SOUTH AFRICAN SUGAR INDUSTRY
AGRONOMISTS' ASSOCIATION

EXPERIMENT RESULT

Code: NK17/87/SW MHL Dap
CAT.: NO. 1657

TITLE: RATES OF NITROGEN AND POTASSIUM FOR RATOON CANE ON A 'D' SET SOIL

1. PARTICULARS OF PROJECT

This crop	:	5th ratoon
Site	:	Mhlume Estate Field 347
Region	:	Northern Irrigated (Swaziland)
Soil Set/Series	:	'D'/Daputi
Design	:	6 * 3 factorial 2 replications
Variety	:	NCO3/6
Fertilizer	:	See treatments

Soil Analyses : Date 8/12/1987

pH	OM %	Clay %	P.U.I.
6.13	1.85	14	-

ppm

P	K	Ca	Mg	S	Zn
80	92	777	248	31	3.3

Age : 12.0 months
Dates : 16/11/87 - 14/11/88
Rainfall : 704 mm
Irrigation : Not Available
Total : -

2. OBJECTIVES

2.1 To determine the optimum levels of N and K for ratoon cane on a Daputi series soil (S.A. Avalon form)

2.2 To monitor monthly third leaf nutrient levels.

2.3 To test the availability of exchangeable potassium.

2.4 To determine more accurately the K threshold values for these soils.

3. TREATMENTS

N (kg/ha)	K (kg/ha)
N0 - Nil	K0 - Nil
N1 - 80	K1 - 100
N2 - 120	K2 - 150
N3 - 160	
N4 - 200	
N5 - 240	

Notes on treatments

* Nitrogen was applied as urea (46% N) in a single top dressing approximately 4 weeks after cutting.

* Phosphate as single supers (10.5% P) was applied 8 weeks after harvesting.

* Potassium as muriate of potash (60% K) was applied 8 weeks after cutting.

* All fertilizer was banded by hand over the cane row.

4. RESULTS

4.1 Growth Data

Table 1. Treatment effects on stalk heights (mm to TVD) and populations (*1000/ha)

Treatment	Stalk Height (mm to TVD)		Populations (* 1000/ha)	
	4 months	8 months	4 months	8 months
Nitrogen				
N0	1260	1810	220	140
N1	1400	1990	229	150
N2	1400	1990	240	146
N3	1410	2000	221	143
N4	1390	1990	220	154
N5	1410	2020	231	100
Potassium				
K0	1370	1920	226	158
K1	1360	1940	231	153
K2	1410	2040	224	152

4.2 Harvest Data

Table 2. Cane yield, sucrose % cane and sucrose yield.

Treatment	Tc/ha	Suc% cane	Ts/ha	
N0	80	13.4	10.7	
N1	84	14.4	12.2	
N2	90	14.0	12.6	
N3	88	13.4	11.7	
N4	92	13.8	12.7	
N5	94	13.9	13.1	
LSD N Means				
(0.05)*	9	0.7	1.6	
(0.01)**	13	1.0	2.2	
Significance	N.S.	**	N.S.	
K0	86	13.6	1.9	11.70
K1	88	13.6	1.9	11.97
K2	89	14.2	2.7	12.64
LSD K Means				
(0.05)*	6	0.5	1.1	
(0.01)**	9	0.7	1.6	
Significance	N.S.	*	N.S	
Trial Mean	88	13.8	2.1	
S.E.	7.5	0.6	1.3	
C.V.%	8.5	4.3	10.9	

* Tons cane/ha/month at the N2 level is 7.5

* At the N2 level the ratio of kg N per tone cane produced is 1.3.

4.3 Foliar Analyses

Table 3. Third leaf N and K (%dm) values

Treatment	3 months (Feb)	4 months (Mar)	6 months (Apr)
Nitrogen (%dm)			
N0	1.84	1.76	1.75
N1	2.02	1.91	1.89
N2	2.08	2.03	1.92
N3	2.15	2.02	1.97
N4	2.10	1.98	1.96
N5	2.13	2.05	2.00
Potassium (%dm)			
K0	0.99 *	1.10	1.16
K1	1.07	1.17	1.24
K2	1.11	1.20	1.28

* = Deficient

5. COMMENTS

5.1 Nitrogen

5.1.1 Cane yield responses to applied N were linear but increases were small and non - significant between nitrogen increments. The highest yield was achieved at the N5 level of nitrogen as was the case for other trials on deep alluvial soils (see reports for NK 6 and NK 10)

5.1.2 Cane quality did not appear to be effected by increasing rates of nitrogen.

5.1.3 Sucrose yield increases to applied nitrogen were effected in a similar fashion to cane yields. Although highest yields were reached at the N5 level of nitrogen, it is doubtful whether gains would be economical above about N2.

5.1.4 The trials on this group of deep soils have generally indicated linear yield responses to the rates of nitrogen applied. However, yield improvements were slight for the N increments and careful consideration would have to be given to the economics of applying high N rates to ratoons.

5.1.5 Growth measurements on average supported yield results.

5.1.6 At no stage did N(%dm) values fall below S.A.S.A. thresholds in the third leaf, but were slightly lower at and below the N1 rate of applied nitrogen.

5.2 Potassium

5.2.1 Applied potassium had a non -significant effect on cane yield.

5.2.2 Potassium increased sucrose% cane significantly from K1 to K2.

5.2.3 The K2 rate of potassium produced the highest sucrose yield but differences were not significant.

5.2.4 These results suggest that the threshold value for soils of this category need to be revised. This was the conclusion drawn from trials on similar deep soils (NK 6 and NK 10) where K responses materialised only at very low soil levels. It is felt that potassium reserves at depth are responsible for this (soil sampling of top 20 cm only)

5.2.5 Third leaf K (%dm) values were influenced by the rates of potassium applied. The low K (%dm) value for K0 in January had little effect on eventual yields.

5.3 Phosphorus

Soil P levels were high for this ratoon and third leaf P (%dm) values were well above the threshold for all samplings.

5.4 This trial has been re - established and is now in it's 6th ratoon.

29/3/89

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TITLE: RATES OF NITROGEN AND POTASSIUM FOR RATOON CANE ON A 'D' SET SOIL

1. PARTICULARS OF PROJECT

This crop	:	6th ratoon
Site	:	Mhlume Estate Field 347
Region	:	Northern Irrigated [Swaziland]
Soil Set/Series:		'D'/Daputi
Design	:	6 * 3 factorial 2 replications
Variety	:	NCO376
Fertilizer	:	See treatments

Soil Analyses: Date 12/12/1988

pH	OM %	Clay %	P.D.I.
6.41	1.85	14	-

ppm					Rep1	Rep2
P	Mg	S	Zn	K	67	90
80	318	30	2.7	Ca	802	1125

Age	:	12.0 months
Dates	:	14/11/88 - 13/11/89
Rainfall	:	658 mm
Irrigation:		1280 mm
Total	:	1938 mm

2. OBJECTIVES

2.1 To determine the optimum levels of N and K for ratoon cane on a Daputi series soil (S.A. Avalon form).

2.2 To monitor third leaf nutrient levels.

2.3 To test the availability of exchangeable potassium.

2.4 To determine more accurately the K threshold values for these soils.

3. TREATMENTS

N (kg/ha)	K (kg/ha)
N0 - Nil	K0 - Nil
N1 - 80	K1 - 100
N2 - 120	K2 - 150
N3 - 160	
N4 - 200	
N5 - 240	

Notes on Treatments

* Nitrogen was applied as urea (46% N) in a single top dressing in December four weeks after cutting.

* Phosphate as single supers (10.5% P) was applied in January nine weeks after harvesting.

* Potassium as muriate of potash (50% K) was applied in January eight weeks after cutting.

* All fertilizer was banded by hand over the cane row.

4. RESULTS

4.1 Growth Data

Table 1: Stalk Height and Population Counts at 11.7 Months of Age

Treatments	Stalk Height (cm to TVD)	Population (X 1000/Ha)
No 0 kg N/Ha	176	116
N_1 80 kg N/Ha	181	108
N_2 120 kg N/Ha	202	120
N_3 160 kg N/Ha	199	135
N_4 200 kg N/Ha	199	117
N_5 240 kg N/Ha	191	113
Ko 0 kg K/Ha	186	117
K_1 150 kg K/Ha	195	123
K_2 300 kg K/Ha	193	102

4.2 Harvest Data

Table 2: Cane Yield, Sucrose % Cane and Sucrose Yield

Treatments	T Cane/Ha	% Sucrose	T Suc/Ha
N_0 0 kg N/Ha	69	15.42	10.7
N_1 80 kg N/Ha	73	14.96	10.9
N_2 120 kg N/Ha	85	15.33	13.1
N_3 160 kg N/Ha	83	15.12	12.6
N_4 200 kg N/Ha	93	15.60	14.6
N_5 240 kg N/Ha	87	15.49	13.5
LSD (0.05)*	19	0.72	3.3
(0.01)**	26	0.99	4.5
Significance	NS	NS	NS
K_0 0 kg K/Ha	76	15.24	11.6
K_1 150 kg K/Ha	88	15.44	13.6
K_2 300 kg K/Ha	82	15.27	12.5
LSD (0.05)*	13	0.51	2.3
(0.01)**	18	0.70	3.2
Significance	NS	NS	NS
Interaction N x K	NS	NS	NS
Trial Mean	82	15.42	12.6
SE	15	0.59	2.7
CV %	19	3.90	21.4

Table 3: Mean Difference Between Treatments and Control

Treatments	T Cane/Ha	% Sucrose	T Suc/Ha
N_1 80 kg N/Ha	4	- 0.46	0.2
N_2 120 kg N/Ha	16	- 0.09	2.4
N_3 160 kg N/Ha	14	- 0.90	1.9
N_4 200 kg N/Ha	24*	0.18	3.9*
N_5 240 kg N/Ha	18	0.07	2.8
K_1 100 kg K/Ha	12	0.20	2.0
K_2 200 kg K/Ha	6	0.03	0.9

* Significant at P = 0.05

4.3 Foliar Analysis

Table 4: Third Leaf Nutrient Content in March at 3.7 Months of Age

TREATMENTS	N	P	K	S	Ca	Mg	Zn/ppm
N0 0 kg N/ha	1.51[b]	0.28	1.17	0.14	0.21	0.16	19.8
N1 80 kg N/ha	1.53[b]	0.29	1.16	0.14	0.22	0.17	19.7
N2 120 kg N/ha	1.67[b]	0.29	1.12	0.15	0.25	0.20	22.5
N3 160 kg N/ha	1.72	0.29	1.18	0.15	0.23	0.18	19.5
N4 200 kg N/ha	1.83	0.29	1.28	0.16	0.23	0.21	20.3
N5 240 kg N/ha	1.84	0.30	1.14	0.15	0.25	0.21	20.5
LSD (0.05)*	0.15	0.030	0.11	0.012	0.028	0.027	3.0
(0.01)**	0.20	0.041	0.145	0.016	0.038	0.037	4.1
Significance	**	NS	NS	NS	NS	**	NS
K0 0 kg K/ha	1.68	0.30	1.03[M]	0.16	0.25	0.22	20.3
K1 150 kg K/ha	1.76	0.29	1.26	0.15	0.23	0.19	20.5
K2 300 kg K/ha	1.62	0.27	1.25	0.15	0.21	0.17	20.3
LSD (0.05)*	0.10	0.021	0.075	0.0084	0.020	0.019	2.1
(0.01)**	0.14	0.029	0.10	0.0115	0.027	0.026	2.9
Significance	*	*	**	NS	**	**	NS
Trial mean	1.69	0.29	1.18	0.15	0.23	0.19	20.4
S.E.	0.12	0.025	0.087	0.0098	0.023	0.022	2.4
C.V. %	7.1	8.5	7.4	6.5	9.8	11.9	11.9

Fig 1: The Response Curve of Cane Yield to Soil-K Levels on Control Plots

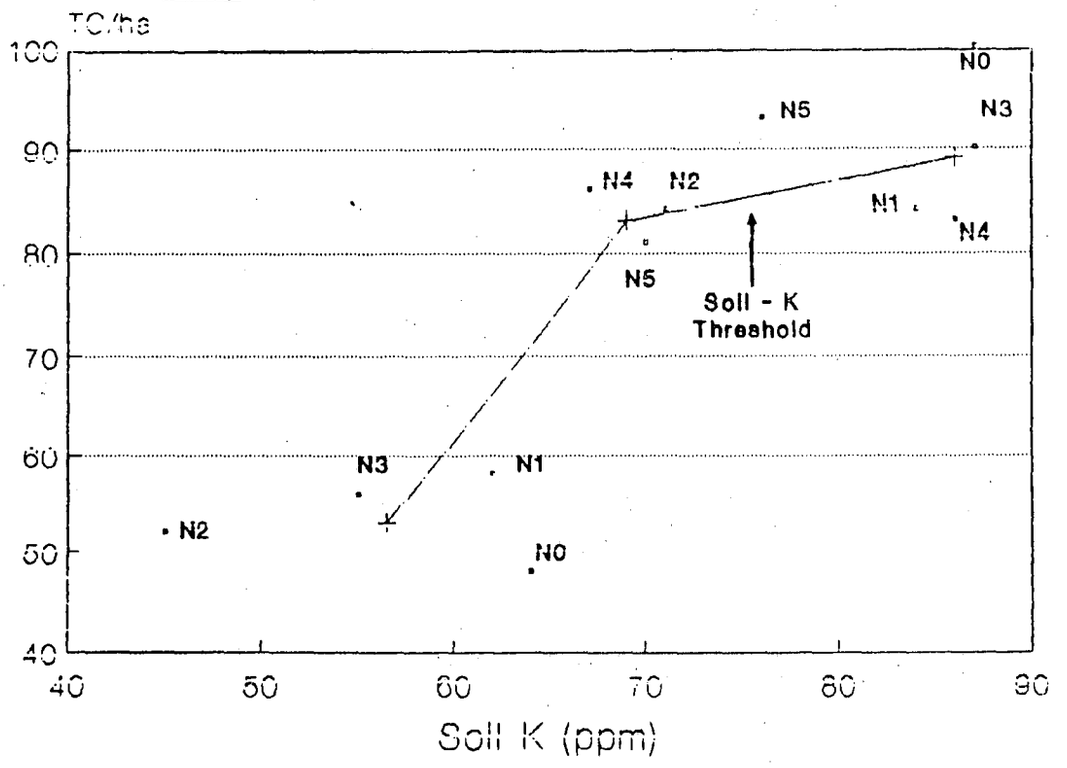


Fig 2: The Response Curve of Sucrose Yield to Soil-K Response in Control Plots

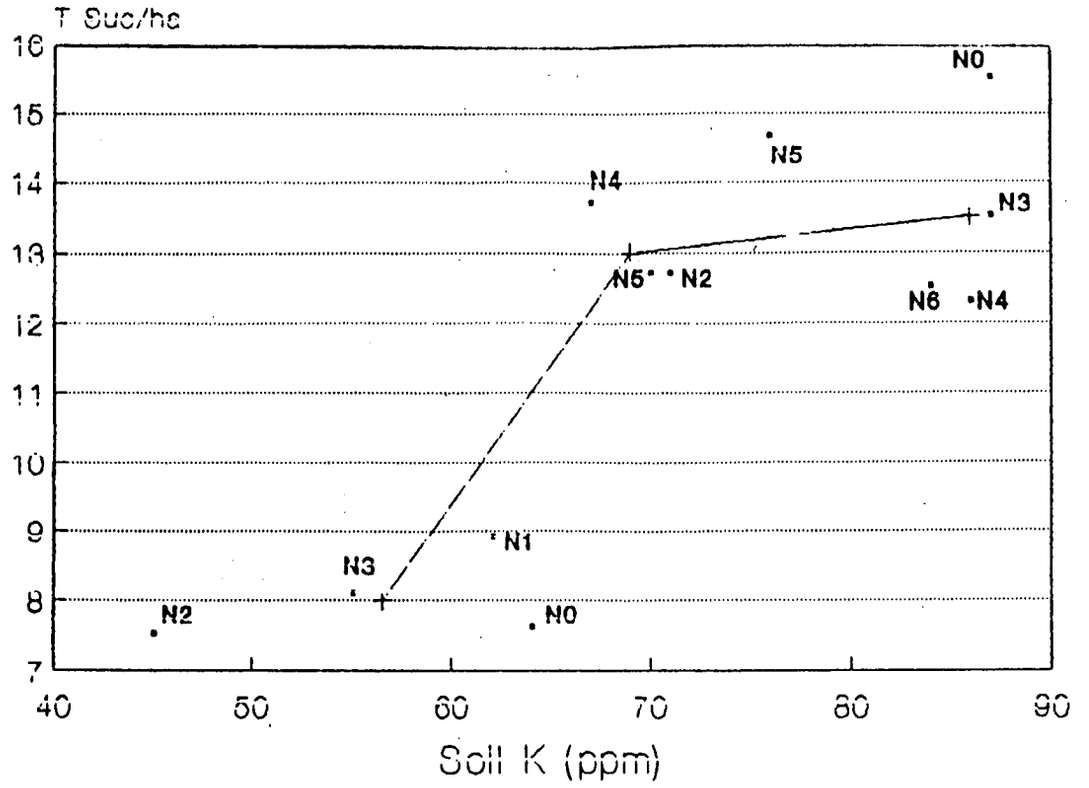
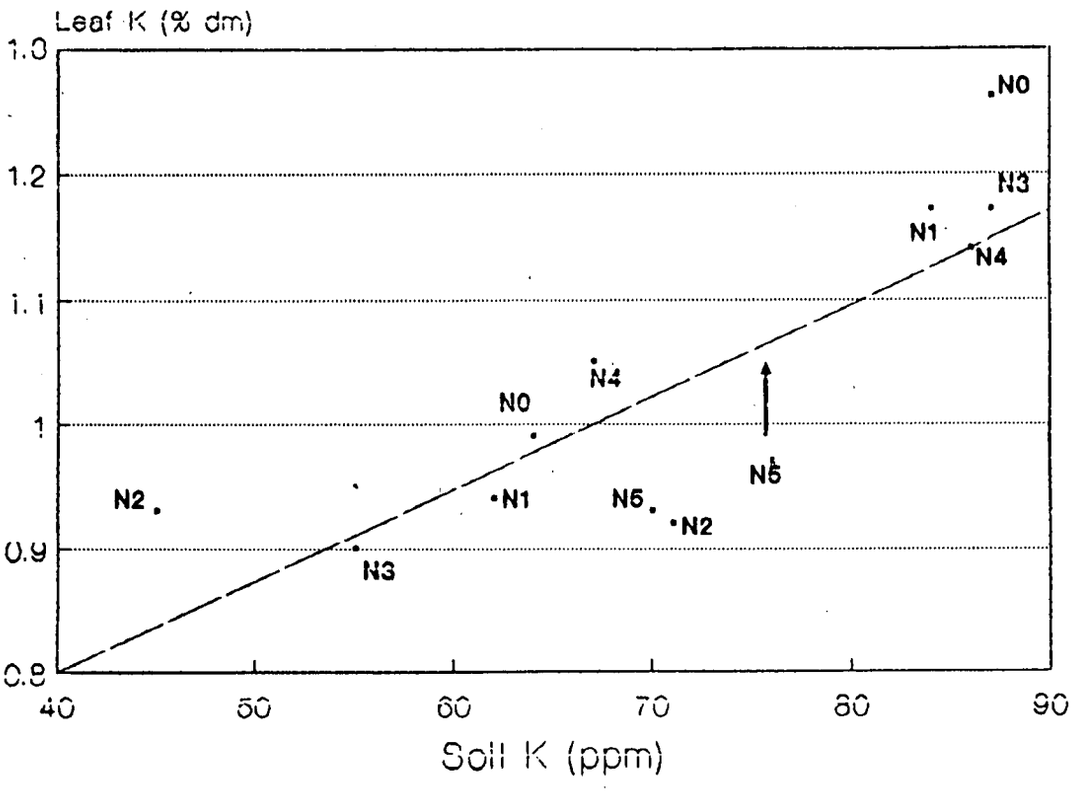


Fig 3: The Relationship Between Leaf-K and Soil-K of Control Plots



5.3 Potassium

5.3.1 Harvest data

* Cane yield

There was a trend for cane yield to respond to potash addition, although this was more evident at the rate of 100 kg K/ha than 200 kg K/ha. Despite a difference of 13 TC/ha, the response at 100 kg K/ha was not quite significant because of the variability experienced in this trial. Fig 1 suggests that the variance in the soil-K content of the K0 plots is responsible for the variability in the responses measured. It can be seen that wide yield differences exist within the K0 plots irrespective of the level of N and that yields increased as the soil-K level increased.

* Quality

Sucrose % were marginally increased by the K treatment but the responses were not significant.

* Sucrose yield

Yield of sucrose reflected the effect of K on cane yield but the responses were not significant as their measurements were subject to the same variability as that of cane yield. This is demonstrated in Fig 2. where the curve of the yield of sucrose response to the soil-K of the K0 plots was found to be very similar to that of the yield response.

5.3.2 Foliar analysis

The uptake of all nutrients except S and Zn was significantly affected by the K treatments (Table 3.). K content in leaves increased with increasing levels of K from a marginal level in the control to above threshold in K treatments. Leaf-K in the K0 plots was sensitive to the level of soil-K (Fig.3) and where it was below threshold, yields were poor. Ca and Mg content decreased with increasing levels of potash addition.

5.3.3 Soil-K threshold

A curve was fitted to the data of Fig 1. and used to extrapolate the soil-K level which coincides with 98 % of the yield maxima as estimated from the fitted curve (93 TC/Ha).

This procedure yielded for the soil-K threshold a value of 75 ppm. This is much lower than the current FAS'threshold and suggests the existence of K reserves in the subsoil.

6. CONCLUSION

* Results of this trial showed that cane grown on 'D' set soil could benefit from relatively high rates of N confirming current recommendations of 180 kg N/ha.

* It was further shown that below a soil-K level of approximately 75 ppm, yield responses to potash application could be expected and under this circumstances a rate of 100 kg K/ha was optimum.

* The current soil K threshold value on these soils is 112 ppm. These results, together with others on deep sandy soils (NK 6 and NK 10) confirm the need for a revised soil K threshold which takes account of K reserves at depth.

* This trial has been terminated on account of the poor yield and was unfortunately ploughed out before samples of the subsoil could be taken.

* Investigations on this soil type will continue at another site.

PCH/aw/ynm
4 June 1990

5. COMMENTS

5.1 General

Yields in this trial were relatively poor and the highest averaged 93 TC/ha. The CV for cane yield was 19% indicating considerable variability in the data. It was noticed that wide differences existed in the soil-K and Ca content between the two experimental blocks (see soil analysis - page 1). This could account for the high variability encountered in this trial.

The interaction term N*K was found to be non significant allowing for the effect of N and K to be examined separately

5.2 Nitrogen

5.2.1 Harvest data

* Cane yield

  There was a trend for the yield of cane to increase with increasing rates of N (Table 2). Despite the variability of the site a significant (P=0.05) response was measured at the rate of 200 kg N/ha (Table 3).

* Quality

  Effects on Sucrose % Cane were variable and non significant.

* Sucrose yield

  Yield of sucrose reflected the effect of N on cane yield and the response at 200 kg N/ha was also found to be significant.

5.2.3 Foliar analysis

Except for N and Mg the nutrient content in third leaf were not significantly affected by the N treatments. Leaf-N and Mg were increased by the addition of N and in the control and the N1-plots (80 kg N/ha) the N content of leaves were below threshold.