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SOUTH AFRICAN SUGAR INDUSTRY
AGRONOMISTS' ASSOCIATION

Code: NK 3/81/E. SW. SIS. TAB
Cat.: 1304

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

1. Particulars of the project:

This crop : 4th Ratoon
Site : SIS Field P3-13
Region : Northern irrigated (Swaziland)
Soil set/series : T Set/Tambankulu
Design : 6 x 3 Factorial with 2 replications
Variety : NCo 376
Fertilizer : See treatments

Soil Analysis: Date 29/5/1981

<u>pH</u>	<u>OM%</u>	<u>Clay%</u>	<u>PDI</u>
5,9	-	37	-

ppm

<u>P</u>	<u>K</u>	<u>Ca</u>	<u>Mg</u>
40	145	1500	>220

Age: 12 months

Dates: 13/5/1981 - 5/5/1982

Rainfall: 806 mm

Irrigation: 1050 mm

Total 1856 mm

50 mm effective water applied on a minimum six day cycle - 12 hr stand time

2. Objectives:

- 2.1 To determine the optimum levels of N and K for ratoon cane growing on a Tambankulu series soil.
- 2.2 To test the availability of exchangeable potassium.

3. Treatments

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

Notes on treatments:

- . Nitrogen as ammonium nitrate (34,5% N) and potassium as muriate of potash (50% K)
- . Phosphorus applied at 40 kg P/ha as single superphosphate (11,3% P) to all plots.
- . N and K were applied by hand over the row as split applications at three and 12 weeks after harvesting. P was applied at five weeks after harvest.

- . All plots received 1,5 ℓ ethrel/ha nine weeks before harvest.
- . Sucrose samples were taken 1 day before harvest. Twelve stalks were taken at random from each plot.

4. Results:

4.1 Harvest data

tons cane/ha

Treatment	N0	N1	N2	N3	N4	N5	Mean
K0	75	110	119	121	128	163	119
K1	81	122	120	136	138	132	121
K2	89	122	129	144	133	158	129
Mean	82	118	123	134	133	151	123

C.V.% 9,2

LSD Treatment means (0,05) N : 13,9 K : 9,8
(0,01) N : 19,0 K : 13,4

Sucrose % cane

Treatment	N0	N1	N2	N3	N4	N5	Mean
K0	13,0	12,4	12,6	12,6	12,8	12,7	12,7
K1	13,3	13,2	12,8	13,2	12,0	14,4	13,1
K2	13,1	1,37	12,4	11,8	12,9	12,0	12,7
Mean	13,2	13,1	12,6	12,5	12,6	13,0	12,8

C.V.% 5,8

LSD Treatment means (0,05) N : 0,9 K : 0,6
(0,01) N : 1,2 K : 0,9

tons sucrose/ha

Treatment	N0	N1	N2	N3	N4	N5	Mean
K0	9,7	13,7	14,9	15,4	16,4	20,7	15,1
K1	10,7	16,2	15,4	17,9	16,6	19,1	16,0
K2	11,8	16,6	16,1	17,0	17,1	19,0	16,3

C.V.% 12,3

LSD Treatment means (0,05) N : 2,36 K : 1,67
(0,01) N : 3,24 K : 2,29

Tons cane/ha/month at the N5 level is 12,6

Tons cane/ha/100 mm at the N5 level is 8,1

At this level the ratio of kg N per ton cane produced is 1,6.

4.2 Third leaf data

	Age in months				
	4 (Sept)	6 (Nov)	7 (Dec)	8,5 (Feb)	10 (Mar)
<u>Nitrogen (% dm)</u>					
N0	1,56	1,20	1,19	1,36	1,38
N1	2,04	1,23	1,30	1,39	1,46
N2	2,19	1,36	1,36	1,48	1,47
N3	2,22	1,38	1,45	1,49	1,53
N4	2,37	1,56	1,59	1,59	1,56
N5	2,37	1,58	1,57	1,58	1,58
<u>Potassium (% dm)</u>					
K0	0,75	0,87	1,22	1,27	1,05
K1	0,91	0,99	1,27	1,29	1,02
K2	1,02	1,00	1,32	1,38	1,08

5. Comments:

5.1 Large responses were evident soon after the fertilizer was applied and the yields obtained indicate high fertilizer requirements for this soil.

5.2 Nitrogen

5.2.1 There was a marked linear yield response from the N0 to the N5 level ($P = 0,01$). The yield at the N5 level was significantly greater ($P = 0,05$) than that at the N4 level indicating the high nitrogen requirements of ratoon cane in a T set soil.

5.2.2 Cane quality was not significantly depressed by increasing N levels.

5.2.3 The response in ts/ha tends to be similar to that of tc/ha.

5.2.4 The third leaf N content was above the threshold at 4 months of age but fell rapidly from November onwards for all levels of nitrogen.

5.2.5 The substantial N response was very evident in the stalk heights. Severe stunting and yellowing appeared in the N0 treatments from an early age.

5.3 Potassium

5.3.1 The exchangeable K level in the soil is close to threshold with some plots having low reserves. The response in cane yield from the K0 to the K2 level attained a level of statistical significance ($P = 0,05$).

5.3.2 Third leaf K levels were very low at four and six months old but increased to above the threshold value during summer and then declined at + 9 months of age.

5.4 Phosphorus

5.4.1 Soil P levels are high at about 40 ppm.

5.4.2 Third leaf P values were above the threshold value and only became marginal at 10 months of age.

5.5 Sulphur

5.5.1 Soil S levels were all above the threshold value.

5.5.2 Third leaf S values were erratic with some below the threshold value at most samplings.

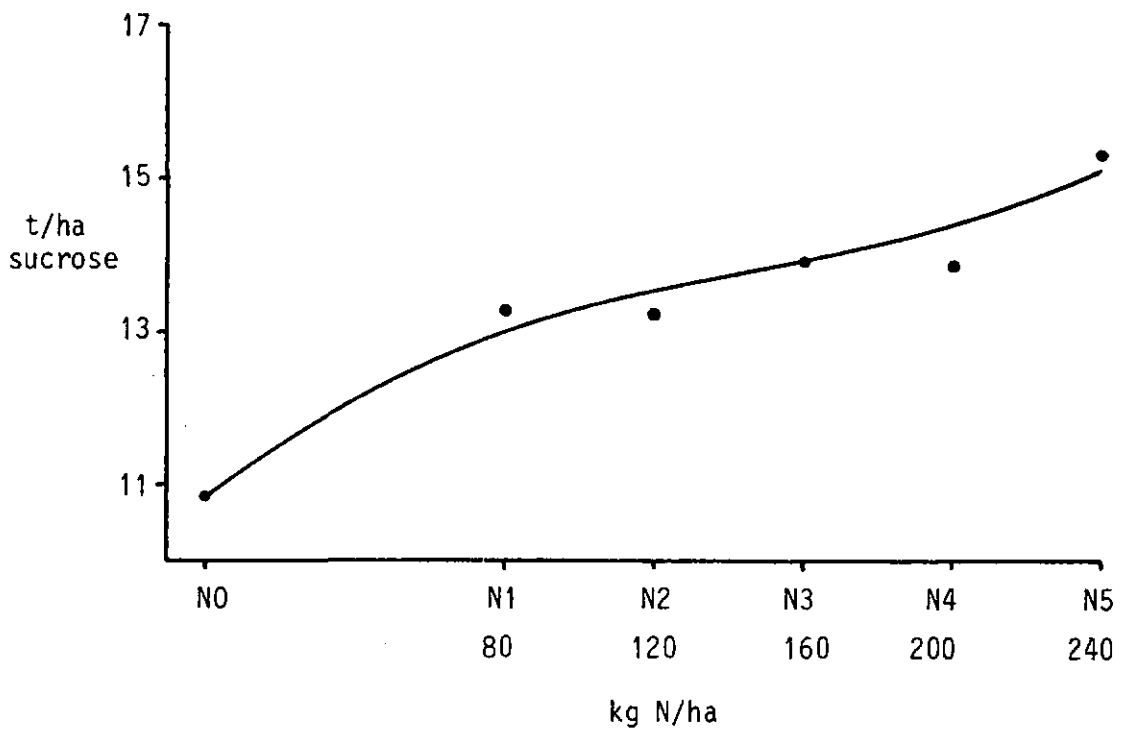
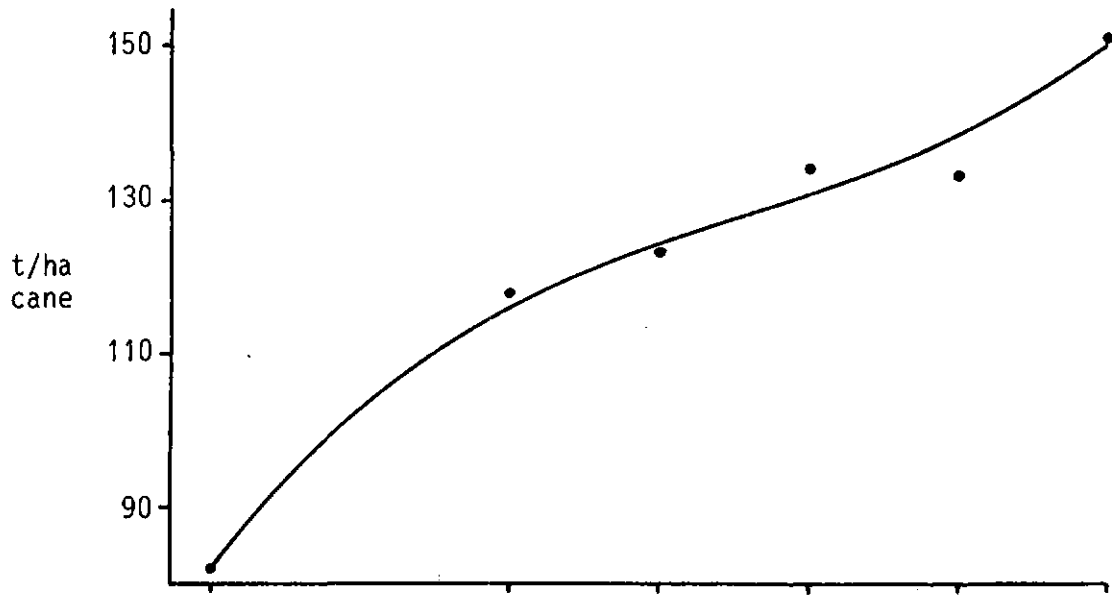
5.6 Zinc

5.6.1 Soil Zn levels were below the threshold value at the initial sampling.

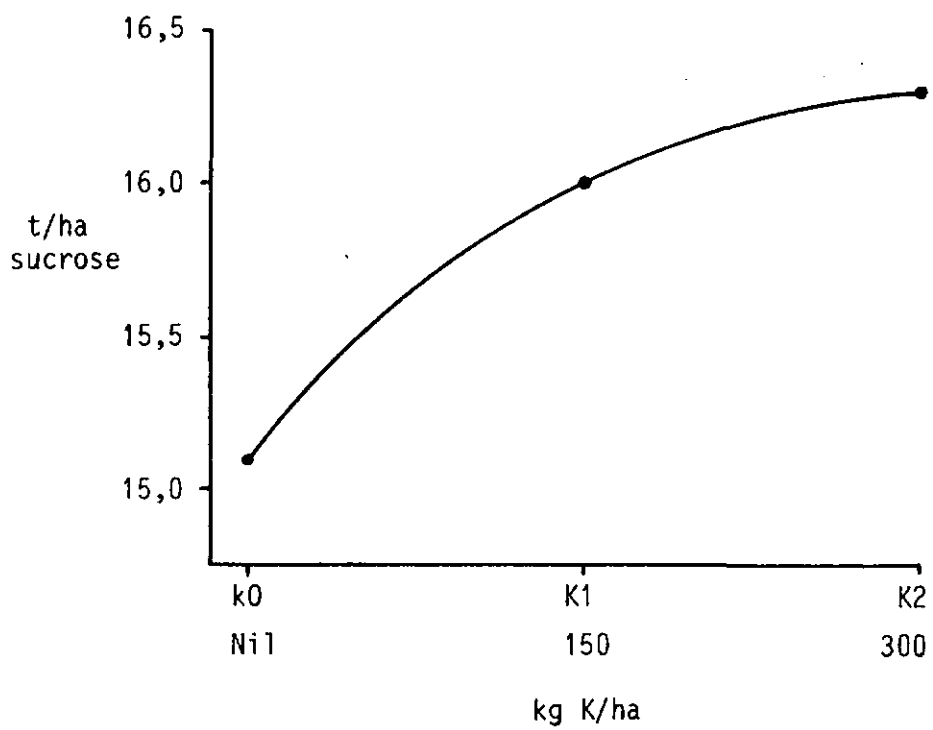
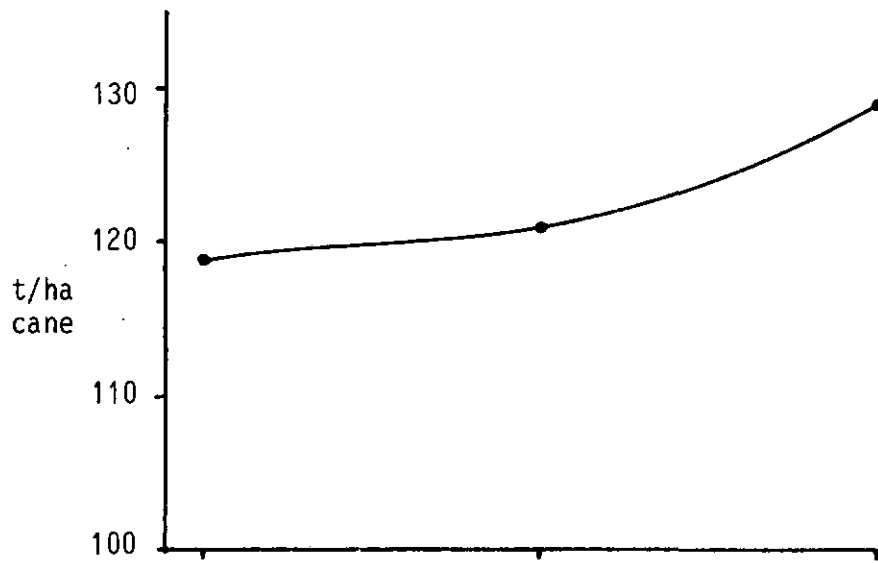
5.6.2 Third leaf Zn levels were mostly above the threshold value.

6. The trial is now in its 5th ratoon and the plots have received the same amounts of N, P and K as in the fourth ratoon.

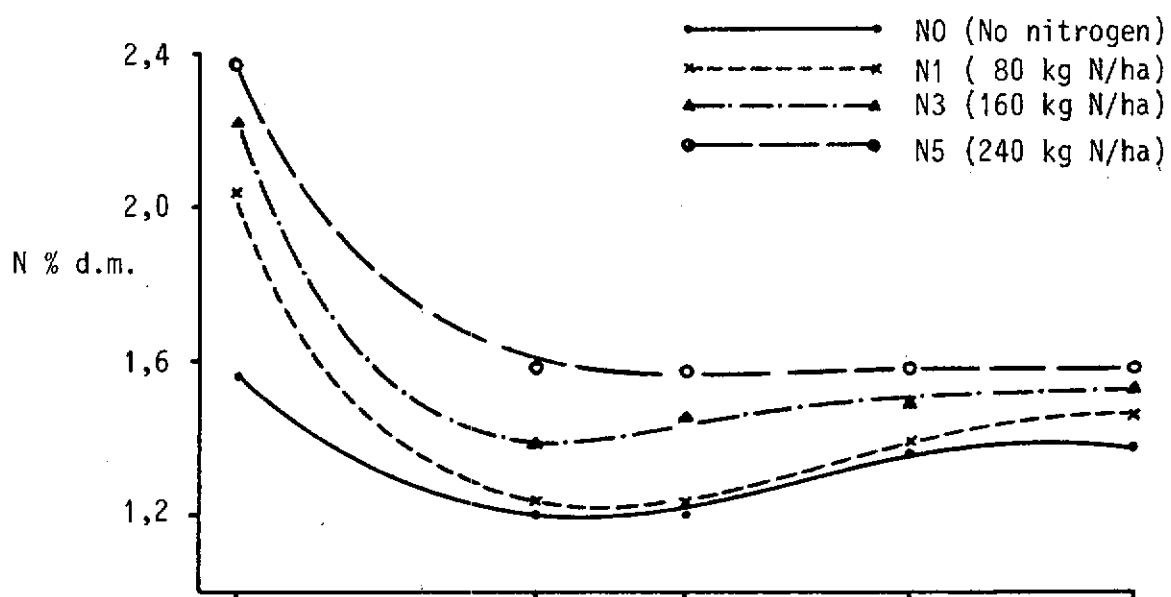
NITROGEN RESPONSE CURVES (Tons cane and sucrose/ha)



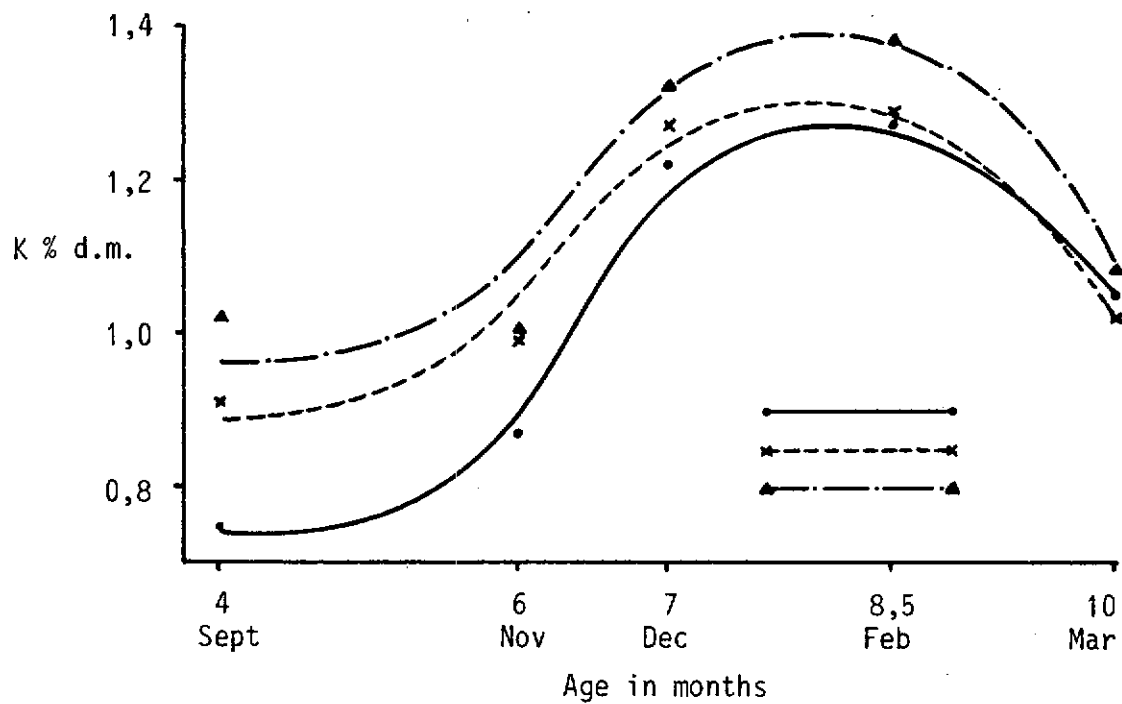
POTASSIUM RESPONSE CURVES
(Tons cane and sucrose/ha)



THIRD LEAF : Nitrogen % d.m.



Potassium % d.m.



Code No : NK 3/81/R-SW SIS TAB

Cat. No.: 1304

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

1. Particulars of project

This crop : 5th ratoon
Site : SIS Field P3-13
Region : Northern Irrigated
 (Swaziland)
Soil Set/Series: T/Tambankulu
Design : 6 x 3 factorial
 with two replications
Variety : NCo 376
Fertilizer : See treatments

Soil analysis: Date 9/6/1982

<u>pH</u>	<u>OM%</u>	<u>Clay %</u>	<u>PDI</u>
4,9	-	> 30	-

ppm

<u>P</u>	<u>K</u>	<u>Ca</u>	<u>Mg</u>	<u>K0</u>	
61	163	1426	> 220	K1	166
				K2	187

Age : 13,4 months

Dates : 5/5/82 - 16/6/83

Rainfall : 459 mm

Irrigation: 702 mm (13,5 cycles
 @ 52 mm per cycle)

Total : 1161 mm

2. Objectives:

- 2.1 To determine the optimum levels of N & K for ratoon cane in a Tambankulu series soil and to compare results with those of the previous crop.
- 2.2 To test the availability of exchangeable potassium.
- 2.3 To test the ability of Polado to increase cane quality, especially on plots receiving high rates of nitrogen.

3. Treatments:

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

Notes on treatments

- Nitrogen as ammonium nitrate (34,5%N) and potassium as muriate of potash (50%K).
- Phosphorus applied at 40 kg P/ha as single superphosphate (10,5% P) to all plots.
- N and K were applied by hand over the row as split applications at 5 and 10 weeks after harvesting. P was applied at 5 weeks after harvest.
- Polado at 500 gm product/ha was applied to half of all plots 14 weeks before harvesting. Heavy rainfall was recorded in this area 5 hours after spraying.
- Sucrose samples were taken three days before harvest.

4. Results

4.1 Harvest data. Table 1: Yields (Tons cane/ha)

Treatment	N0	N1	N2	N3	N4	N5	Mean
K0	66	90	87	126	114	134	103
K1	63	118	116	136	95	132	110
K2	59	99	108	140	127	122	109
Mean	63	102	104	134	112	129	107

CV% 16,1

LSD Treatment Means (0,05) N : 21 K : 15

(0,01) N : 29 K : 20

Sucrose % cane

Treatment	N0	N1	N2	N3	N4	N5	Mean
K0	15,2	14,0	13,4	14,2	12,6	12,8	13,7
K1	14,9	15,8	13,5	13,8	12,5	12,9	13,9
K2	14,9	14,4	14,1	13,8	12,9	12,8	13,8
Mean	15,0	14,8	13,7	13,9	12,7	12,8	13,8

CV% 7,5

LSD Treatment Means (0,05) N : 1,26 K : 0,89

(0,01) N : 1,73 K : 1,23

tons sucrose/ha

Treatment	N0	N1	N2	N3	N4	N5	Mean
K0	10,1	12,7	11,7	17,9	14,6	17,1	14,0
K1	9,5	18,7	15,5	18,4	11,9	17,0	15,2
K2	8,8	14,2	15,4	19,4	16,3	15,9	15,0
Mean	9,5	15,2	14,2	18,6	14,3	16,7	14,7

CV% 19,0

LSD Treatment Means (0,05) N : 3,4 K : 2,4

(0,01) N : 4,7 K : 3,3

Tons cane/ha/month at the N3 level is 10,0

Tons cane/100 mm at the N3 level is 11,5

At this level the ratio of Kg N per ton cane produced is 1,2

Table 11: Treatment effects on stalk heights: (cm to TVD)

Treatment	Age 13,4 m
N0	181
N1	202
N2	197
N3	222
N4	205
N5	217
K0	193
K1	213
K2	206

Third leaf analysis, % d.m.

	Age in months					
	3,1 (Aug)	4,5 (Sept)	5,6 (Oct)	6,8 (Nov)	7,5 (Dec)	8,7 (Jan)
Nitrogen						
N0	2,26	1,54	1,21	1,30	1,12	1,25
N1	2,18	2,27	1,62	1,40	1,19	1,40
N2	2,28	2,40	1,98	1,65	1,47	1,44
N3	2,30	2,43	1,76	1,72	1,50	1,47
N4	2,31	2,42	1,97	1,90	1,61	1,58
N5	2,37	2,44	1,90	1,88	1,65	1,46
Potassium						
K0	0,88	0,68	0,70	0,94	1,16	1,30
K1	0,94	0,85	0,95	1,14	1,29	1,40
K2	1,08	1,05	1,07	1,25	1,36	1,39

5. Comments

5.1 As in the 4th ratoon, there was visual evidence of a large nitrogen response soon after the second application of fertilizer. Yields declined at the higher N levels. Damage by *Heteronychus* to cane in some of the plots is going to necessitate the badly damaged plots being discarded at the next harvest.

5.2 Nitrogen:

5.2.1 There was a marked response from N0 level to the N3 level ($P=0,01$). Cane yield was slightly depressed at the higher rates and this may be due to inadequate irrigation and to greater *Heteronychus* and eldana damage in the high N plots.

5.2.2 Cane quality was reduced significantly ($P=0,01$) by increasing levels of nitrogen.

5.2.3 The response in ts/ha was similar to the response in tc/ha peaking at the N3 level ($P=0,01$). The N5 level also resulted in a high sucrose yield, with an unaccountable dip at the N4 level.

5.2.4 The third leaf N content in cane of 3,1 month old and sampled in August was all very high. Monthly samplings thereafter indicated a steady decline in third leaf N with only the two highest rates of N producing levels above the threshold (1,8 N % dm) at 6,8 months in November.

5.2.5 Stalk heights taken at harvest were a clear indication that the better grown cane was from the N3 and N5 treatments.

5.3 Potassium

5.3.1 Soil samples have shown that K has increased in those plots that were previously treated with potassium.

5.3.2 There was a cane yield response to the K1 level (n.s) and based on soil and threshold levels this was predictable. No response was obtained to the higher level of applied K.

5.3.2 Cane quality was not affected by increasing K levels. The apparent response to K in ts/ha did not attain a level of statistical significance as the variability (CV%) was high.

5.3.3 Monthly third leaf sampling showed a strong response to applied K. Only where the high level of K was applied were the third leaf levels above the accepted threshold value in the August, September and October samplings. The later samplings November, December and January showed the leaf K levels to have risen substantially even where no K had been applied.

5.4 Phosphorus

5.4.1 Soil P values have increased substantially since the initial soil sampling.

5.4.2 Third leaf P values generally decreased with age but were on average higher where the high levels of N had been applied

5.5 Zinc

5.5.1 Soil Zn values were marginal (1,6 ppm)

5.5.2 All third leaf zinc levels were above threshold.

5.6 Sulphur

5.6.1 Soil S values were extremely high (101 ppm)

5.6.2 Third leaf sulphur levels decreased with age and became marginal to low at about 6,5 months in November.

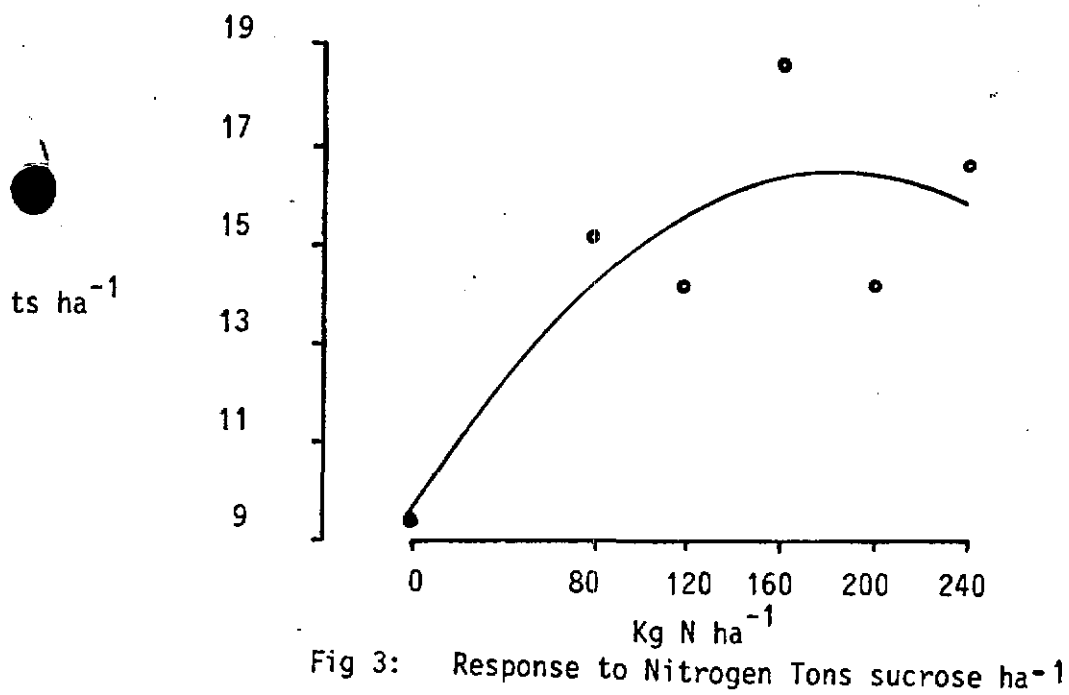
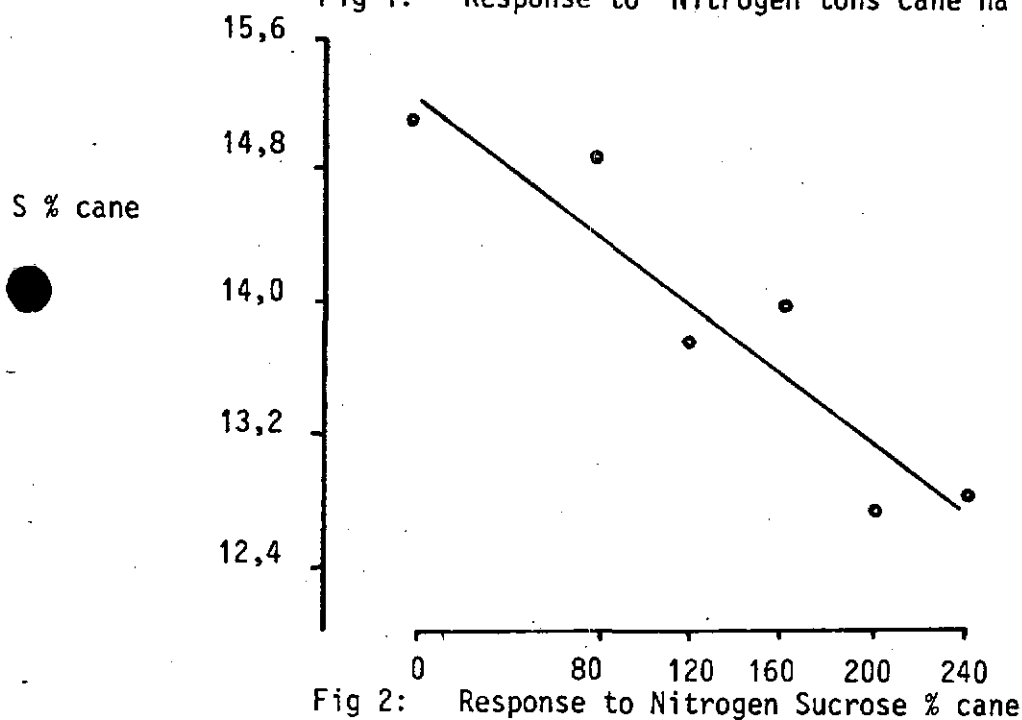
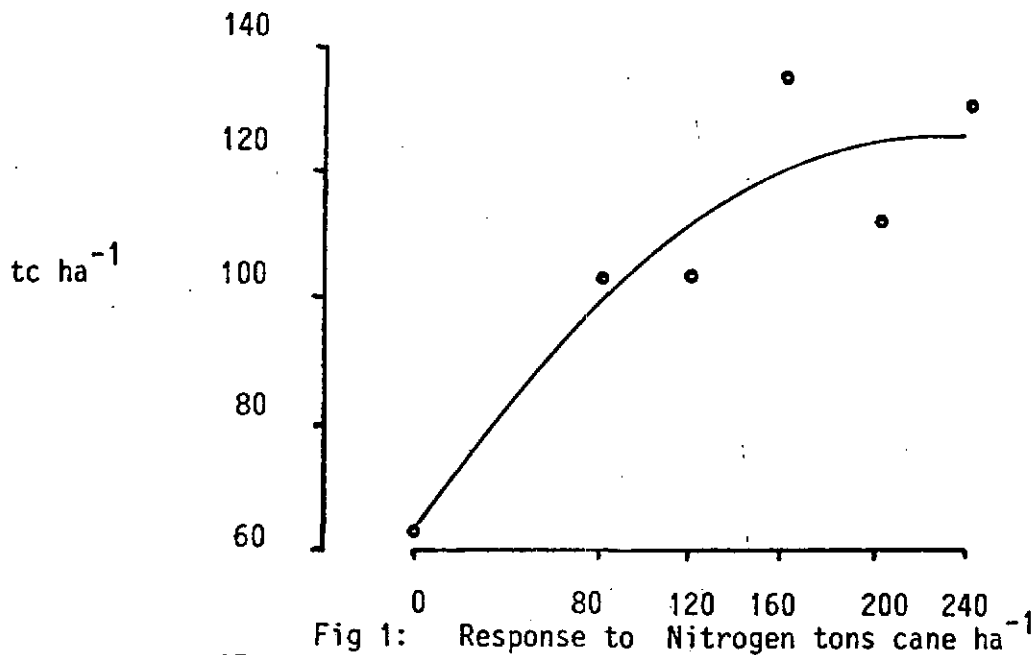
5.7 Polado

The average sucrose % cane from half plots treated with Polado was increased by 0,4 units. Cane yield was depressed where treated (8,6 t/ha) resulting in a reduction of + 0,5 t sucrose/ha. The interval between spraying and harvesting was unfortunately excessive

and this undoubtedly detracted from the likely response.

- 5.8 This trial is now in its 6th ratoon and has been treated with the same rates of N and K as was the previous ratoon.

NBL/IS
2 December 1983



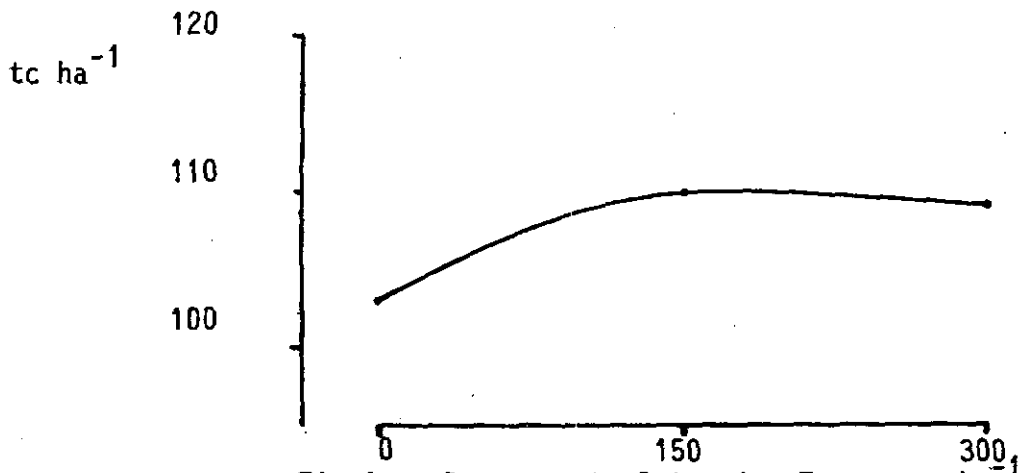


Fig 4: Response to Potassium Tons cane ha⁻¹

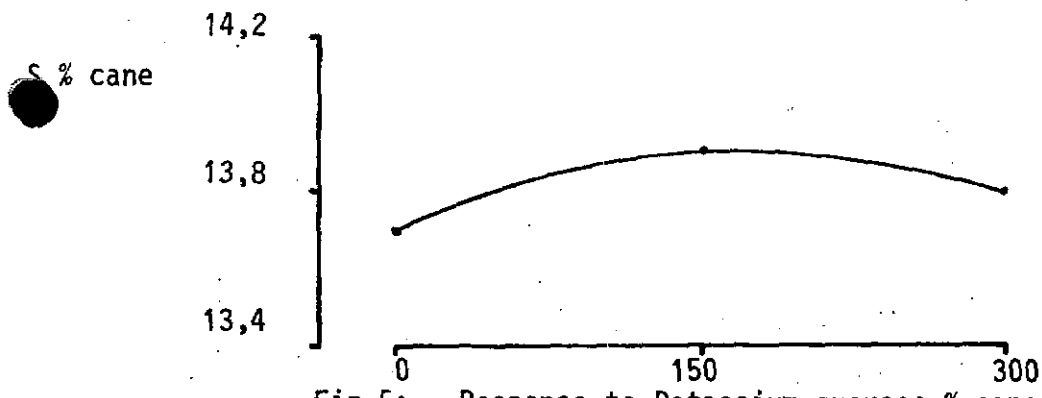


Fig 5: Response to Potassium sucrose % cane

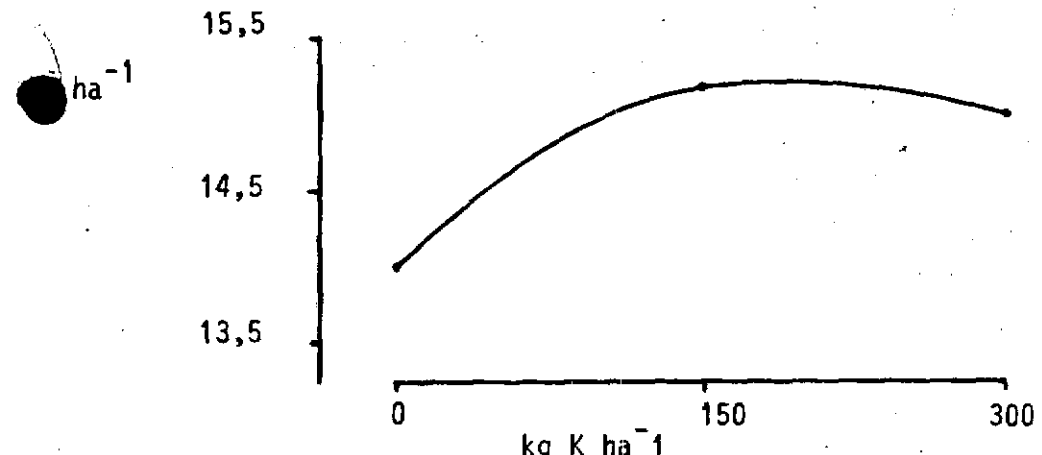


Fig 6: Response to Potassium tons sucrose ha⁻¹

SOUTH AFRICAN SUGAR INDUSTRY

AGRONOMISTS' ASSOCIATION

CODE : NK3/81/Sw SIS Tam

TITLE : RATES OF NITROGEN AND POTASSIUM FOR RATOON CANE ON A TAMBANKULU SERIES SOIL

1. PARTICULARS OF PROJECT

Cat. No. : 1304
 This crop : 6th ratoon
 Site : S.I.S. Field P3-13
 Region : Northern Irrigated (Swaziland)
 Soil Set/Series : 'T'/Tambankulu
 Design : 6 x 3 factorial with two replications
 Variety : NCo 376
 Fertilizer : See Treatments

Soil Analysis : Date 20/7/1984
 pH OM% Clay % P.D.I.
 5,7 3,4 >30 -
 ----- ppm -----
 P K Cu My S Zn
 45 191 1757 >220 17 1,3
 KO K1 K2
 121 186 256
 Age : 12,8 months
 Dates : 16/6/83 - 9/7/84
 Rainfall : 573 mm
 Irrigation : 507 mm
 Total : 1080 mm (effective)

2. OBJECTIVES

- 2.1 To determine the optimum levels of N and K for ratoon cane in a Tambankulu series soil.
- 2.2 To continue testing the availability of exchangeable potassium.
- 2.3 To test the ability of Polado to increase cane quality, especially on plots receiving high rates of nitrogen.

TREATMENTS

<u>N kg/ha</u>	<u>K kg/ha</u>
NO = Nil	KO = Nil
N1 = 80	K1 = 150
N2 = 120	K2 = 300
N3 = 160	
N4 = 200	
N5 = 240	

Notes on Treatments

- * Nitrogen as ammonium nitrate (34,5%N) and potassium as muriate of potash (50% K).
- * Phosphorus applied at 40 kg P/ha as single super-phosphate (10,5%P) to all plots.
- * N and K were applied by hand over the row as a single application 9 weeks after harvest. P was applied at 8,5 weeks after harvesting.
- * 500 gm Polado/ha was sprayed on half of all plots 5 weeks before harvesting.
- * Sucrose samples were taken three days before harvest.

4. RESULTS

4.1 Harvest Data

Table I : Yields (tc/ha)

TREATMENT	NO	N1	N2	N3	N4	N5	MEAN
KO	76	102	137	116	141	150	120
K1	69	126	137	151	164	150	133*
K2	57	125	142	176	163	162	138
MEAN	67	118**	139**	147	156	153	130

CV % 9.4

L.S.D. Treatment means (0.05)* N : 15, K : 10
(0.01)** N : 20, K : 14

Table II : Sucrose % Cane

TREATMENT	NO	N1	N2	N3	N4	N5	MEAN
KO	13,6	12,9	13,6	13,0	13,5	12,9	13,3
K1	14,1	14,2	14,3	13,8	13,4	13,4	13,8*
K2	14,1	14,3	14,1	13,4	13,9	13,0	13,8
MEAN	13,9	13,8	14,0	13,4	13,6	13,1	13,6

CV % 4,6

L.S.D. Treatment means (0.05)* N : 0,8, K : 0,5
(0.01)** N : 1,1, K : 0,7

Table III : Tons Sucrose/ha

TREATMENT	NO	N1	N2	N3	N4	N5	MEAN
KO	10,2	13,3	18,6	15,2	19,1	19,3	16,0
K1	9,6	17,8	19,5	20,9	21,9	20,1	18,3*
K2	8,0	18,0	20,0	23,5	22,7	20,9	18,9
MEAN	9,3	16,4**	19,4*	19,9	21,2	20,1	17,7

CV % 11,4

L.S.D. Treatment means (0,05)* N : 2,5, K : 1,7
 (0,01)** N : 3,4, K : 2,4

Tons cane/ha/month at the N4 level is 12,2.

Tons cane/100 mm water at the N4 level is 14,4.

At the N4 level the ratio of Kg N per ton cane produced is 1,3.

Table IV : Treatment effects on stalk heights (cm to TVD)

TREATMENTS	AGE 8,2M
NO	122
N1	164
N2	174
N3	183
N4	181
N5	182
KO	157
K1	172
K2	174

/4.....

Table V : Third leaf analysis (% dm)

Nitrogen		AGE IN MONTHS						
		2,1	3,5	4,5	5,8	6,2	7,2	8,5
NO		2,30	1,77*	1,63*	1,41*	1,26*	1,22*	1,25*
N1		2,32	2,34	2,02	1,63*	1,52*	1,36*	1,40*
N2		2,39	2,39	2,10	1,89	1,72*	1,47*	1,44*
N3		2,30	2,38	2,10	1,88	1,77*	1,57*	1,47*
N4		2,41	2,33	2,14	1,96	1,85	1,61*	1,58*
N5		2,40	2,31	2,12	1,96	1,87	1,61*	1,46*
Potassium								
KO		1,34	0,94*	0,99*	0,99*	1,08*	1,15	1,30
K1		1,53	1,15	1,29	1,25	1,32	1,34	1,40
K2		1,60	1,38	1,50	1,36	1,38	1,36	1,39

* = Below Threshold

5. COMMENTS

5.1 Heteronychus damaged cane was discarded from the yield analysis at harvest.

5.2 Nitrogen.

*In this crop the nitrogen responses were more realistic than in previous ratoons.

*The 4th, 5th and 6th ratoons all produced peak yields at the N4 rate indicating a high requirement for N by cane on these soils. Responses were linear up to the N4 level and highly significant (P=0.01) from the NO to the N1 and N2 rates.

*Cane quality was reduced with increasing N but the effect was non-significant.

* Responses for tons sucrose/ha were similar to cane yields, peaking at N4 level. Responses were greater at the lower rates of N being highly significant (P=0.01) between NO and N1, less significant (P=0.05) between N1 and N2 and non-significant at the higher levels. There is some evidence of N/K interactions as responses to higher rates of N are greater with increased levels of K.

*The strong N response is shown in the stalk heights.

* Monthly third leaf sampling produced low N % dm values for the NO treatment from 3,5 months of age while higher N plots became deficient from 5,8 months of age in November.

5.3 Potassium.

- *Soil sampling after each harvest has shown a steady increase in K reserves for the K1 and K2 plots. Levels of K in the KO treated plots has remained static for the duration of the trial (131 - 136 ppm).
- *There was a significant ($P=0.05$) response in tc/ha between the KO and K1 level of applied potassium where the soil reserves in the K plots averaged 186 ppm.
- *Significant K responses for tc/ha have been recorded at each harvest until soil K levels reached \pm 180 ppm, but diminished when values exceeded this figure.
- *Sucrose % cane increased significantly ($P=0.05$) from the KO to the K1 level.
- *Sucrose yields peaked at the K2 rate but differences were only significant ($P=0.05$) between KO and K1 levels.
- *Stalk height measurements confirm the response to applied K at the intermediate rate of application.
- *Third leaf sampling showed a strong K response that was above threshold (1,05 K % dm) for all treatments except for the KO treatment during early summer. Third leaf K values are generally greater than the accepted threshold levels and like soil K values, may have to be adjusted for Swaziland conditions.

5.4 Phosphorus

- *Soil P values are still high (40 ppm)
- *Third leaf P values decreased with age.

5.5 Sulphur

- *Soil S values are still above threshold at 17 ppm.
- *Third leaf S values decreased with age particularly in low N plots becoming marginal to low at \pm 5 months of age.

5.6 Polado

- *Polado appeared to depress sucrose % cane (n.s.). Cane yields were unaffected by the chemical but yields for sucrose were reduced (n.s.) due to the decrease in cane quality.

5.7 This trial has been terminated after three crops. A second trial covering a similar soil has been established at a different locality to continue the investigation.

NITROGEN RESPONSE CURVES

FIG. 1 - Cane yield (Tons cane/ha)

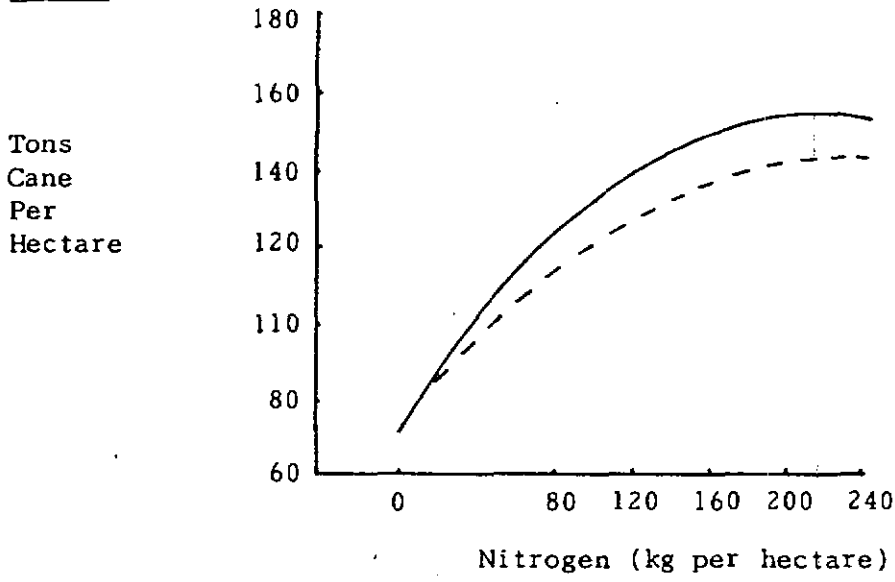
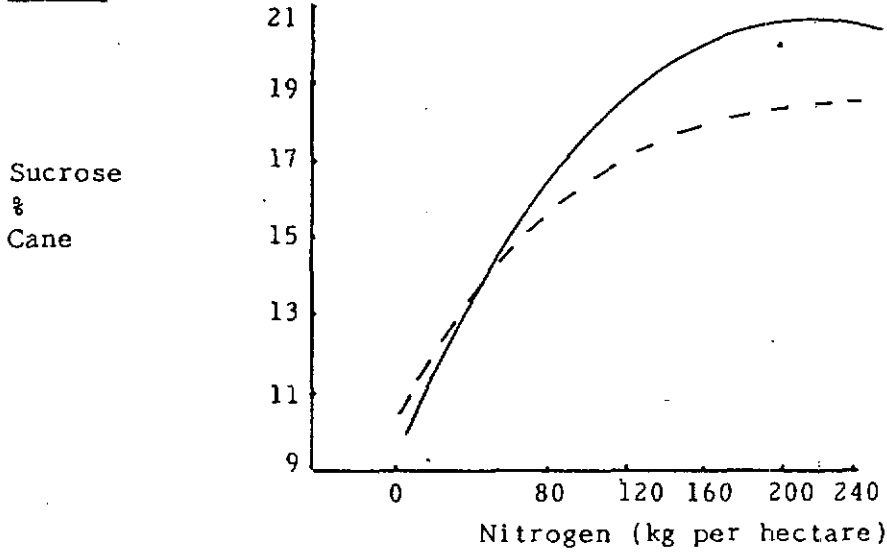


FIG. 2 - Sucrose % Cane



POTASSIUM RESPONSE CURVE

FIG. 3 - Sucrose yield (Tons sucrose/ha)

