SOUTH AFRICAN SUGAR INDUSTRY

AGRONOMISTS' ASSOCIATION

Code: FT14NK/80
Cat: 1264

Title: Rates of nitrogen and potassium for ratoon cane grown on Inanda series soil at Hillcrest.

1. Particulars of the project:

This crop	: 4th ratoon
Site	: Hillcrest
Region	: Midlands Mist Belt
Soil system	: Nottingham
Soil form/series	: Inanda
Design	: 5 x 2 with 2 reps.
Variety	: NCo 376
Fertilizer/ Ameliorants	: N P K 40 see treatments

Soil analysis: Date: 1/10/80

pH	O.M.%	Clay %	P.D.I.
5,3	5,8	39	0,18

ppm

P	K	Ca	Mg	Zn	Al
23	105	726	193	4,0	42

Age: 13,3 m Dates: 30/9/80-9/11/81

Rainfall: 1 251 mm L.T.M. 1 161 mm (Umbumbulu)

Irrigation: Nil

2. Objectives

1. To determine the optimum level of nitrogen for ratoon cane in an Inanda soil.
2. To test the current soil K threshold value.

3. Treatments:

kg/ha N	K
0	125
50	250
75	
100	
150	

Notes on treatments:

- Nitrogen as urea (46% N) and potassium as KCℓ (50% K) was applied in a single application on 1 December eight weeks after harvest.
- Phosphorus was applied at 40 kg/ha as superphosphate (11,3%) to all plots on 15 December at 10 weeks of age.

4. Results:

4.1 Yield:

Tons cane/ha

Treatments (kg/ha)	NO 0	N1 50	N2 75	N3 100	N4 150	Mean
K1 - 125	59	79	76	77	83	75
K2 - 250	67	76	88	81	82	79
	63	77	82	79	82	

C.V.% 12,5

L.S.D. (0,05) Treatment means 16,4
Nitrogen means 11,6
Potassium means 8,2

Sucrose % cane

K1 - 125	11,8	10,7	10,9	10,6	11,2	11,1
K2 - 250	11,0	11,3	11,2	11,2	10,6	11,0
	11,4	11,0	11,0	10,9	10,9	

C.V. % 5,2

L.S.D. (0,05) Treatment means 0,98
Nitrogen means 0,69
Potassium means 0,49

Tons sucrose/ha

K1 - 125	7,0	8,4	8,3	8,1	9,3	8,2
K2 - 250	7,4	8,5	9,9	9,0	8,7	8,7
	7,2	8,5	9,1	8,6	9,0	

C.V. % 14,5

L.S.D. (0,05) Treatment means 2,10
Nitrogen means 1,49
Potassium means 1,05

4.2 Treatment effects on harvested crop characteristics

~~Kg/ha 1000~~	Stalk population x 1000/ha	Stalk length (cm)	Stalk mass (kg)
N0 - 0	118	131	0,53
N1 - 50	128	142	0,61
N2 - 75	128	147	0,64
N3 -100	129	147	0,61
N4 -150	129	147	0,64
K1 -125	126	142	0,59
K2 -250	126	144	0,62

4.3 Third leaf analyses

N% d.m.

Age (m)	3,4-Jan	4,4-Feb	5,3-Mar	6,3-Apr
N0	2,49	2,06	1,76	1,60
N1	2,71	2,34	2,20	1,91
N2	2,84	2,42	2,27	1,90
N3	2,86	2,39	2,33	2,07
N4	2,78	2,37	2,41	2,18
		K% d.m.		
K1	1,28	1,39	1,02	1,07
K2	1,27	1,46	1,12	1,10

5. Comments on results:

5.1 The total rainfall on the crop was 107% of L.T.M. The mean yield was 5,8 tc/ha/m and 6,2 tc/ha/100 mm rainfall.

5.2 A serious incidence of mosaic occurred but disease ratings indicated no correlation with levels of N and K

5.3 Nitrogen: The response to N (in tons cane and sucrose) was substantial ($P = 0,05$) up to the level of 75 kg/ha. The two previous crops showed 50 kg/ha to be the optimum level which confirms that the humic soils mineralize substantial quantities of N; in this crop 57 tc/ha/annum was obtained with no applied nitrogen.

Cane quality was depressed with increasing levels of N. Third leaf analysis indicated a deficiency only in the zero N plots.

Harvested crop characteristics were affected only at the zero N level.

5.4 Potassium: There was only an indication of a very small (n.s.) response to the high rate of K. Third leaf K values in the K1 plots were however marginal, indicating that 125 kg/ha of K was slightly too low for this soil.

RKM/PMO
18.2.82

SOUTH AFRICAN SUGAR INDUSTRY

AGRONOMISTS' ASSOCIATION

Code: FT14NK/80/R5

Cat. No.: 1264

TITLE: Rates of nitrogen and potassium for ratoon cane grown on an Inanda Series soil at Hillcrest

1. Particulars of project

This crop	:	5th Ratoon
Site	:	Hillcrest
Region	:	Midlands mistbelt
Soil system	:	Nottingham
Soil form	:	Inanda
Design	:	5 x 2 with 2 reps
Variety	:	NCo 376
Fertilizer	:	N P K
		40
		(For N & K see treatments)

Soil analysis: Date: 17 November 1981

pH	OM%	Clay %	P.D.I.
5,2	5,5	44	0,17

ppm

P	K	Ca	Mg	Zn	Al
33	K1=121	675	180	> 4	39
	K2=158				

Age: 18,9 m Dates: 9.11.81-6.06.83

Rainfall: 1 369 mm LTM: 1 656 mm (Powerscourt)

Irrigation: Nil

2. Objectives

2. 1 To determine the optimum level of nitrogen for ratoon cane in an Inanda soil.

2. 2 To test two levels of potassium.

3. Treatments

kg ha $^{-1}$

	N		K
N0	Nil	1.	125
N1	50	2.	150
N2	75		
N3	100		
N4	150		

3. 1 Notes on treatments

- Nitrogen as Urea (46%) and Potassium as KCl (50%) was applied in a single dressing on 5 January 1982 eight weeks after harvest
- Phosphorus was applied at 40 kg ha^{-1} as single supers (10,5%) to all plots on 5 January 1982 eight weeks after harvest.

4. Results

4. 1 Yield

Table 1

Tons cane ha^{-1}

K \ Kg ha^{-1} N		N0 Nil	N1 50	N2 75	N3 100	N 4 150	Mean
K1	125	85,8	94,2	115,0	95,0	109,7	99,9
K2	150	103,6	106,1	119,9	104,7	108,6	108,6
	Mean	94,7	100,1	117,4	99,9	109,2	104,3

CV%	13,5
LSD Treatment means	32
Nitrogen means	22,6
Potassium means	14,3

Table 2 Sucrose % cane

K1	125	14,22	14,76	14,93	14,59	15,31	14,76
K2	150	14,98	14,72	14,81	15,33	14,79	14,93
	Mean	14,60	14,74	14,87	14,96	15,05	14,84

CV%	2,9
LSD Treatments means	0,97
Nitrogen means	0,69
Potassium means	0,43

Table 3 Tons sucrose ha^{-1}

K1	125	12,2	13,9	17,2	14,0	16,8	14,8
K2	150	15,5	15,6	17,8	16,0	16,1	16,2
	Mean	13,9	14,7	17,5	15,0	16,4	15,5

CV%	14,3
LSD Treatment means	5,01
Nitrogen means	3,54
Potassium means	2,24

4. 2 Crop characteristics at harvest

Table 4 Stalk counts $x10^3$ ha^{-1}

K1	125	117	135	140	124	154	134
K2	150	142	138	162	152	135	146
	Mean	129	137	151	138	144	140

CV%	10.3
LSD Treatments means	32
Nitrogen means	23
Potassium means	14

Table 5 Stalk length (cm)

Kg ha $^{-1}$ N / N		N0 Nil	N1 50	N2 75	N3 100	N4 150	Mean
K1	125	197	192	199	198	192	195
K2	150	187	203	198	192	207	197
	Mean	192	197	198	195	200	196

CV %		6,2
LSD	Treatment means	27,7
	Nitrogen means	19,5
	Potassium means	12,4

Table 6 Third leaf % dm

Kg ha $^{-1}$		3 months 8.02.1983	4 months 8.03.1983
		N % dm	
N0	Nil	2,26	1,73
N1	50	2,47	2,10
N2	75	2,54	2,15
N3	100	2,60	2,21
N4	150	2,53	2,28
		K % dm	
K1	125	1,69	1,18
K2	150	1,74	1,25

Table 7 Mosaic disease % infestation (assessment at 4,1 m on 12.03.82)

Kg ha $^{-1}$ N		% infestation
N0	Nil	27
N1	50	38
N2	75	34
N3	100	50
N4	150	50
kg ha $^{-1}$ K		
K1	125	34
K2	150	45

5. Comments on results

Rainfall was 83% of the longterm mean but good yields were obtained. The mean yield was 104 tons cane/ha. This is equivalent to 5,5 tons cane/ha/month and 7,6 tons cane/ha/100 m rainfall.

There was a level of mosaic in the trial. Disease ratings in the trial at 4,1 months (Table 7) seem to indicate a positive correlation between % infestation and levels of N and K. The higher the levels of these two nutrients, the higher is the infestation.

Nitrogen

There was a significant response to applied nitrogen both in terms of tons cane/ha ($p \geq 0,05$) and in terms of tons sucrose/ha ($p \geq 0,01$). The optimum N level was 75 kg/ha which is the same as recorded in the fourth ratoon crop. In the two previous ratoons, the optimum amount of N was 50 kg/ha.

The ratio of N (kg/ha) to the optimum cane yield (t/ha) for this crop is 0,6. This is slightly lower than the ratio of 0,8 currently used for recommending N for ratoon cane in these humic soils.

In this crop 94 tons of cane were obtained with no applied N. This, plus the similar results obtained in the previous ratoon crop, indicate that this humic soil must mineralize substantial amounts of N. Moreover, third leaf analyses indicate adequacy at all N levels at three and four months.

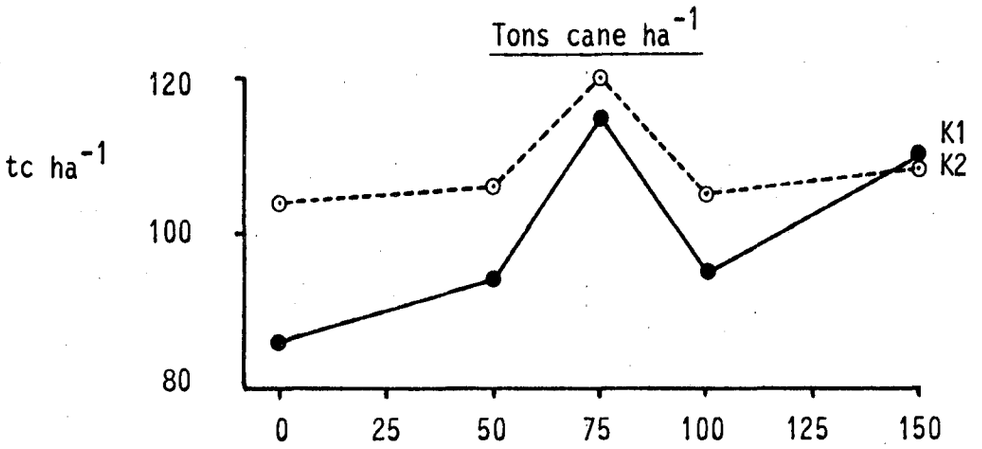
Cane quality was surprisingly not depressed by increasing N levels. The level of sucrose in the cane was high due probably to the drought. The increase in yield by applying N fertilizer was reflected in stalk counts rather than stalk length.

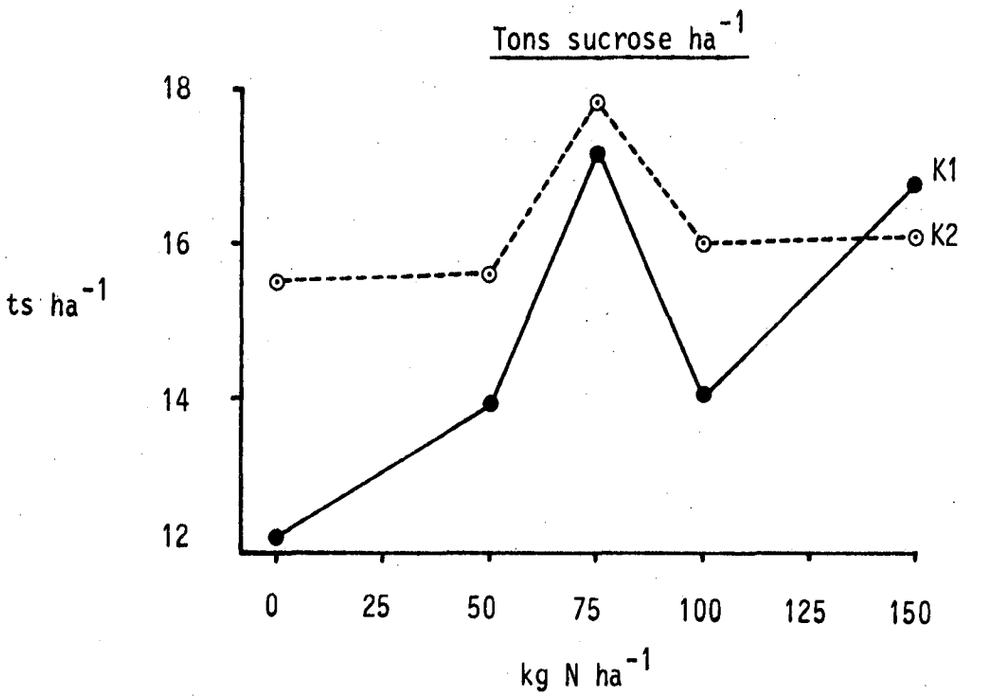
Potassium

There was only a small response (ns) to the high rate of K. Third leaf K values were adequate in all plots at three and four months which was rather young for sampling. In practice a level of about 150 kg/ha would have been recommended and would have been about optimum.

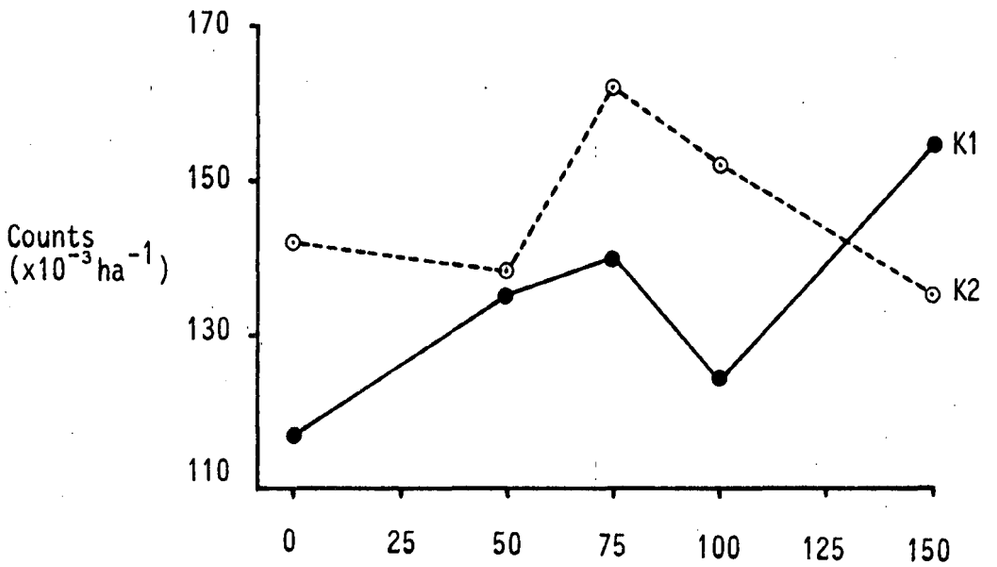
MFA1C/VSJ
2 August 1984

RESPONSE TO NITROGEN

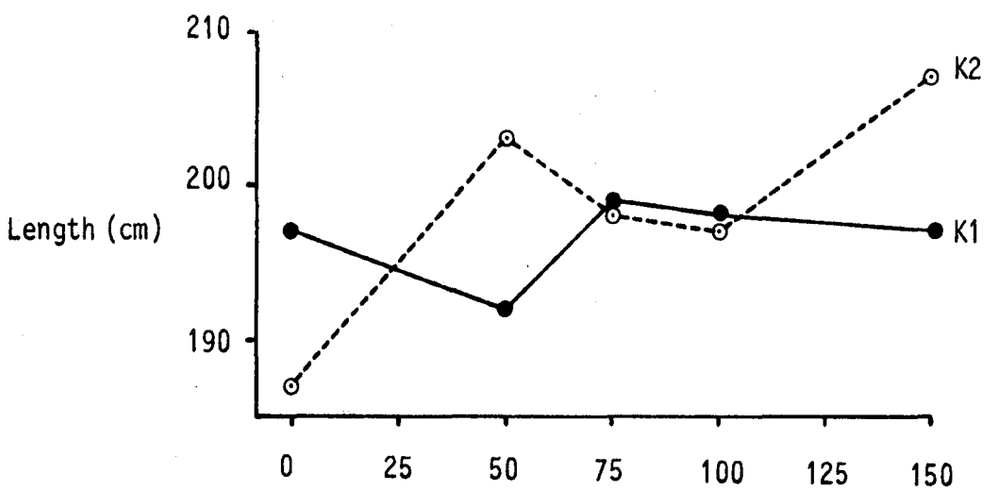




Stalk population ($x10^{-3}ha^{-1}$)



Stalk length (cm)



kg N ha⁻1

SOUTH AFRICAN SUGAR INDUSTRY

AGRONOMISTS' ASSOCIATION

Code: FT14NK/80/R6

Cat. No.: 1264

Title: Rates of nitrogen and potassium for ratoon cane grown on an Inanda series soil at Hillcrest

1. Particulars of project

This crop	:	6th Ratoon
Site	:	Hillcrest
Region	:	Midlands mistbelt
Soil system	:	Nottingham
Soil form/series	:	Inanda
Design	:	5 x 2 with two replications
Variety	:	NCo 376
Fertilizer (kg ha^{-1})	:	N P K [1]
		50

For N and K see treatments

Soil analysis: Date 6 June 1983

pH	O.M.%	Clay %	P.D.I
5,01	5,5	40	0,17

ppm

P	K1	K2	Ca	Mg	Zn	Al
24	104	105	693	179	>4,0	41

Age: 15,5 months Dates: 6.06.83-20.09.84

Rainfall: 1 559 mm LTM: 1 147 mm

(RC Palmer - Kloof) (Powerscourt)

Irrigation: Nil

Soil description: Dark humic topsoil overlying a red structureless subsoil

2. Objectives

- To determine the optimum level of nitrogen for ratoon cane on an Inanda soil
- To test two levels of potassium

3. Treatments (kg ha^{-1})

N			K		
N0	=	Nil	K1	=	125
N1	=	50	K2	=	250
N2	=	75			
N3	=	100			
N4	=	150			

3.1 Notes on treatments

Nitrogen as urea (46) and potassium as KCl (50) were applied in a single dressing on 21 October 1983 nineteen weeks after harvest.

Phosphorus was applied at 50 kg ha^{-1} as single supers (10,5) to all plots on 21 October 1983.

4. Results

Table 1 Tons cane ha^{-1}

K kg ha^{-1} \ Kg ha^{-1} N	N0 0	N1 50	N2 75	N3 100	N4 150	Mean
K1 125	75	85	91	89	94	87
K2 250	78	93	99	82	102	91
Mean	77	89	95	86	98	89

CV % 12,3
SE Treatment means ± 7,7
LSD at 0,05 Nitrogen means 17,4
LSD at 0,05 Potassium means 11,0

Table 2 Sucrose % cane

K1 125	12,2	12,1	12,0	12,6	12,4	12,2
K2 250	11,6	12,6	12,6	12,6	12,5	12,4
Mean	11,9	12,3	12,3	12,6	12,4	12,3

CV % 4,0
SE Treatment means ± 0,34
LSD at 0,05 Nitrogen means 0,78
LSD at 0,05 Potassium means 0,49

Table 3 Tons sucrose ha^{-1}

K1 125	9,2	10,3	10,9	11,2	11,7	10,6
K2 250	9,0	11,7	12,4	10,3	12,6	11,2
Mean	9,1	11,0	11,7	10,7	12,2	10,9

CV % 10,6
SE Treatment means ± 0,82
LSD at 0,05 Nitrogen means 1,85
LSD at 0,05 Potassium means 1,18

Table 4 Stalk counts x 10^{-3} ha^{-1} at harvest

K1 125	128	129	143	135	147	137
K2 250	125	139	149	137	141	138
Mean	127	134	146	136	144	137

CV % 7,5
SE Treatment means ± 7,24
LSD at 0,05 Nitrogen means 16,4
LSD at 0,05 Potassium means 10,4

Table 5 Stalk length (cm) at harvest

K kg ha^{-1} \ kg ha^{-1} N	N0 0	N1 50	N2 75	N3 100	N4 150	Mean
K1 125	168	165	170	178	181	172
K2 250	161	184	183	172	190	178
Mean	164	175	177	175	185	175

Table 6 Third leaf analysis (% dm)

	15.11.83 5,3 m	9.01.84 7,1 m	13.02.84 8,2 m	12.04.84 10,2 m
Nitrogen (kg ha^{-1})		N % dm		
N0 Nil	2,04	1,90	1,66	1,86
N1 50	2,01	2,43	1,94	1,79
N2 75	2,03	2,44	1,88	1,80
N3 100	2,06	2,41	2,03	1,84
N4 150	2,00	2,45	2,13	1,89
Potassium (kg ha^{-1})		K % dm		
K1 125	0,87	1,23	1,03	1,12
K2 250	0,94	1,32	1,13	1,19

Table 7 Mosaic infestation (%) - assessment at 3,8 months on 29.09.83

Nitrogen (kg ha^{-1})		% infestation
N0	Nil	34
N1	50	37
N2	75	66
N3	100	73
N4	150	68
Potassium (kg ha^{-1})		
K1	125	48
K2	250	63

Table 8 Changes in soil exchangeable K from R4 when K levels were introduced

Applied K kg ha^{-1} from 4 R	Pre-treatment end of 3R	End of 4R	End of 5R*	End of 6R
K1 = 125	105	121	104	105
K2 = 250*	105	158	105	145

* In R5 only the K2 level was reduced to 150 kg ha^{-1} applied K

Table 9 Summary of some data from the last five ratoon crops

Crop	Age at harvest (m)	Season	Rain % LTM	Mean yield tc/ha/m	Mean tc/ha/ 100 mm rain	Yield at zero N tc/ha/m	Response to opt. N level %
2R	18,5	Dec-Jun	90	7,6	9,4	6,8	22
3R	15,1	Jun-Sep	85	4,8	7,3	3,6	42
4R	13,3	Sep-Nov	108	5,8	6,2	4,7	26
5R	18,9	Nov-Jun	83	5,5	7,6	5,0	26
6R	15,5	Jun-Sep	136	5,7	5,7	5,0	34

In all crops an amount of 50 to 75 kg/ha N fertilizer was shown to be optimum - in the final ratoon crop however the highest yield of sucrose was obtained from 150 kg/ha nitrogen but the economic optimum level was still 75 kg/ha.

5. Comments on results of 6R

Rainfall: the total recorded was high and yields were good averaging 5,7 tc/ha/m and 5,7 tc/100 mm gross rainfall.

Mosaic: the incidence was high and appeared again to be positively related to the levels of N and K applied.

Nitrogen: the response to nitrogen (N2-N0) was statistically significant (P=0,05) but as in the previous crops it was not particularly high (± 34%) and tended to level out at 75 kg/ha although this is the first crop in the last five where tons sucrose was highest at the highest level of N. It is probable that the economic optimum level would be closer to 75 than 150 kg/ha as the ratio of marginal return:marginal costs is 1,6 when comparing these two levels.

Cane quality tended to improve with increasing levels of N which is unusual and affected presumably by the cane being harvested at the natural sucrose peak period and close attention to topping height.

Third leaf data corroborated yield response and showed a N deficiency only at the zero N level. Stalk population and length were likewise reduced only at the zero N level.

The data from the five consecutive crops do not show any strong evidence of a decline in yield in the zero N plots or a greater response to N with successive ratoons (see Table 9).

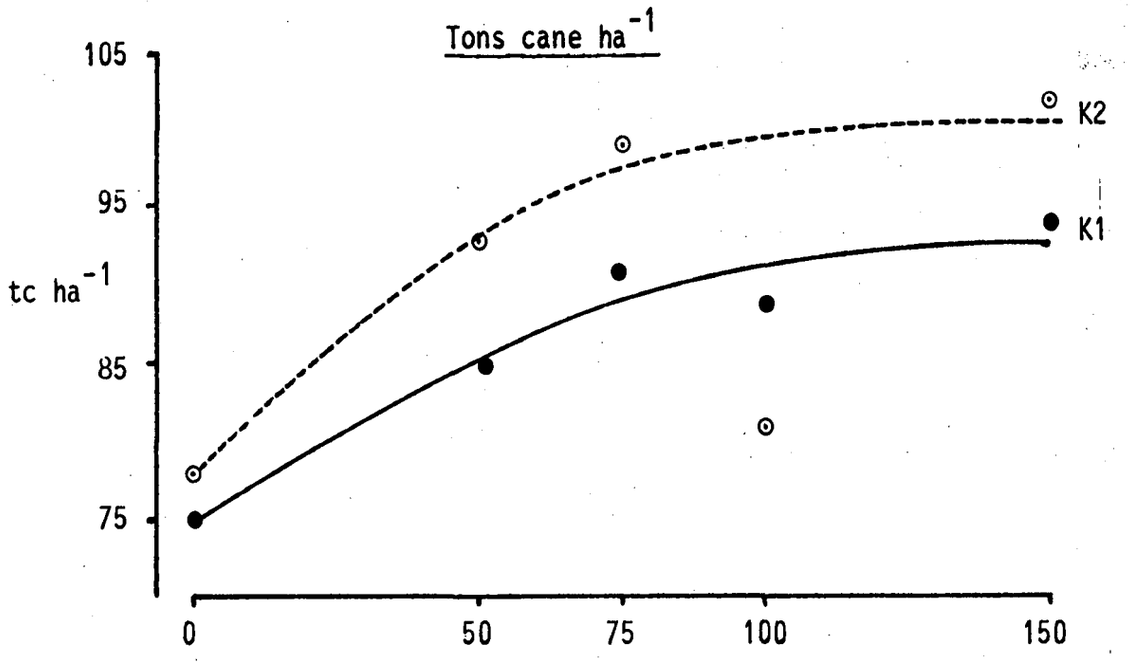
Potassium: the trend (ns) in favour of the higher level of K continued into this crop. The yield increase in both tons cane and sucrose was small but consistent over three crops. This is in good agreement with the current threshold levels which would categorise the soil (K1) as being K deficient and indicate the need for 150 to 175 kg/ha with 125 kg/ha being too low.

Third leaf K values were low at the five month sampling but increased with time to levels which generally were above the threshold value.

The exchangeable K level in the soil appears to have been maintained by the application of 125 kg/ha K. The effect of the higher K rate tended to increase soil exchangeable K but the degree of fluctuation was high.

Final crop: the trial has now been terminated as sufficient N data has now been accumulated and the effect on growth of increasing mosaic infection must be considerable and certainly it contributed towards the increasing yield variability.

PKM/VJ
22 October 1984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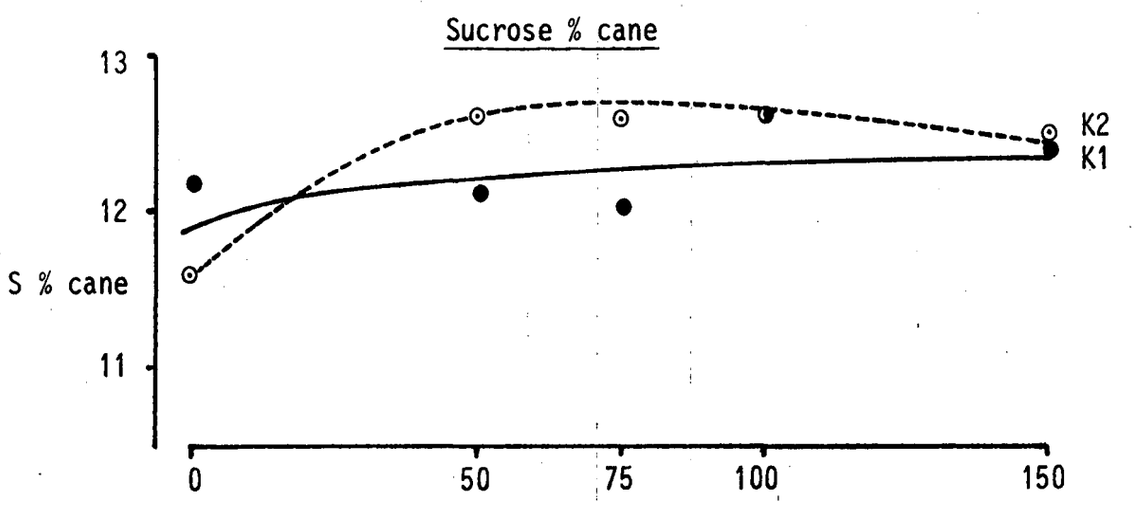
Sucrose % cane
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S % cane
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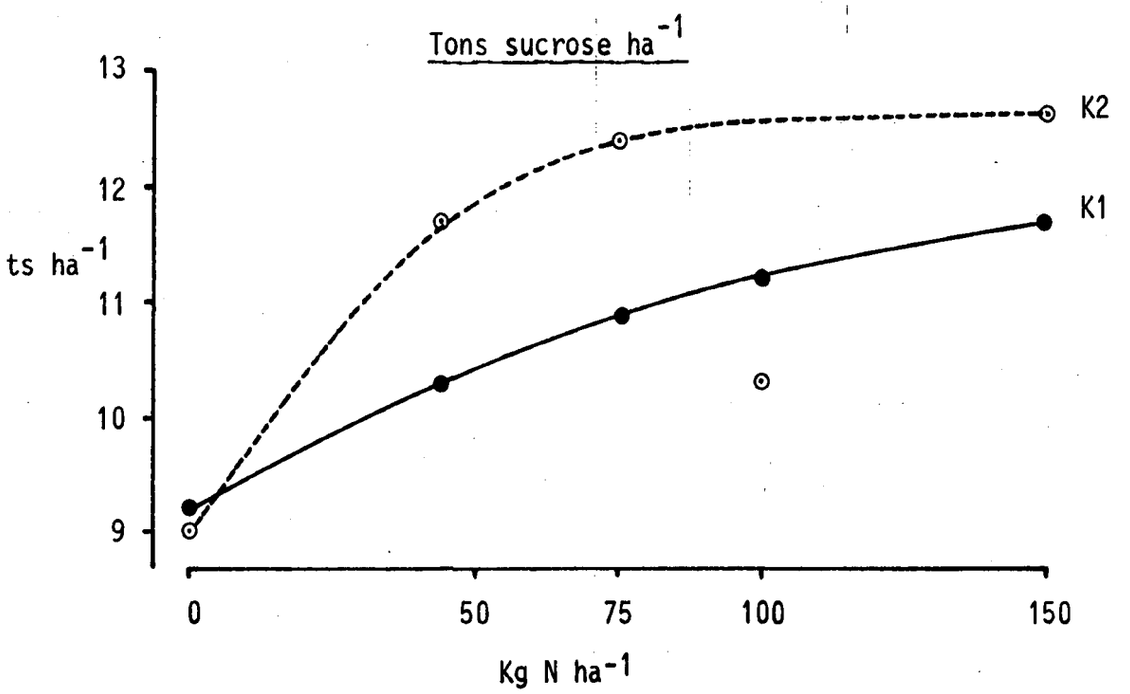
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