treatment Means (0,05) N: 1,7 K: 1,2
(0,01) N: 2,3 K: 1,7

Tons cane/ha/month at the N4 level is 10,6 (N2 = 9,7)
Tons cane/ha/100 mm water at the N4 level is 6,3
At the N4 level the ratio of Kg N per ton cane produced is 1,75 (1,14 at the N2 level)

4.2 Third leaf data

| | Age in months | |
|---|---|---|
| | 3 months (Feb) | 5,5 months (April) |
| Nitrogen % dm | | |
| N0 | 1,69 | 1,36 |
| N1 | 1,95 | 1,57 |
| N2 | 2,06 | 1,57 |
| N3 | 2,14 | 1,67 |
| N4 | 2,14 | 1,68 |
| N5 | 2,09 | 1,68 |
| Potassium % dm | | |
| K0 | 1,33 | 1,50 |
| K1 | 1,35 | 1,53 |
| K2 | 1,40 | 1,59 |

## 5. Comments

This site was harvested early; in spite of this some cane yields were superior to those of the previous ratoon, and responses to fertilizer showed similar trends.

### 5.1 Nitrogen

5.1.1 By comparison with the previous ratoon, the N0 level resulted in very low yields (67 tc/ha, compared to 82 tc/ha). There was a marked yield increase from N0 to the N1 level with smaller but significant (P= 0,05) increases at the higher N rates. Results from the previous crop indicated that 80 kg N/ha was sufficient for optimum cane yields.

The latest results tend to confirm that acceptable yields can be obtained on this soil at the lower rates of N (± 120 kg N/ha).

5.1.2 There was a slight decrease in sucrose % cane with increasing N levels. The N2 level produced sucrose yields that were highly significant (P= 0,01) compared to the N0 treatment. It seems that the growing conditions were more favourable during this crop than in the previous crop.

5.1.3 Third leaf N levels in samples taken at 3 months of age showed a clear response to applied N but did not indicate the optimum N level. Sampling at 5,5 months showed a relatively low N content throughout but indicated more clearly the optimum level of N fertilizer.

### 5.2 Potassium

5.2.1 The K1 and K2 treatments have increased soil K levels but there has been no yield response to the treatment

5.2.2 Third leaf K values indicated adequacy in samples at 3 months of age in February and 5,5 months of age in April.

5.2.3 Cane quality was not effected by increasing K rates.

### 5.3 Phosphorus

5.3.1 Although soil P levels were above threshold, third leaf P values were marginal for plots that received no nitrogen.

### 5.4 Polado

5.4.1 As in the previous year the sucrose % cane was depressed by 0,2% in sprayed cane.

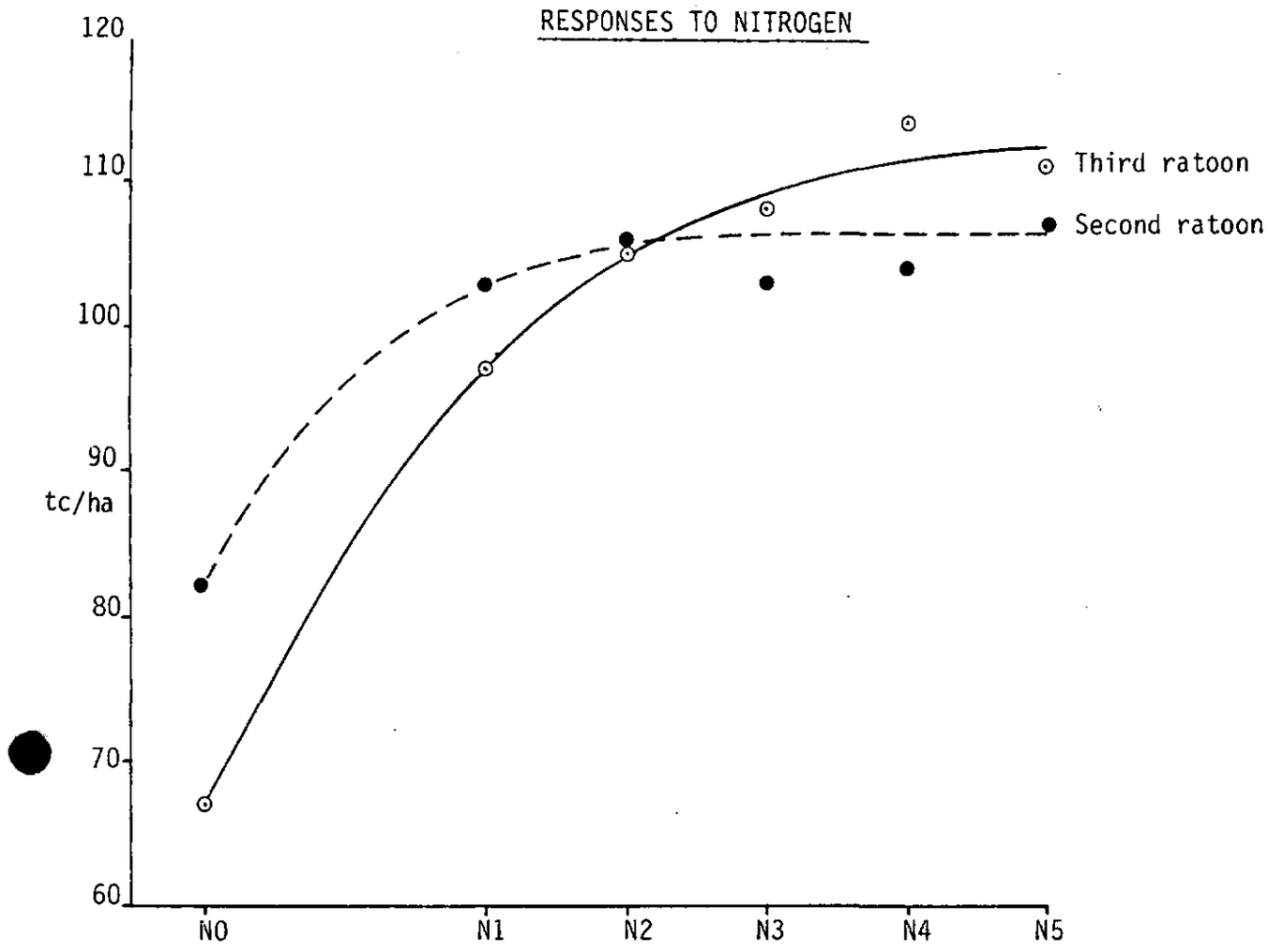
5.4.2 There was a significant (P = 0,01) reduction in cane yields in sprayed cane that became more pronounced at the higher rates of N.

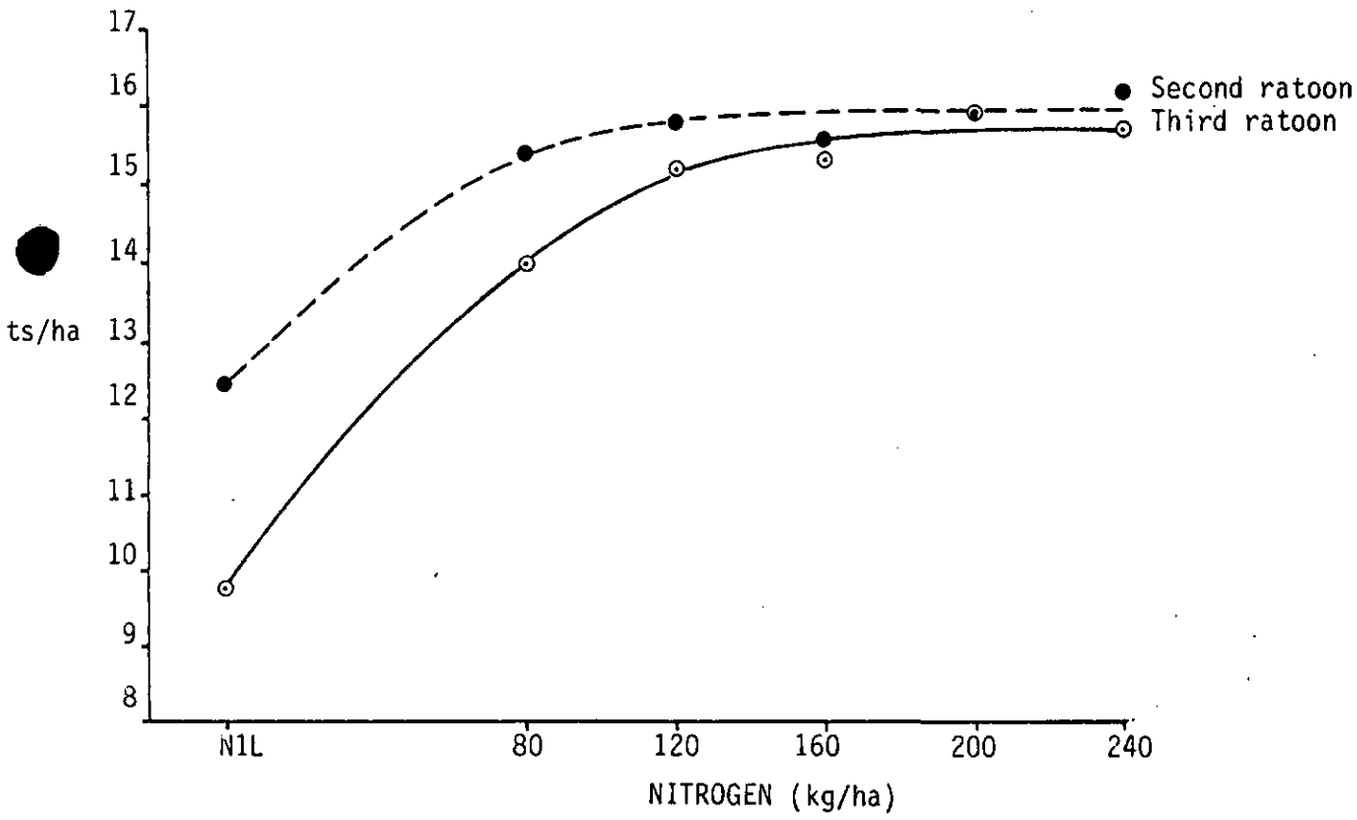
5.5 Zinc

5.5.1 Soil zinc levels were marginal to low during the 3rd ratoon. Third leaf zinc values were adequate during February (3,0 m) and April (5,5 m) but were below threshold for the N0 plots in the first sampling.

6. The trial has been re-established and treated with the same amounts of N and K fertilizer.

NBL/IS
18 July 1983


RESPONSES TO NITROGEN
120
110
100
90
tc/ha
80
70
60
N0
N1
N2
N3
N4
N5
Third ratoon
Second ratoon


17
16
15
14
ts/ha
13
12
11
10
9
8
N1L
80
120
160
200
240
NITROGEN (kg/ha)
Second ratoon
Third ratoon

SOUTH AFRICAN SUGAR INDUSTRY

AGRONOMISTS' ASSOCIATION

Code: NK1/80/R SW Ubo. Som.

Cat. No.: 1272

TITLE: Rates of Nitrogen and Potassium for ratoon cane on a Somerling series soil.

1. Particulars of Project:

This crop : 4th ratoon

Site: Ubombo Ranches
Field Mbabala B.

Region: Northern Irrigated (Swaziland)

Soil set/series: S/Somerling

Design: 6 x 3 factorial with 2 reps.

Variety: NCo 376

Fertilizer: See treatments

Soil analysis: Date:

| pH | OM% | Clay% | PDI |
|---|---|---|---|
| 6,4 | - | 40 | - |

ppm

| P | K | Ca | Mg | Zn |
|---|---|---|---|---|
| 19 | 379 | >1800 | >220 | 1,1 |

K0 324
K1 392
K2 421

Age: 11,5 m Date: 29/9/82-13/9/83

Rainfall: 443 mm

Irrigation: 857 mm (net)

Total Water: 1300 mm (effective)

2. Objectives:

2.1 To determine the optimum levels of N & K for ratoon cane in a Somerling series soil (S.A. Mayo form) and to compare results with those of the previous two crops.

2.2 To test the ability of Polado to increase cane quality, especially on plots receiving high rates of nitrogen.

2.3 To test the availability of exchangeable soil potassium.

3. Treatments:

| N kg/ha | | K kg/ha | |
|---|---|---|---|
| N0 | Nil | K0 | nil |
| N1 | 80 | K1 | 100 |
| N2 | 120 | K2 | 200 |
| 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).
- Fertilizer was applied over the cane row as a single application 5 and 10 weeks after harvest for nitrogen and potassium respectively.

- Polado was not applied to this crop due to lodging prior to harvest.
- Sucrose samples were taken from each whole plot before harvesting.

4. Results:

4.1 Yield results

Tons cane/ha

| N kg/ha / K kg/ha | Nil | 80 | 120 | 160 | 200 | 240 | Mean |
|---|---|---|---|---|---|---|---|
| Nil | 59 | 111 | 118 | 131 | 139 | 120 | 113 |
| 100 | 62 | 111 | 121 | 107 | 127 | 126 | 109 |
| 200 | 74 | 113 | 120 | 132 | 115 | 136 | 115 |
| Mean | 65 | 112 | 120 | 123 | 127 | 127 | 113 |

C.V. % 7,1

LSD Treatment means (0,05) N : 9,7 K : 6,9
(0,01) N : 13,3 K : 9,4

Sucrose % cane

| N kg/ha / K kg/ha | Nil | 80 | 120 | 160 | 200 | 240 | Mean |
|---|---|---|---|---|---|---|---|
| Nil | 14,0 | 14,0 | 13,1 | 13,9 | 13,7 | 14,0 | 13,8 |
| 100 | 14,0 | 13,3 | 13,0 | 13,5 | 14,2 | 13,1 | 13,5 |
| 200 | 14,1 | 13,5 | 12,5 | 14,0 | 13,9 | 13,0 | 13,5 |
| Mean | 14,0 | 13,6 | 12,9 | 13,8 | 13,9 | 13,4 | 13,6 |

C.V. % 4,3

LSD Treatment means (0,05) N : 0,7 K : 0,5
(0,01) N : 1,0 K : 0,7

Tons Sucrose/ha

| N kg/ha / K kg/ha | Nil | 80 | 120 | 160 | 200 | 240 | Mean |
|---|---|---|---|---|---|---|---|
| Nil | 8,2 | 15,6 | 15,6 | 18,2 | 19,0 | 16,8 | 15,6 |
| 100 | 8,7 | 14,8 | 15,8 | 14,4 | 18,0 | 16,4 | 14,7 |
| 200 | 10,4 | 15,3 | 15,0 | 18,5 | 16,1 | 17,4 | 15,5 |
| Mean | 9,1 | 15,2 | 15,5 | 17,1 | 17,7 | 17,0 | 15,3 |

C.V. % 8,5

LSD Treatment means (0,05) N : 1,6 K : 1,1
(0,01) N : 2,2 K : 1,5

Tons cane/ha/month at the N4 level is 11,0

Tons cane/ha/100 mm water at the N4 level is 9,8

At the N4 level the ratio of Kg N per ton cane produced is 1,6 (1,0 at the N2 level).

4.2 Third leaf data

| | Age in months | | | |
|---|---|---|---|---|
| | 2,5 months (Dec) | 4,0 months (Jan) | 4,8 months (Feb) | 5,8 months (Mar) |
| Nitrogen % d.m. | | | | |
| N0 | 1,58 | 1,29 | 1,31 | 1,25 |
| N1 | 2,05 | 1,49 | 1,43 | 1,33 |
| N2 | 2,31 | 1,62 | 1,49 | 1,39 |
| N3 | 2,31 | 1,74 | 1,65 | 1,54 |
| N4 | 2,41 | 1,80 | 1,62 | 1,61 |
| N5 | 2,41 | 1,87 | 1,76 | 1,68 |
| Potassium % d.m. | | | | |
| K0 | 1,20 | 1,47 | 1,31 | 1,45 |
| K1 | 1,24 | 1,48 | 1,32 | 1,45 |
| K2 | 1,27 | 1,50 | 1,34 | 1,48 |

5. Comments

Better yields were obtained from this crop compared to the previous two ratoons. Some severe lodging took place about one month before harvest and this prevented Polado being applied to half plots.

5.1 Nitrogen

- The N0 level resulted in lower yields then were obtained from the previous two ratoons. The difference in yield between the N0 and N1 treatments was far greater in the 4th ratoon than in the first two crops. (47 tc/ha (P = 0,01)). Although increasing rates of nitrogen resulted in a linear increase in tons cane/ha up to the N4 level, the response was not statistically significant above the N2 level.

- There was no clear treatment effect on S % C.

- The response to N in t s/ha was quadratic peaking at a rate of about 200 kg/ha.

- Third leaf N levels from monthly samples commencing at 2,5 months of age in December indicated a clear response to N with all levels except N0 being above threshold (1,8% N d.m.) at the initial sampling. Third leaf N content dropped sharply in later sampling and only cane treated with the N4 and N5 levels was above threshold at 5,8 months in March.

5.2 Potassium

- Soil K levels have risen in the soil previously treated with potassium. There was a slight (n.s.) depression in yield at the intermediate level of K. Cane quality was not affected by increasing K rates. Third leaf K values were above threshold for all four samplings; they reached a maximum during January at 4,0 months of age and then declined slightly during February. Leaf K values increased again in March possibly due to the unusually warm weather during that period.

5.3 Phosphorus

- Soil P levels were adequate but where little to zero N was applied low leaf P levels were induced at about 4 months of age. Third leaf P levels generally increased with increasing N rates.

5.4 Sulphur

- Soil S levels were above threshold (ave. 16 ppm). Some deep samples (500 mm) indicated that the subsoil is reasonably well supplied with sulphur. Despite this, leaf sampling indicated low S values in third leaves. Low N rates induced low S levels.

5.5 Zinc

- Soil sampling results showed zinc to be deficient in this soil. (ave. 1,1 ppm - threshold 1,5 ppm) but no zinc deficiencies were recorded in the third leaf samples.

6. This trial has now been harvested three times and has been terminated.

NL/SN
6 December, 1983

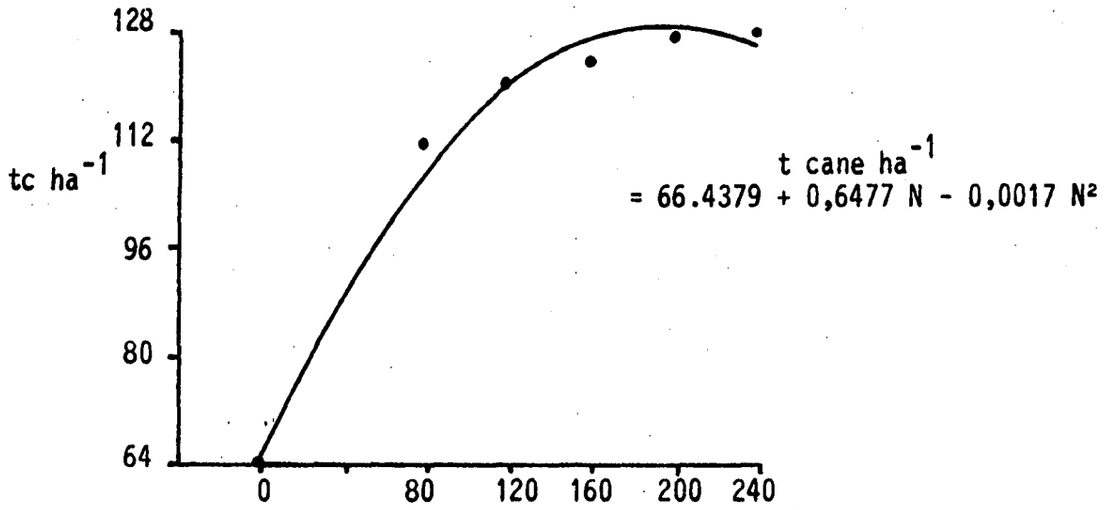



Fig 1 : Response to Nitrogen (Ton cane $ha^{-1}$)

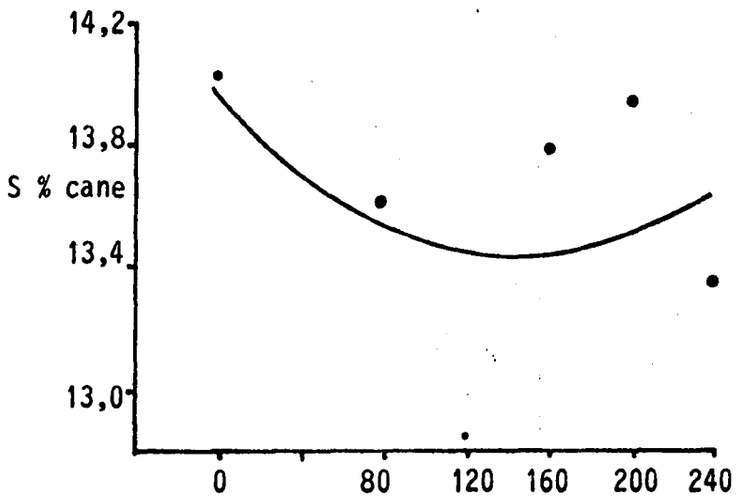



Fig 2 : Response to Nitrogen (sucrose % cane)

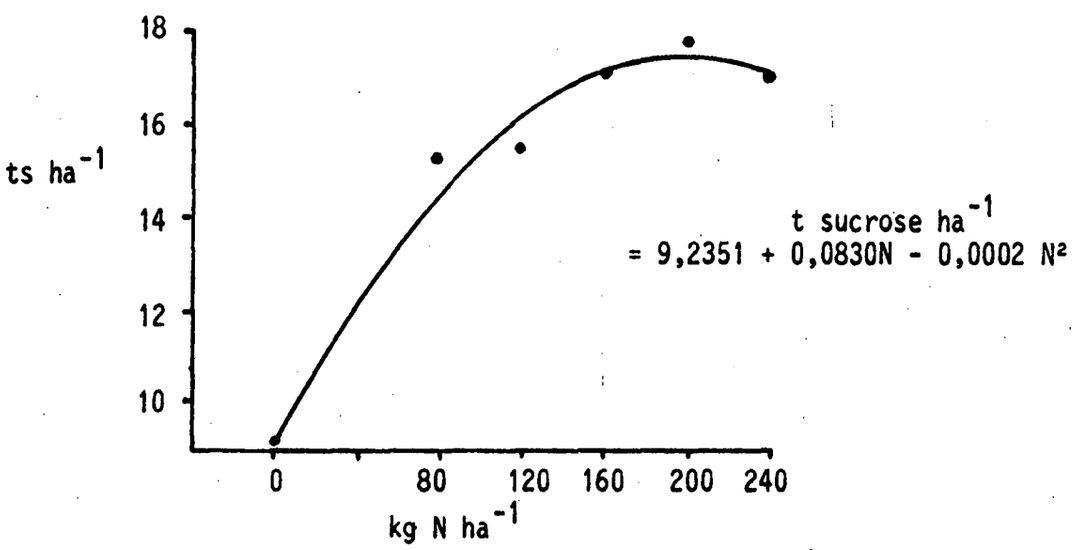



Fig 3 : Response to Nitrogen (Tons suc $ha^{-1}$)