N1

SOUTH AFRICAN SUGAR INDUSTRY
AGRONOMISTS' ASSOCIATION

61

Code : NK11/84/Sw UBO Rath
Cat. No.: 1485

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

1. PARTICULARS OF PROJECT

This crop	:	6th ratoon	
Site	:	Ubombo Ranches Cascades No. 1	
Region	:	Northern Irrigated Swaziland	
Soil Set/Series	:	'R'/Rathbone	
Design	:	6 x 3 factorial 2 replications	
Variety	:	NCo 376	
Fertilizer	:	See Treatments	

Soil Analysis : Date 12/6/1984

pH	OM %	Clay %	PDI
5,7	-	> 30	-

ppm

P	K	Ca	Mg	S	Zn
17	271	1703	>220	15	27

Age	:	12,1 months
Dates	:	4/6/1984 - 7/6/1985
Rainfall	:	575 mm (net)
Irrigation	:	1006 mm (net)
Total	:	1581 mm

2. OBJECTIVES

2.1 To determine the optimum levels of N and K for ratoon cane grown on a Rathbone series soil and to compare these results with those from younger ratoons on similar but shallower soils (NK7 and NK5).

2.2 To test the availability of exchangeable potassium.

3. TREATMENTS

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

/2.....

Notes on Treatments

* Nitrogen applied as ammonium nitrate (34,5 % N) as a split dressing at 1,4 and 6,4 weeks after harvesting.

* Potassium applied as muriate of potash (50 % K) as a split dressing at 1,4 and 6,4 weeks after harvesting.

* 40 kg P/ha as single superphosphate (10,5 % P) was top-dressed at 6,4 weeks after harvesting.

* No ripener was applied as the cane had lodged following a storm in March 1985.

* Sucrose samples were taken at harvest and comprised 12 stalks taken at random from each plot.

4. RESULTS

4.1 Harvest Data

Table I Tons cane/ha

TREATMENT	N0	N1	N2	N3	N4	N5	MEAN
K0	90	105	146	124	156	163	131
K1	87	135	128	156	145	149	133
K2	87	129	131	166	158	149	137
MEAN	88	123**	135	148	153	154	134

CV % 13,2

LSD Treatment Means (0,05)* N : 22 K : 15

(0,01)** N : 30 K : 21

Table II Sucrose % Cane

TREATMENT	N0	N1	N2	N3	N4	N5	MEAN
K0	13,9	13,7	10,6	13,3	12,2	11,7	12,6
K1	13,3	13,6	12,8	11,8	12,6	12,7	12,8
K2	13,4	13,7	13,9	13,5	11,2	12,9	13,1
MEAN	13,5	13,7	12,2*	12,9	12,0	12,4	12,8

CV % 7,7

LSD Treatment Means (0,05)* N : 1,2 K : 0,8

(0,01)** N : 1,6 K : 1,2

/3.....

Table III Tons Sucrose/ha

TREATMENT	N0	N1	N2	N3	N4	N5	MEAN
K0	12,5	14,4	15,5	16,4	19,1	19,0	16,1
K1	11,5	18,4	16,4	18,4	18,1	19,0	17,0
K2	11,6	17,7	18,3	22,3	17,6	19,1	17,8
MEAN	11,9	16,8**	16,7	19,0	18,3	19,0	17,0

CV % 15,7

LSD Treatment means (0,05)* N : 3,2 K : 2,3

(0,01)** N : 4,4 K : 3,1

Tons cane/per/ha/month/ at the N1 level is 10,2

Tons cane/ha/month at the N3 level is 12,2

Tons cane/ha/100 mm water at the N1 level is 7,78

At the N1 level the ratio of kg N per ton cane produced is 0,65 and at the N3 level the ratio is 1,10.

4.2 Crop growth measurements and populations at 9 months of age

Table IV Treatment effects on stalk heights (mm to TVD) and populations (x 1000/ha)

TREATMENT	STALK HEIGHTS (mm)	POPULATIONS
Nitrogen		
N0	1820	107
N1	2080	145
N2	2210	156
N3	2380	156
N4	2420	162
N5	2470	173
Potassium		
K0	2180	151
K1	2250	147
K2	2270	151

/4.....

4.3 Third Leaf Analysis

Table V Third Leaf N + K (% dm) values

	AGE IN MONTHS			
TREATMENT	SEPT (3,0)	OCT (4,5)	NOV (6,0)	DEC (6,6)
Nitrogen (% dm)				
N0	2,18	1,51*	1,42*	1,40*
N1	2,43	1,73*	1,49*	1,60*
N2	2,45	1,94	1,55*	1,64
N3	2,45	1,98	1,65*	1,73*
N4	2,48	2,04	1,78*	1,75
N5	2,48	2,06	1,77*	1,82
Potassium (% dm)				
K0	1,79	1,07	1,08	1,01*
K1	1,81	1,03*	1,11	1,02*
K2	1,93	1,13	1,17	1,05*

* = Marginal to low

Table VI Third leaf S (% dm) values

	AGE IN MONTHS			
TREATMENT	SEPT (3,0)	OCT (4,5)	NOV (6,0)	DEC (6,6)
Nitrogen				
N0	0,19	0,14*	0,12*	0,13*
N1	0,21	0,14*	0,13*	0,12*
N2	0,20	0,15	0,13*	0,13*
N3	0,20	0,15	0,14*	0,13*
N4	0,20	0,14*	0,15	0,14*
N5	0,20	0,16	0,15	0,15

* = Marginal to low

/5.....

Table VII Third leaf P (% dm) values

TREATMENT	AGE IN MONTHS			
	SEPT (3,0)	OCT (4,5)	NOV (6,0)	DEC (6,6)
Nitrogen				
N0	0,30	0,18*	0,18*	0,16*
N1	0,31	0,21	0,19*	0,18*
N2	0,32	0,20	0,19*	0,18*
N3	0,32	0,20	0,19*	0,18*
N4	0,33	0,22	0,20	0,20
N5	0,32	0,21	0,18*	0,20

* = Marginal to low

5. COMMENTS

5.1 Although the cane at this site was lodged by high winds during March 1985, yields were high and typical on these deep red soils. CV % were in excess of the acceptable limits.

5.2 Nitrogen

* There was a large increase in cane yield from the N0 to the N1 level of nitrogen (P = 0,01). The highest yields were achieved at the N5 rate but increases beyond N1 were non-significant although appear to be real. Visual nitrogen deficiency symptoms were evident during the young growth stage for treatments below and including N2. The present SASA N recommendations for crops of greater than 4th ratoon on these soils is 140 kg N/ha, a rate which produced acceptable yields at this site.

* Cane quality seems to have been suppressed by increasing nitrogen rates but results were erratic and possibly influenced by lodging.

* Sucrose yield results were highly significant (p = 0,01) from N0 to N1 with non-significant differences thereafter. As for tons cane, 140 kg N/ha appears to be sufficient on these soils.

* The assumption that N requirements increase with ratoon age seems correct when the above results are compared to that of younger ratoons on a similar soil at site (NK7). Optimum yields from the NK7 trial were obtained at ± 80 kg N/ha in early ratoons.

/6.....

* Stalk height measurements and populations showed poor growth in the N0 treatments with the best growth being in the higher N plots.

* Third leaf N (% dm) values were all above threshold at 3 months of age in September. Thereafter increasingly higher rates of nitrogen treatments become deficient until all levels were below threshold at 6 months of age in November.

5.2 Potassium

* Soil K levels were adequate for this soil and applied potassium had no significant effect on cane yields.

* Potassium had no effect on cane quality.

* Increasing rates of potash porduced slightly better cane growth but populations were uneffected.

* Third leaf K (% dm) values followed the normal pattern, being lower in Spring and rising in Summer. Some abnormally low third leaf K (% dm) values were recorded in December at 6,6 months of age and were probably associated with sudden changes in climatical conditions.

5.3 Phosphorus

* Soil P values were above threshold before the additional 40 kg P/ha was top-dressed.

* Third leaf P (% dm) values were exceptionally high at 3 months of age in November but declined rapidly with age becoming marginal to low from October onwards being in accordance with nitrogen levels. These soils can be P fixing (low PDI values) which may account for the low third leaf P values.

5.4 Sulphur

* The SASA are considering raising soil S threshold to 20 ppm. At this new level the S soil levels were low.

* Approximately 38 kg S/ha was topdressed as single superphosphate (10 % S) but third leaf S (% dm) values were low in most treatments from October onwards. As with phosphate, S was particularly low for low N treatments.

5.5 Zinc

* Soil Zn levels were high.

* Third leaf Zn (% dm) values were well above threshold at 3,0 months of age (31 ppm) but dropped off steadily to become deficient in the low N plots from 6 months of age in November.

/7.....

5.6 Ripener

Ripener was not applied due to lodging.

5.7 This trial has been re-established.

NBL/gj

27.12.1985

60

SOUTH AFRICAN SUGAR INDUSTRY

AGRONOMISTS' ASSOCIATION

Cat.No.: ~~1584~~ 1485
Code: NK11/84/R Sw UBO Rath

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

1. PARTICULARS OF PROJECT

This crop	:	7th Ratoon
Site	:	Ubombo Ranches Cascades No. 1
Region	:	Northern Irrigated (Swaziland)
Soil Set/Series	:	'R'/Rathbone
Design	:	6 x 3 factorial 2 Replications
Variety	:	NCo 376
Fertilizers	:	See Treatments

Soil Analysis : Date 28/6/85

pH	OM %	Clay %	PDI
	2,61	> 30	0,35

ppm

P	K	Cu	Mg	S	Zn	
24	221	–	200	30	–	K0-205 K1-215 K2-243

Age	:	12,3 months
Dates	:	7/6/85 - 16/6/86
Rainfall	:	418 mm
Irrigation	:	1481 mm
Total	:	1899 mm

2. OBJECTIVES

- To determine the optimum levels of N and K for ratoon cane grown on a deep R set soil and to compare responses to those from younger ratoons on shallower R set soils.
- To test the availability of exchangeable potassium.

3. TREATMENTS

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

/2.....

Notes on Treatments

* Nitrogen as ammonium sulphate (21 % N and 24 % S) was applied over the cane row as a split dressing, 3 and 9,5 weeks after harvesting.

* Potassium as muriate of potash (50 % K) was applied over the cane row as a single application 13 weeks after cutting in September when the crop appears to be deficient in K.

* 40 kg/ha P as single superphosphate (10,5 % P) was top-dressed over the cane row 4,5 weeks after cutting.

* A ripener was not sprayed on this trial.

* Sucrose samples were taken at harvest and consisted of 12 stalks taken at random from each nett plot.

4. RESULTS

4.1 Harvest Data

Table I Cane yield, sucrose % cane and sucrose yield

TREATMENT	TC/HA	SUC % CANE	TS/HA
NITROGEN			
N0	79	15,1	11,9
N1	116	15,2	17,5
N2	122	15,4	18,7
N3	146	14,8	21,6
N4	151	14,5	21,8
N5	158	13,9	22,0
LSD N MEANS			
(0,05)*	17	0,7	2,6
(0,01)**	24	1,0	3,5
SIGNIFICANCE	**	N.S	**
POTASSIUM			
K0	131	14,6	19,0
K1	125	14,9	18,5
K2	129	14,9	19,2
LSD K MEANS			
(0,05)*	12	0,5	1,8
(0,01)**	17	0,7	2,5
SIGNIFICANCE	N.S	N.S	N.S
TRIAL MEAN	128	14,8	18,9
S.E. SINGLE PLOT	14,22	0,59	2,10
CV %	11,2	4,0	11,1

/3.....

Tons cane/ha/m at the N3 level is 11,9.

Tons cane/ha/100 mm water at the N3 level is 7,69

At the N3 level the ratio of kg N per ton cane produced is 1,10

4.2 Crop growth measurements and populations at 6,75 months of age.

Table II Treatment effects on stalk heights (mm to TVD) and populations (x 1000/ha)

TREATMENT	STALK HEIGHTS (MM)	POPULATIONS
NITROGEN		
N0	1290	119
N1	1670	160
N2	1650	164
N3	1860	179
N4	1940	167
N5	2020	189
POTASSIUM		
K0	1730	159
K1	1670	160
K2	1800	170

4.3 Third leaf analysis

Table III Third leaf N and K (% dm) values

	AGE IN MONTHS		
TREATMENT	3,5M (SEPT)	4,5M (OCT)	6,0M (DEC)
NITROGEN (% dm)			
N0	1,82*	1,41**	1,28**
N1	2,36	1,49**	1,31**
N2	2,48	1,49**	1,34**
N3	2,44	1,66**	1,49**
N4	2,59	1,69**	1,52**
N5	2,61	1,83*	1,71**
POTASSIUM (% dm)			
K0	1,08	0,86**	0,99**
K1	1,16	0,86**	1,00**
K2	1,19	0,96**	1,03*

* = Marginal

** = Low

/4.....

4.4 Table IV Third leaf S (% dm) values

TREATMENT	AGE IN MONTHS		
	3,5M (SEPT)	4,5M (OCT)	6,0M (DEC)
NITROGEN			
N0	-	0,13*	0,12**
N1	0,21	0,14*	0,13*
N2	0,26	0,13*	0,12**
N3	0,28	0,14**	0,13*
N4	0,28	0,14*	0,14*
N5	0,25	0,16	0,15

* = Marginal

** = Low

4.5 Table V Third leaf P (% dm) values

TREATMENT	AGE IN MONTHS		
	3,5M (SEPT)	4,5M (OCT)	6,0M (DEC)
NITROGEN			
N0	0,25	0,22	0,17**
N1	0,28	0,20	0,17**
N2	0,28	0,19*	0,17**
N3	0,28	0,20	0,18**
N4	0,28	0,20	0,18**
N5	0,27	0,20	0,19*

* = Marginal

** = Low

5. COMMENTS

5.1 Cane yields from this site were generally good but not as high as that from the previous ratoon. CV % were high.

5.2 Nitrogen

* The overall cane yield response to nitrogen was curvilinear but the greatest increase was from N0 to N1 and from N2 to N3. Both increments were significant at the 1% level of significance while increases beyond N3 were non-significant.

/5.....

- Cane quality appears to have been suppressed by increasing nitrogen rates from the N2 level upwards (N.S.)

- Tons sucrose/ha yields increased with rates of N up to N5. Differences between N0 and N1 were significant at the 1% level while that between N2 and N3 reached significance at the 5% level. Increases thereafter were smaller but appear real.

- The current N recommendations for older ratoons on these soils is 140 kg N/ha, which would have been inadequate in this case as 160 kg N/ha and above produced better yield responses. 140 kg N/ha was sufficient in the last crop so additional N may be necessary on older ratoons.

- Soil temperatures may also influence the efficiency of applied N as similar late season trials or equivalent soils show lower optimum N requirements. This trial has now been converted onto a late cycle to determine the climatical effects if any on nitrogen ultilization.

- Cane growth measurements and to a lesser extent populations, reflected the strong response to applied nitrogen.

- Third leaf N (% dm) values were above threshold from N1 upwards at 3,5 months of age in September but subsequent sampling at 4,5 and 6,0 months showed all treatments to be deficient or marginal as in the case of N5.

5.3 Potassium

- Soil K levels were above the threshold of 150 ppm before top-dressing.

- Applied potassium had no significant effect on tons cane/ha, sucrose % cane or tons sucrose/ha yields.

- There was no evidence of the effects of applied K on cane growth or populations.

- Potassium influenced third leaf K (% dm) values which were above threshold in September, below in October and just deficient in December. The lack of response to fertilizer potassium and the erratic nature of the third leaf K (% dm) values emphasises the need for correction factors to be introduced.

5.4 Phosphorus

- Soil P values varied from 12 to 55 ppm between plots with the average being 24 ppm (threshold 11 ppm).

- Third leaf P (% dm) values were all well above the threshold (0,19 % dm) at 3,5 months of age in September but fell off severely to become deficient in all treatments at 6 months of age in December. This situation may have been brought about by the low PDI values (0,35) on this site which suggests a degree of P fixation.

/6.....

5.5 Sulphur

- Soil S values were well above threshold at 30 ppm before additional S in the form of ammonium sulphate (24 % S) and single super phosphate (10 % S) were applied.

- Third leaf S (% dm) values were high in September at 3,5 months of age but fell off in all N treatments for later samplings. These soils may be prone to poor S mineralization and/or leaching of S beyond the root zone.

5.6 This trial has been re-established but has been brought back onto a late cycle to determine the climatical influence if any, on applied N responses.

NBL/gj

24.04.1987

SOUTH AFRICAN SUGAR INDUSTRY
AGRONOMISTS' ASSOCIATION

EXPERIMENT RESULT

CODE: NK 11/84/Sw UBO Rat
CAT: 1485

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

1. PARTICULARS OF PROJECT

This crop	:	8th ratoon
Site	:	Ubombo Ranches Field - Cascades 1
Region	:	Northern Irrigated (Swaziland)
Soil Set/ Series	:	'R'/Rathbone
Design	:	6 x 3 factorial 2 replications
Variety	:	NCo 376
Fertilizer	:	See treatments

Soil Analysis : Date 5/11/1986

pH	OM %	Clay %	PDI
6,51	2,6	>30	0,35

ppm

P	K	Ca	Mg	S	Zn
29	264	1718	769	25	-

K0 234
K1 257
K2 301

Age	:	12,0 months
Date	:	30/10/1986 - 28/10/1987
Rainfall	:	410 mm
Irrigation	:	983 mm
Total	:	1393 mm

2. OBJECTIVES

* To determine the optimum levels of N and K for ratoon cane grown on a deep 'R' set soil.
* To compare N and K responses for early and late season cane grown on the same site to determine seasonal influence.
* 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	=	150
K2	=	300

Notes on Treatments

* Nitrogen as urea (46% N) was applied as a single dressing ± 1 week after cutting back the young ratoon (to convert to a later cycle).

* Potassium as KCL (50% K) was applied as a single dressing ± 5 weeks after cutting.

4. RESULTS

4.1 Growth data.

Table I. Crop growth measurements and populations at 3,0 and 4,5 months of age.

TREATMENT	STALK HEIGHTS (MM TO TVD)	POPULATIONS (x1000/ha)	
	4,5 MONTHS	3,0 MONTHS	4,5 MONTHS
Nitrogen			
N0	154	190	144
N1	170	194	176
N2	195	196	180
N3	202	227	197
N4	207	216	182
N5	214	228	201
Potassium			
K0	183	207	182
K1	186	216	180
K2	187	203	179

4.2 Harvest Data

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

TREATMENT	T.C/HA	SUC % CANE	T.S./HA
Nitrogen			
N0 Nil	65	15,4	10,1
N1 80	114	16,1	18,4
N2 120	131	15,6	20,4
N3 160	144	15,6	22,5
N4 200	135	15,4	20,9
N5 240	145	15,4	22,2
LSD N MEANS			
(0,05)*	8	0,6	2,0
(0,01)**	11	0,8	2,8
Significance	**	N.S	**/*
Potassium			
K0	121	15,4	18,7
K1	124	15,8	19,6
K2	122	15,6	19,0
LSD K MEANS			
(0,05)*	11	0,4	1,4
(0,01)**	16	0,6	2,0
Significance	N.S	*	N.S
Trial Mean	122	15,6	19,1
S.E. Single Plot	9,7	0,5	1,7
CV %	7,9	3,2	8,7

4.3 Third leaf analysis.

Table III. Third leaf N & K (%dm) values at 1,5 ; 2,5 ; 3,4 and 4,3 months of age.

TREATMENT	1,5m DEC	2,5m JAN	3,4m FEB	4,3m MAR
Nitrogen (%dm)				
N0	1,57**	1,25**	1,40**	1,43**
N1	2,10	1,45**	1,53**	1,44**
N2	2,30	1,61*	1,67*	1,58*
N3	2,39	1,79	1,79	1,66
N4	2,45	1,84	1,86	1,76
N5	2,40	1,90	1,94	1,79
Potassium (%dm)				
K0	2,18	1,62	1,69	1,62
K1	2,20	1,66	1,69	1,59
K2	2,23	1,65	1,71	1,62

* = Marginal
** = Low

Table IV. Third leaf P and S (%dm) values at 1,5 ; 2,5 ; 3,4 and 4,3 months of age.

TREATMENT	AGE IN MONTHS							
	1,5m DEC		2,5m JAN		3,4m FEB		4,3m MAR	
Nitrogen	P(%dm)	S(%dm)	P(%dm)	S(%dm)	P(%dm)	S(%dm)	P(%dm)	S(%dm)
N0	0,24	0,14	0,18*	0,10**	0,20	0,12*	0,19*	0,12*
N1	0,26	0,15	0,19*	0,10**	0,21	0,12*	0,19*	0,11**
N2	0,26	0,14	0,21	0,11**	0,23	0,12*	0,20	0,11**
N3	0,25	0,15	0,22	0,13	0,24	0,13	0,21	0,13
N4	0,25	0,15	0,23	0,13	0,25	0,13	0,22	0,13
N5	0,24	0,16	0,22	0,13	0,25	0,14	0,23	0,13

* = Marginal
** = Low

4.4 Smut

Table V. Percent smut whips at ± 3 months of age in January.

TREATMENT	PERCENTAGE SMUT WHIPS
Nitrogen	
N0	1,10
N1	1,39
N2	1,80
N3	1,45
N4	1,54
N5	2,12
Potassium	
K0	1,93
K1	1,39
K2	1,45

5. COMMENTS

5.1 The cane at this site was cut back in October 1986 to convert it onto a later cycle, the objective being to assess seasonal influence on N and K requirements.

5.2 Nitrogen.

* Crop measurements taken at 4,5 months of age showed better growth from the high N treatments.

* Cane yields increased significantly up to the N3 level while additional nitrogen had no further influence. Similar responses were found in the previous ratoon crop on an earlier winter cycle which suggests that season has little influence on optimum N levels. There were however stronger (N.S.) responses to the N4 and N5 rates for winter cut cane (See Fig.I) which may have been induced by slower N mineralization during the cooler months.

* Nitrogen had little influence on cane quality except between N0 and N1.

* Sucrose yields increased significantly up to N3 which was a repeat of the previous crops responses.

* The 7th and 8th ratoons on early and late cycles respectively have shown that 160 kg N/ha is optimum for older NCo 376 ratoons on these soils. This represents a 20 kg N/ha increase on the SSA recommended level.

* Third leaf N(%dm) values were strongly influenced by applied N but only remained above threshold for levels greater than N2.

* The incidence of smut increased slightly with higher N levels.

5.3 Potassium

* Potassium had no influence on crop growth.

* Soil K values have declined only slightly for the K0 treatments from the 6th to the 8th ratoon which implies considerable K mineralization by the soil.

* Additional K had no effect on cane yields as was the case for the previous two early season crops.

* Cane quality responses were significant between K0 and K1 but are not conclusive.

* Sucrose yields did not benefit significantly from applied K.

* Third leaf K(%dm) values were well above the threshold for all 4 samplings.

* Yield responses to applied K are not expected until soil K reserves are depleted to below threshold levels for this soil (ie ± 150 ppm).

5.4 Phosphorus

* Fertilizer P was not applied to this crop as soil levels were above the threshold for ratoon cane (ie 11 ppm).

* Third leaf P(%dm) values were strongly influenced by rates of N from ± 2,5,months of age (See Table IV) and became marginal to deficient in the low N treatments. This suggests that yields of the lower N treatments could have been further effected by insufficient phosporus.

* PDI values for this soil indicate moderate P fixing properties.

5.5 Sulphur

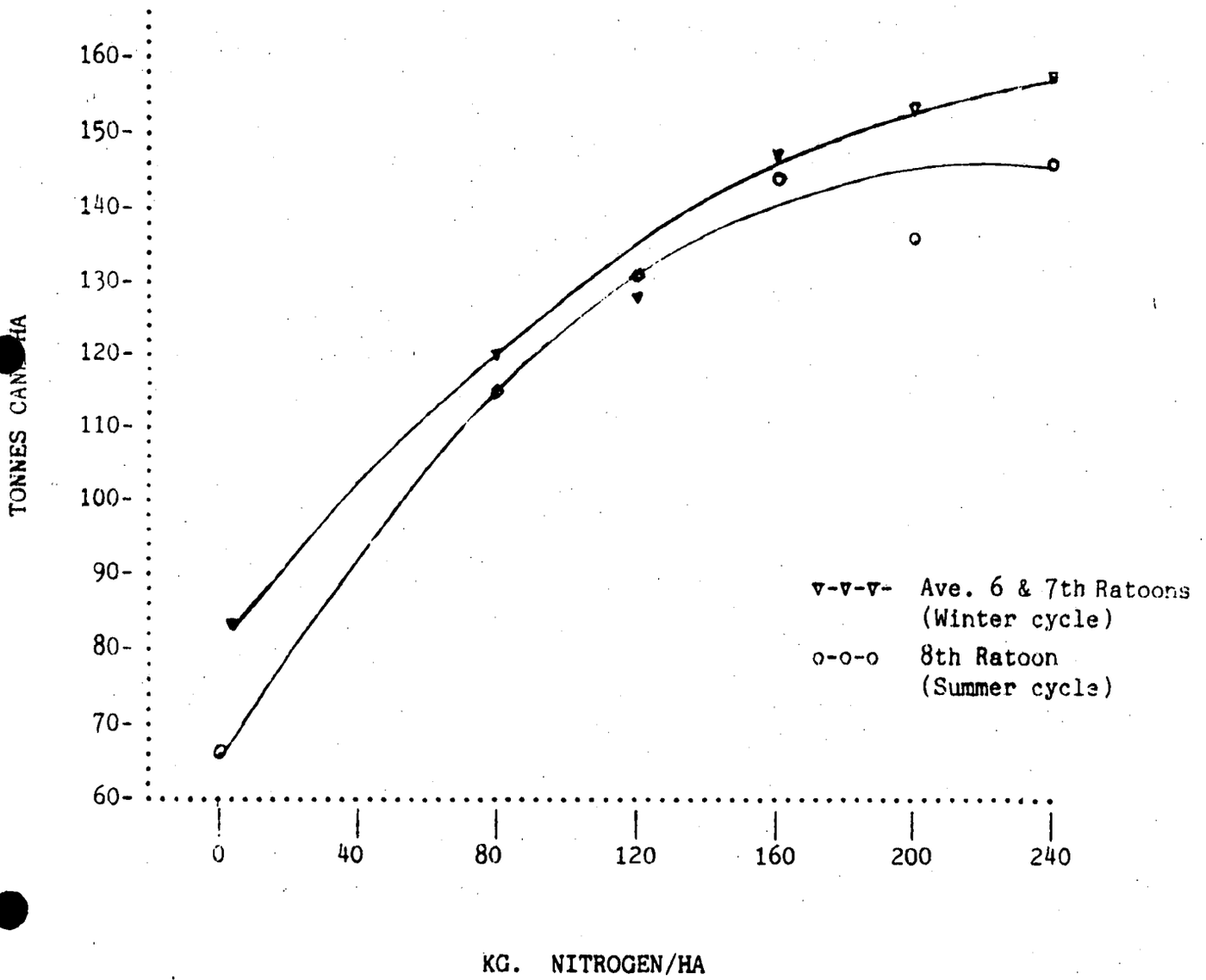
* Soil S levels were high and no further sulphur was applied to this crop.

* Third leaf S(%dm) values, as for phosphate, showed a positive correlation with increasing rates of nitrogen. Sulphur became marginal to deficient in the third leaf for all N treatments below N3 which may have further enhanced the overall response to nitrogen.

5.6 This trial has been re-established and is now in it's 9th ratoon.

NBL/cg
18/4/88

FIG. 1 TONNES CANE/HA RESPONSE TO RATES OF NITROGEN APPLIED



SOUTH AFRICAN SUGAR INDUSTRY
AGRONOMISTS' ASSOCIATION

EXPERIMENT RESULT

Code: NK11/84/SW UBO R
CAT. NO.: 1485

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

1. PARTICULARS OF PROJECT

This crop	: 9th ratoon
Site	: Ubombo Ranches Field Cascades 1
Region	: Northern Irrigated (Swaziland)
Soil Set/Series	: 'R '/ Rathbone
Design	: 6 * 3 factorial 2 replications
Variety	: NCO376
Fertilizer	: See treatments

Soil Analyses : Date 6/11/1987

ph	OM %	Clay %	P.U.I.
6.55	-	30	-

ppm

P	K	Ca	Mg	S
35	245	1459	616	24

K0 = 199
K1 = 245
K2 = 291

Age	: 12.1 months
Dates	: 28/10/87 - 2/11/88
Rainfall	: 619 mm
Irrigation	: 1006 mm
Total	: 1625 mm

2. OBJECTIVES

2.1 To determine the optimum levels of N and K for ratoon cane on a deep 'R 'set soil.

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 - 150
N2 - 120	K2 - 300
N3 - 160	
N4 - 200	
N5 - 240	

Notes on treatments

* Nitrogen was applied as urea (46% N) in a single top dressing approximately 5 weeks after cutting.

* Phosphate as single supers (10.5% P)@ 40 P/ha was applied 6 weeks after harvesting.

* Potassium as muriate of potash (50% K) was applied 6 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) at 3 months of age

Treatment	Stalk Height (mm to TVD)	Populations (* 1000/ha)
Nitrogen		
N0	970	277
N1	1040	282
N2	1180	287
N3	1180	304
N4	1170	299
N5	1180	280
Potassium		
K0	1040	289
K1	1110	289
K2	1110	286

4.2 Harvest Data

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

Treatment	Tc/ha	Suc% cane	Ts/ha
N0	58	16.4	9.6
N1	97	16.0	15.4
N2	118	16.0	19.0
N3	117	15.7	18.4
N4	120	15.4	18.5
N5	117	15.4	18.0
LSD N Means			
(0.05)*	15	0.7	2.3
(0.01)**	20	0.9	3.1
Significance	**	NS	**
K0	103	15.9	16.2
K1	106	15.8	16.8
K2	104	15.8	16.4
LSD K Means			
(0.05)*	11	0.5	1.6
(0.01)**	14	0.7	2.2
Significance	NS	NS	NS
Trial Mean	105	15.8	16.6
S.E. Single Plot	12.2	0.6	1.9
C.V.%	11.7	3.5	11.3

* Tons cane/ha/month at the N2 level is 9.8

* Tons cane/ha/100 mm water at the N2 level is 7.3

* 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	2.5 months (Jan)	4.2 months (Mar)
Nitrogen (%dm)		
N0	1.54 *	1.48 *
N1	1.69	1.48 *
N2	1.87	1.63
N3	2.05	1.71
N4	2.10	1.80
N5	2.10	1.84
Potassium (%dm)		
K0	1.12	1.24
K1	1.24	1.30
K2	1.32	1.33

* = Deficient

Table 4. Third leaf P (%dm) and S (%dm) values

Treatment	2.5 months (Jan) P	2.5 months (Jan) S	4.2 months (Mar) P	4.2 months (Mar) S
Nitrogen (%dm)				
N0	0.20	0.15	0.17*	0.10*
N1	0.20	0.15	0.17*	0.11*
N2	0.22	0.16	0.18*	0.11*
N3	0.21	0.16	0.19	0.12*
N4	0.22	0.16	0.21	0.13
N5	0.21	0.17	0.22	0.13

* = Deficient

5. COMMENTS

5.1 Cane yields for this crop were much lower than in the previous three ratoons.

5.2 Nitrogen

5.2.1 Responses to applied nitrogen were not as marked as in the earlier crops and significant differences were reached only up to the N2 level .

5.2.2 Cane quality was unaffected by the rates of N applied.

5.2.3 The increase in tons sucrose/ha yield was a function of cane yield and significant differences were recorded up to the N2 level only.

5.2.4 Nitrogen responses appear to be largely dependent on the season's growth potential. Results have shown that N requirements for older ratoons on these soils are higher when conditions are favourable, but that responses are less when yields are low (see previous results for NK11 and NK7) As a result, the N3 rate of nitrogen is to be recommended for older ratoons on these soils.

5.2.5 Third leaf N (%dm) values became deficient up to the N2 level.

5.3 Potassium

5.3.1 The soil K status has gradually been reduced to below 200 ppm where no K has been applied for four crops.

5.3.2 Potassium had no effect on cane yields.

5.3.3 Cane quality remained unchanged for the rates of K applied.

5.3.4 Sucrose yields were not influenced by potash.

5.3.5 Results suggest that the critical soil K threshold for the 'R' sets has not yet been reached.

5.3.6 Third leaf K (%dm) values were above the threshold for both samplings.

5.4 Phosphorus

5.4.1 Soil P levels were above the threshold before 40 kg of P/ha was applied.

5.4.2 P (%dm) in the third leaf increased with the rates of N applied. As for the previous ratoon, P (%dm) values became deficient in the low nitrogen treatments which may have further suppressed yields.

5.4.3 The influence of nitrogen on P uptake in the third leaf and the moderate P fixation on these soils provides further reason to increase recommended N rates up to 160 kg/ha for the older ratoons.

5.5 Sulphur

5.5.1 The soil S level before top-dressing was just above the threshold.

5.5.2 Despite applied fertilizer S as single supers, third leaf S (%dm) values became deficient in the low N treatments.

5.6 The trial has been re-established and is now in it's 10th ratoon.

1/4/89

SOUTH AFRICAN SUGAR INDUSTRY

AGRONOMISTS' ASSOCIATION

EXPERIMENT RESULT

Code: NK11/84/SW UBO 'R'
CAT.NO.: 1485

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

1. PARTICULARS OF PROJECT

This crop	: 10th ratoon
Site	: Ubombo Ranches Field Cascades 1
Region	: Northern Irrigated [Swaziland]
Soil Set/Series	: 'R '/ Rathbone
Design	: 6 * 3 factorial 2 replications
Variety	: NCo376
Fertilizer	: See treatments

Soil Analysis: Date 22/11/1988

pH	OM %	Clay %	P.D.I.
6.55	-	> 30	-

ppm

P	K	Ca	Mg	S
38	313	1929	757	-

K0 = 218
K1 = 318
K2 = 392

Age	: 12 months
Dates	: 1/11/88 - 1/11/89
Rainfall	: 363 mm
Irrigation	: 1232 mm
Total	: 1595 mm

2. OBJECTIVES

2.1 To determine the optimum levels of N and K for ratoon cane on a deep 'R 'set soil.

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 - 150
N2 - 120	K2 - 300
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)@ 40kg P/ha was applied 6 weeks after harvesting.

* Potassium as muriate of potash (50% K) was applied 6 weeks after cutting.

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

4. RESULTS

4.1 Harvest Data

Table 1: Cane Yield, Sucrose % Cane and Sucrose Yield

Treatment	TC/Ha	Suc % Cane	TS/Ha
N0 0kg N/ha	58	14.6	8.5
N1 80kg N/ha	98	15.4	15.1
N2 120kg N/ha	124	15.1	18.7
N3 160kg N/ha	119	14.8	17.6
N4 200kg N/ha	125	14.0	17.6
N5 240kg N/ha	124	14.3	17.7
LSD N			
(0.05)*	9	0.7	1.5
(0.01)**	12	0.9	2.0
Significance	**	**	**
K0 0kg/ha	102	14.5	14.8
K1 150kg/ha	116	14.9	17.2
K2 300kg/ha	106	14.7	15.6
LSD K			
(0.05)*	6	0.5	1.0
(0.01)**	9	0.6	1.4
Significance	**	NS	**
Trial Mean	108	14.7	15.9
S.E.	7.2	0.5	1.2
C.V. %	6.7	3.7	7.6
N * K Interaction	**	NS	**

NS: Not Significant

Table 2: Third Leaf Analysis (% dm) at 3 Months of Age

TREATMENTS	N	K	P	S	Ca	Mg	Zn/ppm
N0 0 kg N/ha	1.51[D]	1.13	0.23	0.15	0.18	0.15	15.0
N1 80 kg N/ha	1.53[D]	1.17	0.20	0.14	0.18	0.16	14.0
N2 120 kg N/ha	1.75	1.19	0.21	0.15	0.19	0.17	15.7
N3 160 kg N/ha	1.79	1.30	0.21	0.16	0.19	0.19	16.8
N4 200 kg N/ha	1.90	1.30	0.22	0.16	0.18	0.18	17.2
N5 240 kg N/ha	1.91	1.34	0.22	0.16	0.19	0.19	19.3
LSD							
(0.05)*	0.07	0.08	0.02	0.06	0.01	0.01	1.6
(0.01)**	0.09	0.10	0.03	0.09	0.02	0.02	2.2
Significance	**	**	NS	**	NS	**	**
K0 0 kg K/ha	1.74	1.14	0.22	0.16	0.19	0.18	17.3
K1 150 kg K/ha	1.72	1.29	0.22	0.15	0.18	0.18	16.3
K2 300 kg K/ha	1.73	1.29	0.21	0.15	0.18	0.16	15.4
LSD							
(0.05)*	0.05	0.05	0.01	0.04	0.007	0.008	1.1
(0.01)**	0.07	0.07	0.02	0.06	0.01	0.01	1.5
Significance	NS	**	NS	NS	*	**	**
Mean	1.73	1.24	0.22	0.15	0.19	0.17	16.3
S.E.	0.05	0.06	0.01	0.005	0.008	0.01	1.3
C.V. %	3.2	5.0	6.7	3.4	4.5	5.7	8.0

D: Deficient

Table 3: Effect of N Treatment on N and K Content (% dm) of Third Leaf at 2.3; 3; 4; 5 Months of Age

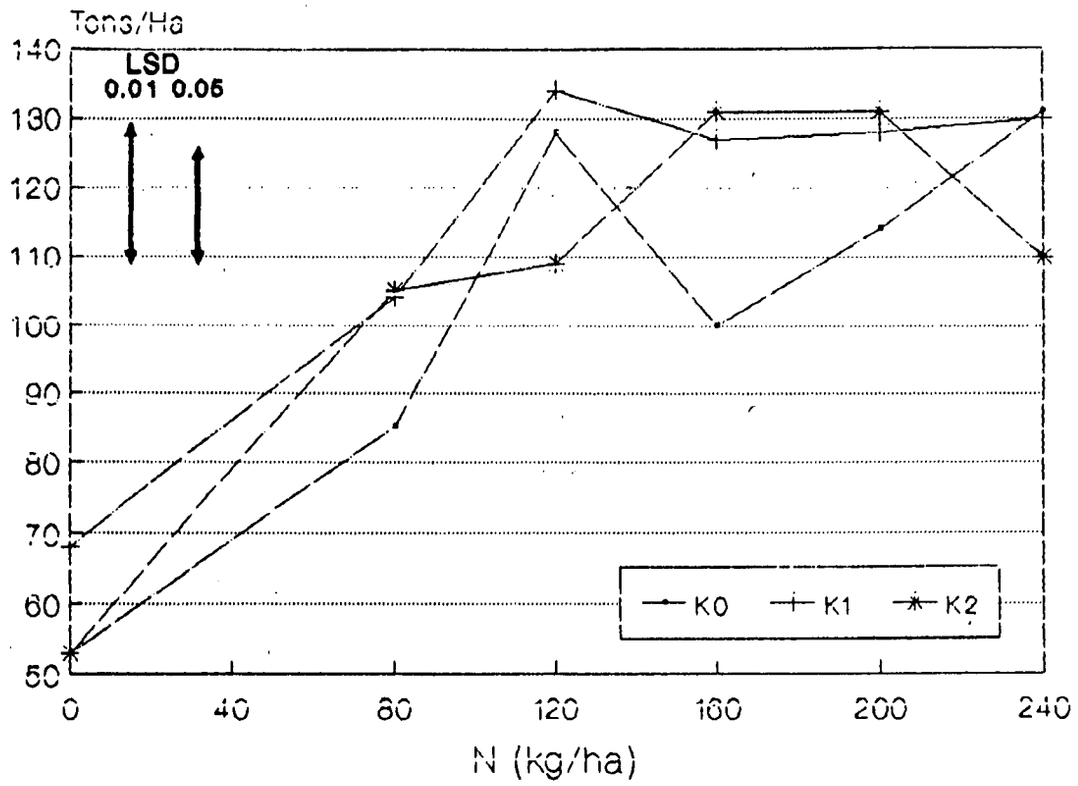
Treatment	2.25 m		3 m		4 m		5 m	
	N	K	N	K	N	K	N	K
N0 0kg N/ha	1.55[D]	1.08	1.51[D]	1.13	1.51[D]	1.21	1.52[D]	1.18
N1 80kg N/ha	2.01	1.34	1.53[D]	1.17	1.53[D]	1.27	1.43[D]	1.21
N2 120kg N/ha	2.12	1.32	1.75	1.19	1.69	1.36	1.53[D]	1.28
N3 160kg N/ha	2.20	1.34	1.79	1.30	1.71	1.42	1.59[M]	1.32
N4 200kg N/ha	2.22	1.29	1.90	1.30	1.84	1.44	1.66	1.35
N5 240kg N/ha	2.25	1.32	1.91	1.34	1.86	1.50	1.69	1.34
LSD								
(0.05)*	0.11	0.11	0.07	0.08	0.09	0.06	0.06	0.04
(0.01)**	0.16	0.15	0.09	0.10	0.12	0.09	0.08	0.06
Significance	**	**	**	**	**	**	**	**
Mean	2.06	1.28	1.73	1.24	1.69	1.37	1.57	1.28
SE	0.09	0.09	0.05	0.06	0.07	0.08	0.05	0.04
CV %	4.5	7.1	3.2	5.0	4.4	5.7	3.2	3.0

D: Deficient
M: Marginal

Table 4: Effect of K Treatment on Mg Content (% dm) of Third Leaf at 2.3; 3; 4 and 5 Months of Age

	Mg (% dm)			
Treatment	2.3 m	3 m	4 m	5 m
K0 0 kg K/ha	0.19	0.18	0.17	0.18
K1 150 kg K/ha	0.18	0.18	0.18	0.17
K2 300 kg K/ha	0.16	0.16	0.17	0.17
LSD				
(0.05)*	0.009	0.008	0.010	0.007
(0.01)**	0.010	0.010	0.013	0.01
Significance	**	**	NS	*

Figure 1: Yield of Cane as a Function of N Application Rate and at Three Levels of K Addition



5. COMMENTS

5.1 General

* Cane yields for this crop were similar to that of last season and the maximum yield was 130 Tons/ha.

* The interaction between N and K was highly significant with respect to cane and sucrose yield (Table 1). This means that the effect of N or K on response cannot be examined separately and the combined responses to the different levels of N - K treatment are presented in Figure 1.

5.2 Nitrogen

5.2.1 Harvest data

* Cane yield responded to N up to 120 kg N/ha in the K0 and K1 plots and up 160 kg N/ha in the K2 plots before levelling off (Figure 1). The recommendation for this type of soil is normally 160kg N/ha under favourable conditions but in this trial the yield potential was lower than in the past when 160kg N/ha was found to be optimum. An additional factor that could account for the lower optimum rate is the possibility of increasing residual N content as a result of continuous fertilization.

* There were significant differences in sucrose % cane between treatments and increasing rates of N tended to reduce sucrose content.

* Sucrose yield followed the trend in cane yields and increased significantly up to 120 kg N/ha before reaching a plateau.

5.2.2 Foliar analysis

* Third leaf content indicated N0 to be deficient throughout growth and N1 to be adequate during the first two and a half months but to become deficient thereafter (Table 3). All fertilizer in this trial was top-dressed 6 weeks after harvest and it is therefore apparent that 80kg/ha was only sufficient to maintain adequate N levels in the leaf for 5-6 weeks. Thus in split application of N at this time of the year, it would appear that optimum timing for the second dressing would be at about 5 to 6 weeks after the first application when the starter rate is 80kg N/ha or less.

* N2 and N3 also became marginal to deficient at 5 months (Table 3) but with seemingly no adverse effect on yield.

* Inadequate N supply impaired K uptake as its content in third leaves was lower where N was deficient (Table 2 & 3). This implies that potassium in the K0 plots is being depleted faster where N is sufficient than where it is deficient. In Figure 1 it can be seen for instance that the single highest response (difference in yield between K1 or K2 and K0 lines) to potash addition occurred at 160 kg N/Ha in the N sufficiency zone.

* In terms of K soil test levels, plots which never receive potash but to which sufficient N is applied will attain critical levels sooner than those that receive insufficient N. For instance the mean level of K soil test for the K0-160 kg N/Ha plots was among the lowest (210 ppm) of all K levels in this trial. It must be emphasised here that due to the variability inherent to soil testing this effect of N on the levels of soil test K is not easy to measure.

* Nitrogen apparently enhances Mg uptake as the third leaf content in this element increased with increasing rates of N application (Table 2).

5.3 Potassium

5.3.1 Harvest data

* Cane yield responded to the application of potassium and the optimum rate appeared to be 150 kg K/ha (Figure 1). Yield of the K0 level was significantly lower than that of K1 or K2 only at N3. Possible explanation for this effect has already been provided above.

* Quality was unaffected by potash treatments.

* Yields of sucrose therefore followed the trend in cane yields and went through a significant maxima at 150 kg K/Ha before dropping again.

5.3.2 Foliar analysis

* Third leaf K content reflected correctly the increased rates of potash application and were found to be always above threshold including that of the K0 plots.

* It is of interest to note that increasing rates of applied potash caused a significant reduction in Mg during the early stages of growth although levels remained well above the threshold level.

5.3.3 Summary

* Yield responded to N up to 120 kg N/Ha.

* Response to potash was variable as yields were increased by application of 150 kg K/ha but not by 300 kg K/Ha.

* Variability in soil analysis data indicates that soil sampling should be intensified and analysis duplicated if thresholds are to be determined accurately.

* Further observation is necessary to confirm the trends in yield response especially with respect to K. This trial is being continued into its 11th ratoon.

PCH/aw/fjs
21 May 1990

SOUTH AFRICAN SUGAR INDUSTRY

AGRONOMISTS' ASSOCIATION

EXPERIMENT RESULT

CODE: NK11/84/SW UBO 'R'

CAT. NO.: 1485

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

1. PARTICULARS OF PROJECT

This crop	:	11th ratoon	
Site	:	Ubombo Ranches Field Cascades 1	
Region	:	Northern Irrigated [Swaziland]	
Soil Set/Series:		'R'/ Rathbone	
Design	:	6 * 3 factorial 2 replications	
Variety	:	NCo376	
Fertilizer	:	See treatments	
Fertilizer Total (kg/ha)	:	N P K 200 40 Treatment	

Soil Analysis: Date 17/11/1989

pH	Clay%	Silt%	Sand%
6.5	59	18	26

ppm

P	K	Ca	Mg	S	Zn
47	K0-227	2061	786	24	2.33
	K1-317	2066	778		
	K2-375	2023	756		

Age : 12.25 months

Dates : 01/11/89-09/11/89

Rainfall : 662 mm
Irrigation : 1288 mm
Total : 1950 mm

2. OBJECTIVES

2.1 To determine the optimum levels of N and K for ratoon cane on a deep 'R' set soil.

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	-	150
N2	-	120	K2	-	300
N3	-	160			
N4	-	200			
N5	-	240			

Notes on treatments

* Nitrogen was applied as Urea (46% N) in a single top dressing on 04/12/1989.

* Potassium as KCl (50% K) was applied on the 04/11/1989.

* Phosphate as Single Supers (10.5% P) @ 40 kg P/ha was applied on the 08/12/1989.

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

4. RESULTS

4.1 Harvest Data

Table 1: Cane Yield, Sucrose % Cane and Sucrose Yield

Treatments	TC/Ha	Suc % Cane	TS/Ha
N0 0kg N/ha	64	15.15	9.6
N1 80kg "	92	15.30	14.2
N2 120kg "	109	15.40	16.8
N3 160kg "	122	15.32	18.7
N4 200kg "	122	15.54	18.9
N5 240kg "	124	15.27	19.0
LSD N			
(0.05)	14	0.62	2.4
(0.01)	19	0.86	3.3
Significance	**	NS	**
K0 0kg K/ha	101	15.38	15.6
K1 150kg "	108	15.42	16.6
K2 300kg "	108	15.19	16.4
LSD K			
(0.05)	10	0.44	1.7
(0.01)	14	0.61	2.3
Significance	NS	NS	NS
N * K Interaction	NS	NS	NS
Trial Mean	10.5	15.33	16.2
SE	11.5	0.50	2.0
CV%	11.00	3.3	12.2

NS: Not Significant

Table 2: Third Leaf Analysis (% dm) at 3 months of Age at the end of January

TREATMENTS	N	K	P	S	Ca	Mg	Zn(ppm)
N0 0 kg N/ha	1.53	1.04	0.19	0.13	0.18	0.13	11.2
N1 80 kg "	1.69	1.11	0.18	0.13	0.19	0.14	12.2
N2 120 kg "	1.75	1.20	0.19	0.14	0.18	0.14	11.0
N3 160 kg "	1.82	1.26	0.19	0.14	0.19	0.15	12.3
N4 200 kg "	1.90	1.24	0.20	0.15	0.19	0.16	14.0
N5 240 kg "	1.98	1.26	0.20	0.15	0.19	0.17	14.2
LSD							
(0.05)	0.14	0.14	0.011	0.011	0.025	0.014	2.2
(0.01)	0.002	0.19	0.016	0.015	0.034	0.019	3.1
Significance	**	*	*/NS	*	NS	**	*
K0 0 kg K/ha	1.78	1.04	0.22	0.15	0.20	0.16	13.0
K1 150 kg "	1.75	1.22	0.22	0.14	0.18	0.15	12.3
K2 300 kg "	1.81	1.29	0.21	0.14	0.17	0.14	12.2
LSD							
(0.05)	0.10	0.097	0.008	0.008	0.017	0.010	1.6
(0.01)	0.14	0.13	0.011	0.010	0.014	0.013	2.2
Significance	NS	**	NS	NS	**	**	NS
Mean	1.78	1.19	0.19	0.14	0.18	0.15	12.5
SE	0.12	0.11	0.009	0.002	0.020	0.011	1.85
VC%	6.8	9.5	4.9	6.3	11.2	7.6	14.8

Table 3: Effect of N Application on third leaf N content (% dm)

Treatments	Jan (3 m)	Feb (4 m)
N0 0 kg N ha^{-1}	1.53^{D}	1.45^{D}
N_1 80 kg "	1.69^{M}	1.52^{D}
N_2 120 kg "	1.75	1.52^{D}
N_3 160 kg "	1.82	1.63^{M}
N_4 200 kg "	1.90	1.71
N_5 240 kg "	1.98	1.80
LSD 0.05	0.10	0.090
0.01	0.114	0.12
Significance	**	**
Mean	1.78	1.61
SE	0.12	0.10
CV%	6.8	6.5

M: Marginal; D: Deficient

5. COMMENTS

5.1 Nitrogen

5.1.1 Cane Yield

The effects of Nitrogen on cane yield were highly significant. Cane yield increased with increasing rate of Nitrogen until a plateau was reached at 160 kg N ha^{-1}.

5.1.2 Cane Quality

The effects of Nitrogen on sucrose content were variable and non significant.

5.1.3 Sucrose Yield

The effects of Nitrogen on sucrose yield were highly significant and reflected the effects on cane yield. Sucrose yields increased with increasing rate of Nitrogen but the function followed the law of diminishing returns and the optimum rate was reached at 160 kg N ha^{-1}.

5.1.4 Leaf Analysis

Increasing the rate of Nitrogen induced significant increases in the uptake of all nutrients except Ca. It is interesting to note that at 4 months of age N deficiencies had spread to the N_1 and N_2 plots (Table 3). All fertilizer in this trial was applied 4 weeks after harvest and it is apparent that 80 kg N ha^{-1} and 120 kg N ha^{-1} were sufficient to maintain adequate levels only for 8 weeks. This result implies that in split applications the optimum timing for the second application is about to 7 to 8 weeks at this time of the year when starter rates are 80 or 120 kg N ha^{-1}.

5.2 Potassium

5.2.1 Cane Yield

Potassium application tended to increase cane yield but the responses were not quite significant (P=0.05).

5.2.2 Cane Quality

The effects of Potassium on sucrose content were variable and non significant.

5.2.3 Sucrose Yield

Sucrose yield tended to be increased by Potassium application but the responses were not significant.

5.2.4 Leaf Analysis

Increasing the rate of Potassium increased the leaf content of K while it decreased both Ca and Mg levels. Difference in the content of the other nutrients between treatments was not significant.

Levels of third leaf K in the K0 plots were marginally below the threshold level.

6. CONCLUSION

* Results of this 11th ratoon showed that the optimum rate of Nitrogen for sucrose yield appeared to be approximately 160 Kg ha^{-1} on this deep 'R' set soil. This is in agreement with the recommended rate of N for older ratoon growing on this soil type.

* The mean soil K level in the K0 plots was approximately equal to the new FAS soil K threshold. The corresponding leaf K content was marginal and application of K tended to benefit cane and sucrose yields. These results tend to confirm the adequacy of the new soil K threshold on these soils. (225 ppm).

* This trial is being continued and is now in its 12th ratoon.

AGK/PCH/vnm
20.05.91

SOUTH AFRICAN SUGAR INDUSTRY

AGRONOMISTS' ASSOCIATION

EXPERIMENT RESULT

CAT. NO.: 1485
CODE: NK11/84/SW UBO 'R'

TITLE: RATES OF NITROGEN AND POTASSIUM FOR RATOON CANE ON AN 'R' SET SOIL

1. PARTICULARS OF PROJECT

This crop	:	12th ratoon
Site	:	Ubombo Ranches Field Cascades 1
Region	:	Northern Irrigated [Swaziland]
Soil Set/Series:		'R'/ Rathbone
Design	:	6 * 3 factorial 2 replications
Variety	:	NCo376
Fertilizer	:	N & K See treatments
	:	P
Total (kg/ha)	:	40

Soil Analysis: Date 23/11/1990

pH	Clay%	Silt%	Sand%
6.6	59	18	26

ppm

P	K	Ca	Mg	(Ca+Mg)/K
63	K_0-248	1867	836	11
	K_1-329	1819	761	
	K_2-490	1854	745	

CEC	:	17.05 meq/100g soil
KDI	:	0.82
Age	:	12 months
Dates	:	09/11/90- 11/11/91
Rainfall	:	1235 mm
Irrigation	:	572 mm
Total	:	1807 mm

2. OBJECTIVES

2.1 To determine the optimum levels of N and K for ratoon cane on a deep 'R' set soil.

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	-	150
N2	-	120	K2	-	300
N3	-	160			
N4	-	200			
N5	-	240			

Notes on treatments

* Nitrogen was applied as Urea (46% N) in a single top dressing on 23/11/1990, 2 weeks after harvest.

* Potassium as KCl (50% K) was applied on the 23/11/1990, 2 weeks after harvest.

* Phosphate as Single Supers (10.5% P) @ 40 kg P/ha was applied on the 12/12/1990, 1 month after harvest.

* Nitrogen was banded on the cane row while K and P were surface broadcast.

4. RESULTS

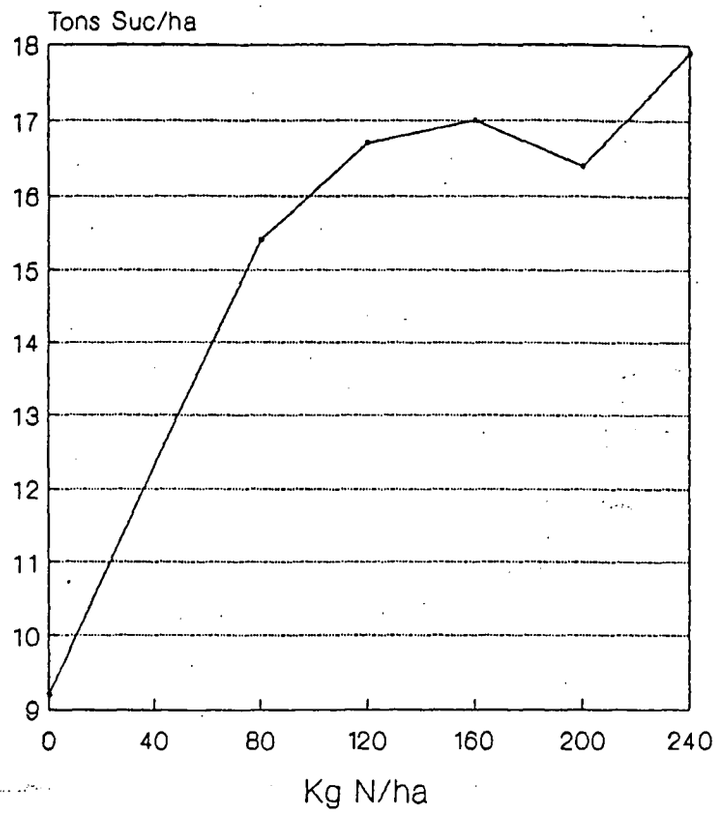
4.1 Harvest Data

Table 1: Cane Yield, Sucrose % Cane and Sucrose Yield

Treatments	TC/Ha	Suc % Cane	TS/Ha	Lodging
N_0 0kg N/ha	58	15.78	9.2	1.0
N_1 80kg "	94	16.28	15.4	2.7
N_2 120kg "	106	15.80	16.7	6.5
N_3 160kg "	108	15.70	17.0	7.0
N_4 200kg "	106	15.25	16.4	7.8
N_5 240kg "	112	15.98	17.9	6.3
LSD N				
(0.05)	11	1.00	2.2	
(0.01)	15	1.37	3.0	
Significance	**	NS	**	
K_0 0kg K/ha	96	15.92	15.4	4.9
K_1 150kg "	101	16.12	16.3	4.6
K_2 300kg "	95	15.35	14.6	5.8
LSD K				
(0.05)	8	0.70	1.5	
(0.01)	11	0.97	2.1	
Significance	NS	NS	NS	
N * K Interaction	NS	NS	NS	
Trial Mean	98	15.80	15.4	
SE	9.2	0.82	1.8	
CV%	9.4	5.2	11.5	

Lodging Score: 0 = no lodging
9 = complete lodging

Figure 1: Yield response to applied Nitrogen



4.2 Leaf Analysis

Table 2: Third Leaf Analysis (% dm) in Feb. at 3.75 months of age

Treatments	N	P	K	S	Ca	Mg	Zn(ppm)
N_0 0 kg N/ha	1.73	0.21	1.11	0.16	0.22	0.15	12.8
N_1 80 kg "	1.72	0.21	1.26	0.15	0.22	0.16	12.7
N_2 120 kg "	1.78	0.22	1.33	0.16	0.21	0.17	14.5
N_3 160 kg "	1.85	0.23	1.35	0.17	0.20	0.18	16.0
N_4 200 kg "	1.92	0.22	1.37	0.17	0.22	0.18	14.3
N_5 240 kg "	1.89	0.23	1.34	0.17	0.21	0.17	14.3
LSD (0.05)	0.095	0.020	0.094	0.008	0.018	0.018	1.9
(0.01)	0.13	0.028	0.13	0.011	0.024	0.025	2.7
Significance	**	NS	**	**	NS	**	*
K_0 0 kg K/ha	1.80	0.23	1.17	0.16	0.22	0.17	14.3
K_1 150 kg "	1.85	0.22	1.33	0.17	0.21	0.17	14.3
K_2 300 kg "	1.80	0.22	1.38	0.16	0.21	0.16	13.7
LSD (0.05)	0.067	0.014	0.066	0.006	0.012	0.013	1.4
(0.01)	0.092	0.020	0.091	0.008	0.017	0.018	1.9
Significance	NS	NS	**	NS	NS	NS	NS
N * K Interaction	NS	NS	NS	NS	NS	NS	NS
Mean	1.82	0.22	1.29	0.16	0.22	0.17	14.1
SE one plot	0.078	0.017	0.077	0.007	0.015	0.015	1.6
CV %	4.3	7.6	6.0	4.1	6.8	8.8	11.4

5. COMMENTS

5.1 General

The interaction between N and K in the harvest data was non-significant (Table 1) allowing for the effects of N to be examined separately from the effects of K.

5.2 Soil Analysis

Methods of potassium fertilizer application in this ratoon was changed from top-dressing on the cane row to broadcasting. Soil sampling method was also changed and consisted of 40 cores taken from each plot at a ratio of 16 on the row to 24 interow (ie. 1:1.5 instead of 1:8).

Soil K status in the control was above FAS threshold for soils with more than 40 % clay and the (Ca + Mg)/K ratio was low indicating that response to K fertilizer application were unlikely. It is of interest to note that while soil-K increased as a result of K treatments, Mg tended to decrease suggesting displacement by K.

5.3 Nitrogen

5.3.1 Cane Yield

The effects of Nitrogen on cane yield were highly significant. Cane yield increased with increasing rate of N up to 120 kg N ha^{-1} where it tended to level off (Table 1).

5.3.2 Cane Quality

The effects of Nitrogen on sucrose yield were variable and non-significant.

5.3.3 Sucrose Yield

The effects of Nitrogen on sucrose yield were highly significant and reflected the effects on cane yield.

The sucrose yield curve showed two apparent maxima, one at 160 kg N ha^{-1} and one at 240 kg N ha^{-1}, thus complicating the interpretation (Fig. 1). Inspection of the last 2 years data indicated, however, that N_4 in this trial was out of line by being abnormally low and N_5 is likely to be the true maximum. N_4 could have been out of the line because lodging was most severe in that treatment.

5.4 Potassium

5.4.1 Cane Yield

The low rate of K application (150 kg K ha^{-1}) tended to increase cane yield but this effect might not be real in view of the lack of effect of the high rate (Table 1).

5.4.2 Cane Quality

The effect of K on sucrose content were variable and non significant.

5.4.3 Sucrose Yield

The effect of K on sucrose yield were variable and non significant although the low rate of K, through a combination of higher cane yield and sucrose content, tended to be better.

5.5 Leaf Analysis

N content in all treatments, including No, were above threshold at 3.75 months of age. Increasing the rate of N significantly increased the uptake of N, K, S and Zn (Table 2).

K treatments significantly increased leaf-K content at 3.75 months but had no effect on the status of the other nutrients.

6. CONCLUSION

* Results of this 12th ratoon tended to indicate that the optimum rate of N for this season was higher than the 160 kg N ha^{-1} which has previously been the optimum at this site.

* The optimum rate of N for this season could not be easily interpolated but should be more or less 200 kg N ha^{-1}.

* Potassium status of the control was above threshold and a response was not expected.

* This trial has been continued and is now in its 13th ratoon.

PCH/fkd
18.02.92

SOUTH AFRICAN SUGAR INDUSTRY
AGRONOMISTS' ASSOCIATION

EXPERIMENT RESULT

CODE: NK11/84/SW UBO 'R'
CAT No: 1485

TITLE: RATES OF NITROGEN AND POTASSIUM FOR RATOON CANE ON AN 'R' SET SOIL

1. PARTICULARS OF PROJECT

This crop	:	13th ratoon
Site	:	Ubombo Ranches Field Cascades 1
Region	:	Northern Irrigated (Swaziland)
Design	:	6 * 3 factorial 2 replications
Soil set/series:		'R'/Rathbone
Variety	:	NCo376
Fertilizer	:	N & K see treatments
Total (kg/ha)	:	P 0

Soil Analysis: Date 07.05.1992

pH	Clay%	Silt%	Sand%	Sand%
	59	3.54	17.88	26.76

ppm

P		K	Ca	Mg	(Ca+Mg)/K
62	K_0	210	2023	701	
	K_1	329	2028	570	
	K_2	401	2033	528	

CEC	:	17.05 meq/100g soil
KDI	:	0.82
Dates	:	11.11.91 - 27.10.92
Age	:	11.5 months
Rainfall	:	353 mm
Irrigation	:	1457 mm
Total	:	1810 mm

2. OBJECTIVES

2.1 To determine the optimum levels of N and K for ratoon cane on a deep 'R' set soil.

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	- 150
N2	- 120	K2	- 300
N3	- 160		
N4	- 200		
N5	- 240		

Notes on treatments

Nitrogen as urea (46% N) and Potassium as KCl (50% K) were topdressed on 29.11.91 2.6 weeks after harvest. Nitrogen was banded on the cane row while K was surface broadcast.

Notes on soil sampling

Topsoil: 40 cores were taken from each plot at a ratio of 16 on row to 24 interrow (i.e. 1:1.5)

4. RESULTS

4.1 Soil Analysis

Table 1: K, Ca and Mg status (ppm) of the topsoil - May 1992

Treatments	K	Ca	Mg	(Ca+Mg)/K
N_0 0kg N/ha	392	1960	529	7.1
N_1 80kg "	270	2151	693	13.6
N_2 120kg "	338	2000	546	9.2
N_3 160kg "	274	1819	526	10.8
N_4 200kg "	333	2323	685	9.7
N_5 240kg "	272	1913	621	11.2
LSD N (0.05)	134	299	207	4.3
SED ±	63.3	141.6	98.2	2.1
Significance	NS	*	NS	NS
K_0 0kg K/ha	210	2023	701	15.3
K_1 150kg "	329	2028	570	8.4
K_2 300kg "	401	2033	528	7.1
LSD K (0.05)	94	211	147	3.1
SED ±	44.8	100.1	69.5	1.5
Significance	**	NS	NS	**
Interaction N * K	NS	NS	NS	NS
Mean	313	2028	600	10.3
CV%	35.0	12.1	28.4	34.7

4.2 Leaf Analysis

Table 2a: Third Leaf Analysis (% dm) in Feb. at 3.5 months of age

Treatments	N	P	K	Ca	Mg	(Ca+Mg)/K
N_0 0 kg N/ha	1.57	0.22	1.02	0.17	0.15	0.33
N_1 80 kg "	1.55	0.22	1.19	0.19	0.16	0.31
N_2 120 kg "	1.54	0.22	1.37	0.18	0.15	0.24
N_3 160 kg "	1.62	0.23	1.44	0.17	0.18	0.26
N_4 200 kg "	1.67	0.22	1.42	0.17	0.18	0.26
N_5 240 kg "	1.65	0.23	1.39	0.19	0.19	0.29
LSD N (0.05)	0.19	0.01	0.23	0.04	0.04	0.09
SED ±	0.09	0.004	0.11	0.02	0.02	0.04
Significance	NS	NS	**	NS	NS	NS
K_0 0 kg K/ha	1.63	0.22	1.16	0.20	0.20	0.35
K_1 150 kg "	1.61	0.22	1.36	0.17	0.16	0.25
K_2 300 kg "	1.56	0.22	1.39	0.17	0.16	0.24
LSD K (0.05)	0.14	0.01	0.17	0.03	0.03	0.07
SED ±	0.06	0.03	0.08	0.01	0.01	0.03
Significance	NS	NS	*	NS	**	**
Interaction N * K	NS	NS	NS	NS	NS	NS
Mean	1.60	0.22	1.30	0.18	0.17	0.28
CV%	9.8	3.4	14.8	21.0	17.2	27.1

Table 2b: Third Leaf Analysis (% dm) in Mar. at 4.4 months of age

Treatments	N	P	K	Ca	Mg	(Ca+Mg)/K
N_0 0 kg N/ha	1.58	0.23	1.39	0.18	0.16	0.25
N_1 80 kg "	1.52	0.22	1.42	0.20	0.17	0.26
N_2 120 kg "	1.46	0.22	1.38	0.22	0.16	0.28
N_3 160 kg "	1.59	0.22	1.42	0.20	0.19	0.28
N_4 200 kg "	1.56	0.22	1.41	0.23	0.16	0.28
N_5 240 kg "	1.54	0.21	1.31	0.20	0.18	0.29
LSD N (0.05)	0.13	0.01	0.20	0.04	0.04	0.07
SED ±	0.06	0.004	0.09	0.02	0.02	0.03
Significance	NS	*	NS	NS	NS	NS
K_0 0 kg K/ha	1.55	0.22	1.33	0.18	0.18	0.28
K_1 150 kg "	1.55	0.22	1.42	0.22	0.16	0.27
K_2 300 kg "	1.52	0.22	1.41	0.21	0.16	0.27
LSD K (0.05)	0.09	0.01	0.14	0.03	0.03	0.05
SED ±	0.04	0.003	0.07	0.01	0.01	0.02
Significance	NS	NS	NS	*	NS	NS
Interaction N * K	NS	**	NS	NS	NS	NS
Mean	1.54	0.22	1.39	0.21	0.17	0.27
CV%	7.2	3.3	11.7	16.3	18.1	19.9

Table 2c: The effect of N * K on leaf - P content (%dm)

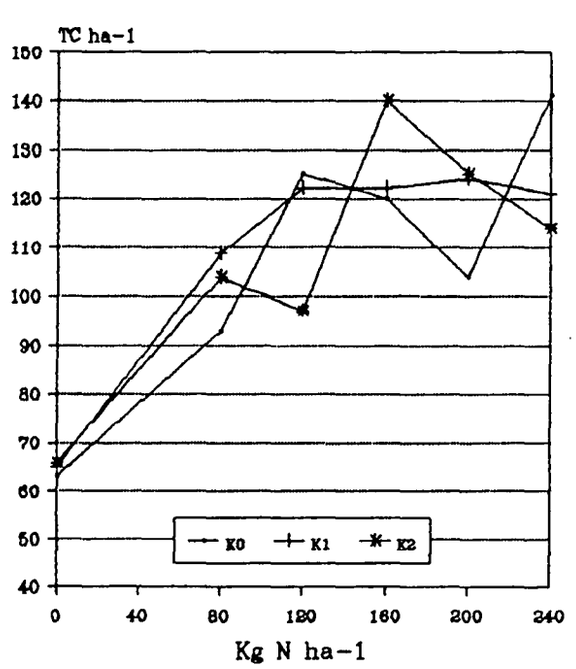
Treatment	N_0	N_1	N_2	N_3	N_4	N_5
K_0	0.23	0.24	0.22	0.22	0.22	0.22
K_1	0.24	0.20	0.22	0.23	0.22	0.21
K_2	0.23	0.22	0.22	0.23	0.23	0.22

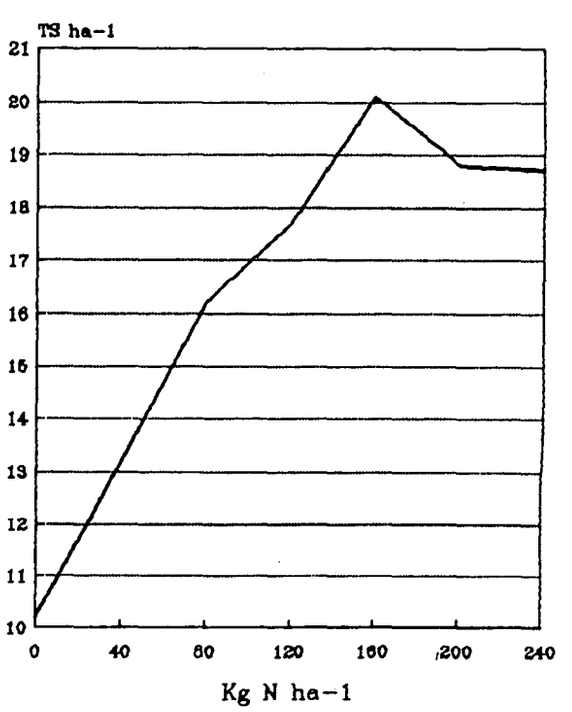
4.3 Harvest Data

Table 3: Cane Yield, Sucrose % cane and Sucrose Yield

Treatment	TC/ha	Sucrose % cane	TS/ha
N_0 0 kg K/ha	65	15.67	10.2
N_1 80 kg K/ha	102	15.87	16.2
N_2 120 kg K/ha	115	15.53	17.7
N_3 160 kg K/ha	127	15.81	20.1
N_4 200 kg K/ha	118	15.99	18.8
N_5 240 kg K/ha	125	14.94	18.7
LSD N (0.05)	12	0.85	2.0
SED ±	5.7	0.40	0.9
Significance	**	NS	**
K_0 0 kg K/ha	108	15.60	16.7
K_1 150 kg K/ha	110	15.68	17.3
K_3 300 kg K/ha	108	15.63	16.8
LSD K (0.05)	9	0.60	1.4
SED ±	4.0	0.28	0.4
Significance	NS	NS	NS
Interaction N * K	*	NS	NS
Mean	109	15.64	16.9
CV%	9.1	4.5	9.6

Figure1 :Interaction between N & K on cane yield and effect of N on sucrose yield





5. COMMENTS

5.1 General

There was an apparent interaction between N & K in terms of cane yield but the interaction was difficult to interpret and may not have been a 'real' effect.

5.2 Soil Analysis

The soil K level of the control (210 ppm) was below the threshold of 225 ppm for these soils and a response to applied K was predicted. Levels of Ca + Mg were not excessive and did not indicate that uptake of K would be inhibited. Mg levels tended to be reduced by applications of K. Applications of K increased soil K levels above the threshold as expected and consequently reduced the (Ca + Mg)/K ratios (Table 1).

5.3 Leaf Analysis

Third leaf analysis in February showed that N was deficient in all treatments to which less than 160 kg/N/ha had been applied. All treatments were deficient by March, however, when there was no longer any increase in N levels with treatment. Uptake of K was apparently increased by applications of N in February but this effect had disappeared by March.

Leaf K levels in the control were above the current threshold and were surprisingly high in March. Applications of K increased leaf K values but there was no apparent difference in uptake between the two rates applied. Increases in K uptake were accompanied by decreases in Mg levels in the leaf. The effects of K application on Ca uptake were variable.

5.4 Harvest Data

Cane yields were significantly improved by applications of N and tended to increase consistently in most K treatments up to the 160 kg N/ha level (Fig 1). Thereafter yields were variable and no consistent pattern could be determined. Sucrose content was apparently unaffected by applications of N (except at the highest rate) so that sucrose yields reflected the effects on cane yields.

Applications of K did not significantly affect cane yields or quality or sucrose yield although small increases in cane yield at the lower K rate tended to increase sucrose yields marginally.

6. CONCLUSIONS

* Results of this 13th ratoon crop indicated that optimum rates of N were 160 kg N/ha. This agrees with current recommendations on this soil.

* K status of the control was marginally lower than the threshold value but there were no statistically significant responses to applied K.

AGK/DMZ/vnm
12.02.93

SOUTH AFRICAN SUGAR INDUSTRY AGRONOMISTS' ASSOCIATION

Cat. No.: 1485

CODE: NK11/84/Sw/UBO 'R'

TITLE: RATES OF NITROGEN AND POTASSIUM FOR RATOON CANE ON AN 'R' SET SOIL

1. PARTICULARS OF PROJECT

This crop	: 14th Ratoon	Soil Analysis: Date 09/11/93	
Site	: Ubombo Ranches Ltd. Field Cascade 1	pH 6.8	OM% 3.5	Clay % 59*
Region	: Northern Irrigated (Swaziland)	ppm (control)		
		P 53	K 248	Ca 2266	Mg 800	(Ca+Mg)/K 13
Soil Set/Series	: 'R' / (Rathbone)					
Design	: 6 * 3 factorial 2 replications	Age : 11.7 months				
		Date : 27/10/92 - 18/10/93				
Variety	: NCo376					
		Rainfall : 387 mm				
Fertilizer	: N & K P	Irrigation :1228 mm (overhead)				
Total (kg/ha)	:See treatments 0	Total :1615 mm				

* Sampled on 07/05/92

2. OBJECTIVES

2.1 To determine the optimum levels of N and K for ratoon cane on a deep 'R' set soil.

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

3.1 Notes on Treatments

Nitrogen		Potassium	
Treatment	(kg/ha)	Treatment	(kg/ha)
N0	Nil	K0	Nil
N1	80	K1	150
N2	120	K2	300
N3	160		
N4	200		
N5	240		

Nitrogen (Urea, 46% N) and Potassium (KCl, 50% K) were applied 2.3 weeks after harvest. Nitrogen was banded on the cane row while K was broadcast.

3.2 Notes on Soil Sampling

Topsoil: 40 cores were taken from each plot at a ratio of 16 on row to 24 interrow (i.e. 1:1.5).

4. RESULTS

4.1 Soil Analysis

Table 1: P, K, Ca and Mg status (ppm) of the topsoil - November 1992

Treatment	ppm				(Ca+Mg)/K
	P	K	Ca	Mg	
K0	50	248	2266	800	12.7
K1	51	291	2175	768	7.8
K2	57	581	2138	806	5.1
LSD (0.05)	12	65	398	95	1.4
SED ±	5.9	30.6	188.7	45.0	0.7
Significance	NS	**	NS	NS	**
Mean	53	407	2193	791	8.5
CV %	27.4	18.5	21.1	13.9	19.0

4.2 Leaf Analysis

Table 2: Third leaf nutrient analysis (% dm) at various ages

Treatment	N		P		K		Ca		Mg	
	Jan (2.4m)	Feb (3.4 m)	Jan (2.4 m)	Feb (3.4 m)	Jan (2.4 m)	Feb (3.4 m)	Jan (2.4 m)	Feb (3.4 m)	Jan (2.4 m)	Feb (3.4 m)
N0	1.53	1.61	0.24	0.23	1.23	1.04	0.24	0.19	0.16	0.13
N1	1.63	1.59	0.21	0.21	1.14	1.17	0.22	0.17	0.18	0.16
N2	1.76	1.60	0.23	0.23	1.37	1.21	0.22	0.20	0.17	0.15
N3	1.77	1.67	0.21	0.22	1.29	1.29	0.24	0.19	0.22	0.16
N4	1.70	1.69	0.21	0.21	1.35	1.31	0.24	0.19	0.21	0.16
N5	1.74	1.79	0.22	0.22	1.42	1.35	0.25	0.18	0.20	0.18
LSD (0.05)	0.12	0.11	0.02	0.02	0.24	0.14	0.04	0.04	0.04	0.04
SED ±	0.05	0.05	0.01	0.01	0.11	0.07	0.02	0.02	0.02	0.02
Significance	**	*	*	NS	NS	**	NS	NS	NS	NS
K0	1.66	1.68	0.21	0.23	1.19	1.13	0.24	0.18	0.22	0.18
K1	1.70	1.61	0.22	0.21	1.30	1.24	0.23	0.20	0.18	0.16
K2	1.70	1.68	0.22	0.22	1.42	1.31	0.24	0.18	0.17	0.14
LSD (0.05)	0.08	0.08	0.01	0.01	0.17	0.10	0.03	0.03	0.03	0.03
SED ±	0.04	0.04	0.006	0.006	0.08	0.05	0.01	0.01	0.01	0.01
Significance	NS	NS	NS	NS	*	**	NS	NS	**	**
Interaction N*K	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Mean	1.69	1.66	0.22	0.22	1.30	1.23	0.24	0.19	0.19	0.16
CV %	5.7	5.3	7.5	6.8	15.0	9.6	13.6	15.3	17.8	16.9

4.3 Growth Data

Table 3: Cane measurements at 3.3, 6.2 and 11 months of age

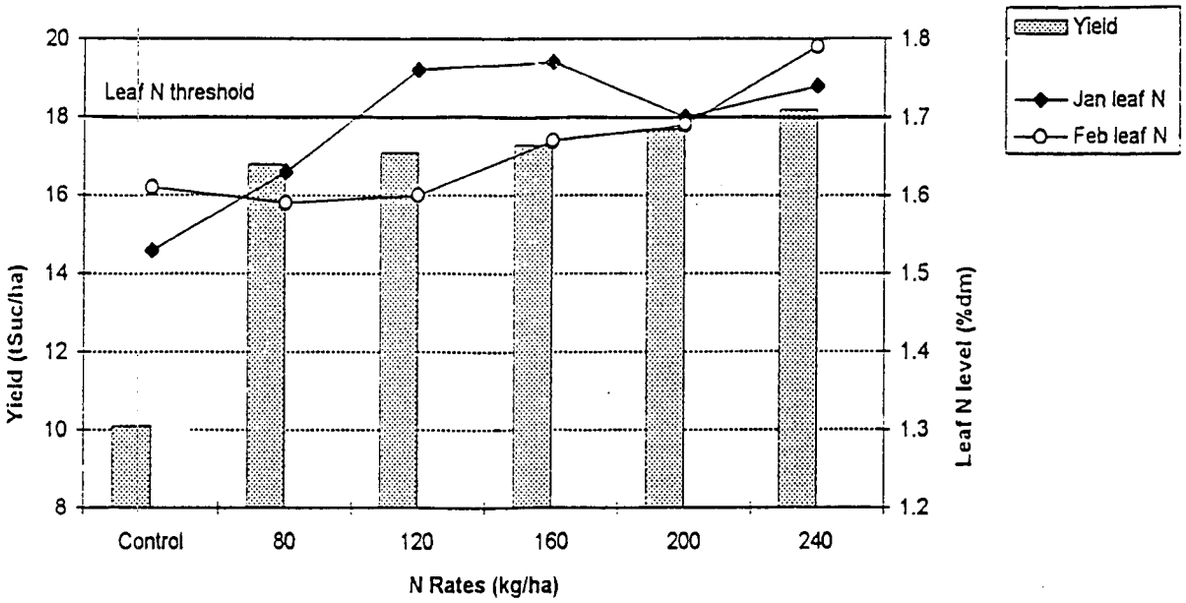
Treatment	Height (cm to TVD)			Population (*1000/ha)		
	Feb (3.3mths)	May (6.2 mths)	Sept (11 mths)	Feb (3.3 mths)	May (6.2 mths)	Sept (11 mths)
N0	103	195	220	245	137	122
N1	121	229	255	243	142	136
N2	129	235	258	294	158	142
N3	132	247	259	260	151	142
N4	126	246	268	215	157	148
N5	138	237	253	249	157	147
K0	122	228	258	224	147	134
K1	125	235	251	260	154	142
K2	127	231	247	270	148	142
Mean	125	231	252	251	150	140
Interaction N*K	NS	NS	*	NS	NS	NS

4.4 Harvest Data

Table 4: Cane yield, sucrose % cane and sucrose yield

Treatment	TCane/ha	Suc. % Cane	TSuc/ha
N0	65	15.42	10.1
N1	109	15.45	16.8
N2	114	15.01	17.1
N3	116	14.86	17.3
N4	117	15.09	17.7
N5	124	14.71	18.2
LSD (0.05)	16	0.71	2.4
SED ±	7.5	0.34	1.1
Significance	**	NS	**
K0	111	14.95	16.5
K1	104	15.31	15.9
K2	108	15.01	16.2
LSD (0.05)	11	0.50	1.7
SED ±	5.3	0.24	0.8
Significance	NS	NS	NS
Interaction N*K	NS	NS	NS
Mean	108	15.09	16.2
CV%	12.0	3.9	11.9

Figure 1: N Rates vs. Sucrose yield and leaf N levels in November and January



5. COMMENTS

5.1 General

There was no statistical significant interaction between N and K in either leaf nutrient or harvest data analysis. As result of this, these results will be examined independently

5.2 Soil Analysis

The soil K status of the control was above the FAS threshold of 225 ppm before fertilization (soil >40% clay) and a yield response was not expected. Soil K levels were improved by previous applications of K and soil K levels reflected the different rates applied. Applications of K had no statistically significant effect on the availability of P, Ca and Mg. Soil Ca+Mg/K ratios were low at this site and no limitations to the uptake of K was expected (table 1).

5.3 Leaf Analysis

Nitrogen

Leaf N levels of the control treatment were below the current threshold (1.70 %dm) in January as well as in February. Leaf N levels were increased by N applications although leaf levels of the N1 treatment remained below the threshold in January. Leaf N levels were inexplicably lowered from January to February and only the leaf N level of the N5 treatment was above the threshold in February (table 2, figure 1).

Leaf levels of P, Ca and Mg were generally sufficient and above their respective thresholds, The uptake of K was improved by increasing rates of N in February while the uptake of P was lowered by increasing rates of N in January.

Potassium

Leaf K levels of the control were above threshold in both months (0.95 and 1.05 %dm respectively) and were generally increased by applications of K. No responses to applications of K were expected. Leaf K levels decreased from January to February, but remained above threshold. Applications of K decreased the uptake of Mg but had no evident effect on the uptake of N, P and Ca (table 2).

5.4 Growth Data

Nitrogen

Stalk height was generally increased by N rates of 160 kg/ha and below. Above this level, effects were variable and heights were in some cases decreased in all three months sampled. Stalk population was generally increased by applications of N although results were not consistent and did not always follow a consistent pattern (table 3).

Potassium

Both stalk height and stalk population was increased by applications of K although increases did not always follow a consistent pattern (table 3).

Nitrogen * Potassium

In September, the increasing rates of K had the effect of significantly reducing cane height at the high rate of 240 kg N/ha (table 3).

5.5 Harvest Data

Nitrogen

Cane yield was significantly improved (P=0.01) by applications of Nitrogen and increases reflected the different amounts applied. The highest cane yield was obtained from the N5 treatment (240 kg N/ha) (table 4, figure 1).

Sucrose contents were apparently decreased by increasing rates of N although results were variable and there was no consistent pattern (table 4).

Sucrose yield was significantly improved (P=0.01) by rates of N. Increases in sucrose yield reflected the different amounts applied and the highest sucrose yield was obtained from the N5 treatment (240 kg N/ha). The difference between the 80 kg N/ha treatment and the 240 kg N/ha treatments was relatively small in this trial (1.1 tons of sucrose) (table 4).

Potassium

Neither cane nor sucrose yield was increased by applications of K. Sucrose content was increased by applications of K but the responses were not statistically significant (table 5).

6. CONCLUSIONS

- Results from this trial indicate that the recommended application of 160 kg N/ha for this soil type ('R' set) did not achieve yields as high as those achieved from the 240 kg N/ha treatment (N5). In previous crops optimum yields were usually obtained from either the 160 or 200 kg N/ha rates, showing that this year's result was rather exceptional and should be viewed as such.

- Leaf N levels above the recommended threshold level were not in all cases indicative of optimum yield results indicate that leaf N thresholds may need to be increased.

- Yield results from this trial support the currently recommended soil and leaf K thresholds.

- This trial has been continued and it is now in its 15th ratoon.

DMZ/AJD/fkn
10.01.94

SOUTH AFRICAN SUGAR INDUSTRY AGRONOMISTS' ASSOCIATION

CAT. NO.: 1485

CODE: NK11/84/Sw/UBO 'R'

TITLE: RATES OF NITROGEN AND POTASSIUM FOR RATOON CANE ON AN 'R' SET SOIL

1. PARTICULARS OF PROJECT

This crop	: 15th Ratoon		
Site	: Ubombo Ranches Ltd. Field Cascade 1		
Region	: Northern Irrigated (Swaziland)		
Soil Set/Series	: 'R' / (Rathbone)		
Design	: 6 * 3 factorial 2 replications		
Variety	: NCo376		
Fertilizer	: N & K	P	
Total (kg/ha)	:See Treatment	0	

Soil analysis: October 1993

pH	OM%	Clay %
6.3	3.5	59

ppm (control)

P	K	Ca	Mg	(Ca+Mg)/K
43	178	2199	714	16

Dates : 18/10/93 - 29/09/94
Age : 11.4 months

Rainfall : 323 mm
Irrigation : 1460 mm (overhead)
Total : 1783 mm

2. OBJECTIVES

2.1 To determine the optimum levels of N and K for ratoon cane on a deep 'R' set soil.

2.2 To determine 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

3.1 Notes on Treatments

Nitrogen		Potassium	
Treatment	(kg/ha)	Treatment	(kg/ha)
N0	0	K0	0
N1	80	K1	150
N2	120	K2	300
N3	160		
N4	200		
N5	240		

Nitrogen (Urea, 46% N) was banded on the cane row and Potassium (KCl, 50% K) was broadcast, 1.4 weeks after harvest.

3.2 Notes on Soil Sampling

Topsoil: 40 cores were taken from each plot at a ratio of 16 on row to 24 interrow (i.e. 1:1.5)

4. RESULTS

4.1 Soil Analysis

Table 1: P, K, Ca and Mg status (ppm) of the topsoil - October 1993

Treatment	ppm				
	P	K	Ca	Mg	(Ca+Mg)/K
K0 - 0	43	178	2199	714	16.4
K1 - 150	36	265	2082	674	10.4
K2 - 300	43	433	2148	720	6.6
LSD (0.05)	7	78	189	109	-
SE Diff. ±	3.3	36.9	89.5	51.5	-
Significance	NS	**	NS	NS	-
Mean	41	292	2143	703	11.1
CV%	19.6	31.0	10.2	18.0	-

4.2 Leaf Analysis

Table 2: Third leaf Nutrient analysis (% dm) at 2.6 and 4.6 months of age

Treatment	N		P		K		Ca		Mg	
	Jan (2.6m)	Mar (4.6m)	Jan (2.6m)	Mar (4.6m)	Jan (2.6m)	Mar (4.6m)	Jan (2.6m)	Mar (4.6m)	Jan (2.6m)	Mar (4.6m)
N0 - 0	1.82	1.67	0.33	0.26	1.26	1.21	0.28	0.26	0.24	0.18
N1 - 80	1.84	1.56	0.30	0.27	1.38	1.19	0.24	0.27	0.23	0.20
N2 - 120	2.00	1.61	0.31	0.26	1.50	1.29	0.30	0.26	0.26	0.20
N3 - 160	2.01	1.60	0.31	0.27	1.53	1.21	0.27	0.27	0.31	0.20
N4 - 200	2.02	1.68	0.30	0.28	1.48	1.30	0.27	0.23	0.26	0.21
N5 - 240	2.00	1.67	0.31	0.26	1.28	1.32	0.28	0.25	0.30	0.23
LSD (0.05)	0.13	0.08	0.03	0.02	0.32	0.12	0.05	0.04	0.07	0.04
SED ±	0.06	0.04	0.01	0.01	0.15	0.05	0.03	0.02	0.03	0.02
Significance	*	*	NS	NS	NS	NS	NS	NS	NS	NS
K0 - 0	1.93	1.65	0.31	0.27	1.36	1.20	0.25	0.26	0.27	0.22
K1 - 150	1.98	1.63	0.31	0.27	1.40	1.25	0.30	0.27	0.28	0.21
K2 - 300	1.94	1.62	0.30	0.26	1.45	1.31	0.27	0.24	0.24	0.18
LSD (0.05	0.09	0.05	0.02	0.02	0.22	0.08	0.04	0.03	0.05	0.03
SED ±	0.04	0.03	0.01	0.01	0.11	0.04	0.02	0.01	0.02	0.01
Significance	NS	NS	NS	NS	NS	*	*	*	NS	**
Interaction N*K	NS	NS	NS	NS	NS	**	NS	NS	NS	NS
Mean	1.95	1.63	0.31	0.27	1.40	1.25	0.27	0.26	0.26	0.20
CV%	5.6	4.1	6.8	6.9	18.5	7.6	16.0	11.3	22.4	14.8

4.3 Growth Data

Table 3: Growth measurements at 4.6 and 8.8 months of age

Treatment	Height (cm to TVD)		Population (*1000/ha)
	Mar. (4.6 mths)	July (8.8 mths)	Mar. (4.6 mths)
N0 - 0	115	174	175
N1 - 80	152	206	184
N2 - 120	171	237	191
N3 - 160	165	238	181
N4 - 200	177	242	197
N5 - 240	175	233	191
K0 - 0	157	219	192
K1 - 150	159	220	185
K2 - 300	161	226	183
Mean	159	222	186

4.4 Lodging

Table 4: Lodging Scores at 8.8 months of age in July

Treatment	Lodging Score#
N0 - 0	2
N1 - 80	3
N2 - 120	5
N3 - 160	5
N4 - 200	6
N5 - 240	8
Mean	5

On a scale of 1 - 9, where 9 represents complete lodging

4.5 Harvest Data

Table 5: Cane yield, sucrose % cane and sucrose yield

Treatment	TCane/ha	Suc % Cane	TSuc/ha
N0 - 0	48	15.23	7.3
N1 - 80	86	15.80	13.6
N2 - 120	102	15.81	16.1
N3 - 160	115	15.79	18.2
N4 - 200	104	14.81	15.4
N5 - 240	115	15.38	17.7
LSD N (0.05)	12	1.30	2.4
SE Difference ±	5.8	0.62	1.1
Significance	**	NS	**
K0 - 0	91	15.29	14.0
K1 - 150	98	15.42	15.1
K2 - 300	96	15.69	15.1
LSD K (0.05)	9	0.92	1.7
SE Difference ±	4.1	0.44	0.8
Significance	NS	NS	NS
Interaction N*K	NS	NS	NS
Mean	95	15.47	14.7
CV%	10.6	6.9	13.5

5. COMMENTS

5.1 Soil Analysis

Soil K levels of the control were below the FAS threshold of 225 ppm before fertilization (table 1). Responses to applications of K were therefore expected.
Previous applications of K had improved the soil K status in the treatments of applied K to levels above the threshold and the increase in soil K corresponded with the different rates applied.
Although the (Ca+Mg)/K ratio was high in the control treatment it was reduced by K applications and no limitations in the uptake of K was expected in treatments that received K.
Soil analysis results were variable (CV = 31%) and should be viewed with caution.

5.2 Leaf Analysis

General
Third leaf nutrient analysis in January and March showed that levels of P, Ca and Mg were satisfactory and above their respective thresholds in all treatments (table 2).

Nitrogen
Leaf N levels of the control treatments were above the current FAS threshold levels in January (1.8% dm) and March (1.6% dm) and no responses to N applications were expected. N levels of treatments receiving N were, except for the N1 treatment in March, generally above threshold levels. Applications of N in January did not increase leaf N above that of the N2 treatment while in March at 4.6 months of age, the effect of N applications on leaf N levels were variable and inconsistent. N treatments had no apparent effect on the uptake of P, K, Ca or Mg.

Potassium
Leaf K levels were above the FAS thresholds of 0.95% and 1.05% dm in January and March respectively. Leaf K levels were increased by applications of K and corresponded with the rates of K that were applied. K treatments reduced Mg uptake in March and had a variable effect on the uptake of Ca. The uptake of N and P was apparently not influenced by K application.

5.3 Growth Data

Stalk heights were significantly increased by N treatments in January and March. Stalk population was generally increased by N applications although the effect was variable and did not correspond with the different rates applied (table 3).
Applications of K improved stalk heights and differences corresponded with the different rates applied. Stalk populations were however, generally reduced by applications of K.

5.4 Lodging

Lodging in July at 8.8 months appeared to increase with increased N applications (table 4).

5.5 Harvest Data

General

There was no statistically significant interaction between N and K in harvest data results and the effect of N and K can therefore be examined independently.

Nitrogen

Cane yield was significantly increased (P = 0.01) by nitrogen applications up to the N3 treatment (table 5).

Cane quality was variable and no consistent trend related to the amounts of N applied could be observed.

Sucrose yield was significantly (P = 0.05) increased by rates of N up to treatment N3 (160 kg/ha) while differences between treatments N3 and N5 (240kg N/ha) were not statistically significant.

Potassium

K treatments improved cane yield, sucrose content and sucrose yield in this trial, but responses were not statistically significant (table 5). Sucrose content improved with an increase in the amount of applied K but there was no apparent difference in resultant sucrose yields between the K1 and K2 treatments.

6. CONCLUSIONS

- The results of this trial confirm the current recommendation of 160kg N/ha for this soil type.
- Results from this trial indicate that the current leaf N thresholds for January and March are too low.
- Applications of K improved yields marginally, indicating that a soil threshold level of 150 ppm K might be slightly too low for this soil. Due to a high variability, soil analysis results should be interpreted with caution. The rate of 150kg K/ha appeared to be sufficient for these conditions.
- This trial has been terminated and a summary of results from the 6th to the 15th ratoon are attached.

DMZ/AJD/ppd
25.01.95

TERMINAL REPORT: TRIAL NK11/84/Sw/UBO/'R'

6th to 15th ratoon

Leaf N levels were generally low in treatments <160kg N/ha and showed a definite decline as leaf age increased. Leaf N levels of treatments >160 kg N were generally above threshold levels. K levels of the control treatment were generally high in all the crops, presumably due to a high degree of K mineralization in this soil. Applications of K increased soil K levels and high levels of K were recorded in the K2 treatment after 10 crops. Leaf K levels did not always show an increase with increasing levels of K.

Cane and sucrose yields generally increased with increasing levels of K up to the 160 kg N/ha treatment above which results were variable. Cane quality was usually reduced by applications of more than 160 kg N.

Table 1: Soil analysis data (Average for 10 crops)

pH	KDI	OM%	CEC meq /100g soil	Clay%	Silt%	Sand%	Ca (ppm)	Mg (ppm)
6.5	0.82	3.54	17.05	59	17	26	1914	747

Table 2: K, Ca and Mg status of the topsoil - 6th to 15th ratoon

Season	Crop	Analysis date	ppm			(Ca+Mg)/K (control)
			K	K1	K2	
1984/85	6th R	12/06/84	271	-	-	7.10
1985/86	7th R	28/06/85 (BF)	205	215	243	-
1986/87	8th R	5/11/86 (BF)	234	257	301	10.63
1987/88	9th R	6/11/87 (BF)	199	245	291	10.43
1988/89	10th R	22/11/88 (BF)	218	318	392	12.32
1989/90	11th R	17/11/89 (AF)	227	317	375	12.54
1990/91	12th R	23/11/90 (BF)	248	329	490	10.90
1991/92	13th R	7/05/92 (AF)	210	329	401	12.97
1992/93	14th R	9/11/93 (BF)	248	291	581	12.36
1993/94	15th R	25/10/93 (BF)	178	265	433	16.37
Mean			229	249	390	11.74

NB: BF = Before fertilization
AF = After fertilization

Table 4: Rainfall and irrigation figures - 6th to 15th ratoon

Season	Crop	Period	Rainfall	Irrigation	Total (mm)
1984/85	6th R	4/6/84-7/6/85	575	1006	1581
1985/86	7th R	7/6/85-16/6/86	418	1481	1899
1986/87	8th R	30/10/86-28/10/87	410	983	1393
1987/88	9th R	28/10/87-2/11/88	619	1006	1625
1988/89	10th R	1/11/88-1/11/89	363	1232	1595
1989/90	11th R	1/11/89-9/11/90	662	1288	1950
1990/91	12th R	9/11/90-11/11/91	572	1235	572
1991/92	13th R	11/11/91-27/10/92	353	1457	1810
1992/93	14th R	27/10/92-18/10/93	387	1228	1615
1993/94	15th R	18/10/93-29/9/94	323	1460	1783
Mean			468	1238	1582

Table 3: Third leaf N and K analysis (%dm) at various ages - 6th to 15 ratoon.

Year	Crop	Month	Age (mths)	Leaf N levels of N treatments						K levels of K trtmts		
				N0	N1	N2	N3	N4	N5	K0	K1	K2
1984/85	6th R	Sep.	3.0	2.18	2.43	2.45	2.45	2.48	2.48			
		Oct.	4.5	1.51	1.73	1.94	1.98	2.04	2.06	1.07	1.03	1.13
		Nov.	6.0	1.42	1.49	1.55	1.65	1.78	1.77	1.08	1.11	1.17
		Dec.	6.6	1.40	1.60	1.64	1.73	1.75	1.82	1.01	1.02	1.05
1985/86	7th R	Sep.	3.5	1.82	2.36	2.48	2.44	2.59	2.61	1.08	1.16	1.19
		Oct.	4.5	1.41	1.49	1.49	1.66	1.69	1.83	0.86	0.86	0.96
		Dec.	6.0	1.28	1.31	1.34	1.49	1.52	1.71	0.99	1.00	1.03
1986/87	8th R	Dec.	1.5	1.57	2.10	2.30	2.39	2.45	2.40			
		Jan.	2.5	1.25	1.45	1.61	1.79	1.84	1.90			
		Feb.	3.4	1.40	1.53	1.67	1.79	1.86	1.94			
		Mar.	4.3	1.43	1.44	1.58	1.66	1.76	1.79			
1987/88	9th R	Jan.	2.5	1.54	1.69	1.87	2.05	2.10	2.10	1.12	1.24	1.32
		Mar.	4.2	1.48	1.48	1.63	1.71	1.80	1.84	1.24	1.30	1.33
1988/89	10th R	Feb.	3.0	1.51	1.53	1.75	1.79	1.90	1.91	1.14	1.29	1.29
1989/90	11th R	Jan.	3.0	1.53	1.69	1.75	1.82	1.90	1.98	1.04	1.22	1.29
1990/91	12th R	Feb.	3.8	1.73	1.72	1.78	1.85	1.92	1.89	1.17	1.33	1.38
1991/92	13th R	Feb.	3.5	1.57	1.55	1.54	1.62	1.67	1.65	1.16	1.36	1.39
		Mar.	4.4	1.58	1.52	1.46	1.59	1.56	1.54	1.33	1.42	1.41
1992/93	14th R	Jan.	2.4	1.53	1.63	1.76	1.77	1.70	1.74	1.19	1.30	1.42
		Feb.	3.4	1.61	1.59	1.60	1.67	1.69	1.79	1.13	1.24	1.31
1993/94	15th R	Jan.	2.6	1.82	1.84	2.00	2.01	2.02	2.00			
		Mar.	4.6	1.57	1.56	1.61	1.60	1.68	1.67			

Table 5: Yield Results, 6th to 15th ratoon, sucrose % cane and sucrose yield -

Table 5 a: Cane yield

Season	Crop	Growing period	Age (mths)	N Treatment							K Treatment		
					N0	N1	N2	N3	N4	N5	K0	K1	K2
1984/85	6th R	4/06/84- 7/06/85	12.1	K0	90	105	146	124	156	163			
				K1	87	135	128	156	145	149			
				K2	87	129	131	166	158	149			
				Mean	88	123	135	149	153	154			
1985/86	7th R	7/06/85 - 16/06/86	12.3		79	116	122	146	151	158	131	125	129
1986/87	8th R	30/10/86 - 28/10/87	12.0		65	114	131	144	135	145	121	124	122
1987/88	9th R	28/10/87 - 2/11/88	12.1		58	97	118	117	120	117	103	106	104
1988/89	10th R	1/11/88 - 1/11/89	12.0		58	98	124	119	125	124	102	116	106
1989/90	11th R	1/11/89 - 9/11/90	12.3		64	92	109	122	122	124	101	108	108
1990/91	12th R	9/11/90 - 11/11/91	12.0		58	94	106	108	106	112	96	101	95
1991/92	13th R	11/11/91 - 27/10/92	11.5		65	102	115	127	118	125	108	110	108
1992/93	14th R	27/10/92 - 18/10/93	11.7		65	109	114	116	117	124	111	104	108
1993/94	15th R	18/10/93 - 29/09/94	11.4		48	86	102	115	104	115	91	98	96
		Mean	11.9		62	101	116	124	122	127	107	110	108

Table 5 b: Sucrose % cane

Season	Crop	Growing period	Age (mths)		N Treatment						K Treatment		
					N0	N1	N2	N3	N4	N5	K0	K1	K2
1984/85	6th R	4/06/84- 7/06/85	12.1	K0	13.90	13.70	10.60	13.30	12.20	11.70			
				K1	13.30	13.60	12.80	11.80	12.60	12.70			
				K2	13.40	13.70	13.90	13.50	11.20	12.90			
				Mean	13.53	13.67	12.43	12.87	12.00	12.43			
1985/86	7th R	7/06/85 - 16/06/86	12.3		15.10	15.20	15.40	14.80	14.50	13.90	14.60	14.90	14.90
1986/87	8th R	30/10/86 - 28/10/87	12.0		15.40	16.10	15.60	15.60	15.40	15.40	15.40	15.80	15.60
1987/88	9th R	28/10/87 - 2/11/88	12.1		16.40	16.00	16.00	15.70	15.40	15.40	15.90	15.80	15.80
1988/89	10th R	1/11/88 - 1/11/89	12.0		14.60	15.40	15.10	14.80	14.00	14.30	14.50	14.90	14.70
1989/90	11th R	1/11/89 - 9/11/90	12.2		15.15	15.30	15.40	15.32	15.54	15.27	15.38	15.42	15.19
1990/91	12th R	9/11/90 - 11/11/91	12.0		15.78	16.28	15.80	15.70	15.25	15.98	15.92	16.12	15.35
1991/92	13th R	11/11/91 - 27/10/92	11.5		15.67	15.87	15.53	15.81	15.99	15.94	15.60	15.68	15.63
1992/93	14th R	27/10/92 - 18/10/93	11.7		15.42	15.45	15.01	14.86	15.09	14.71	14.95	15.31	15.01
1993/94	15th R	18/10/93 - 29/09/94	11.4		15.23	15.80	15.81	15.79	14.81	15.38	15.29	15.42	15.69
		Mean	11.9		15.42	15.71	15.52	15.38	15.11	15.14	15.28	15.48	15.[illegible]

Table 5 c: Sucrose yield (t/ha)

Season	Crop	Growing period	Age (mths)		N Treatment						K Treatment		
					N0	N1	N2	N3	N4	N5	K0	K1	K2
1984/85	6th R	4/06/84- 7/06/85	12.1	K0	12.5	14.4	15.5	16.4	19.1	19.0			
				K1	11.5	18.4	16.4	18.4	18.1	19.0			
				K2	11.6	17.7	18.3	22.3	17.6	19.1			
				Mean	11.9	16.8	16.7	19.0	18.3	19.0			
1985/86	7th R	7/06/85 - 16/06/86	12.3		11.9	17.5	18.7	21.6	21.8	22.0	19.0	18.5	19.2
1986/87	8th R	30/10/86 - 28/10/87	12.0		10.1	18.4	20.4	22.5	20.9	22.2	18.7	19.6	19.0
1987/88	9th R	28/10/87 - 2/11/88	12.1		9.6	15.4	19.0	18.4	18.5	18.0	16.2	16.8	16.4
1988/89	10th R	1/11/88 - 1/11/89	12.0		8.5	15.1	18.7	17.6	17.6	17.7	14.8	17.2	15.6
1989/90	11th R	1/11/89 - 9/11/90	12.2		9.6	14.2	16.8	18.7	18.9	19.0	15.6	16.6	16.4
1990/91	12th R	9/11/90 - 11/11/91	12.0		9.2	15.4	16.7	17.0	16.4	17.9	15.4	16.3	14.[illegible]
1991/92	13th R	11/11/91 - 27/10/92	11.5		10.2	16.2	17.7	20.1	18.8	18.7	16.7	17.3	16.8
1992/93	14th R	27/10/92 - 18/10/93	11.7		10.1	16.8	17.1	17.3	17.7	18.2	16.5	15.9	16.2
1993/94	15th R	18/10/93 - 29/09/94	11.4		7.3	13.6	16.1	18.2	15.4	17.7	14.0	15.1	15.1
		Mean	11.9		9.6	15.8	17.9	19.0	18.4	19.0	16.3	17.0	16.6