SOUTH AFRICAN SUGAR INDUSTRY

AGRONOMISTS' ASSOCIATION

EXPERIMENT RESULT

CODE: K13/90/SW/UBO 'K'

CAT.NO.: 1831

TITLE: LEVELS OF POTASSIUM APPLICATION FOR LATE SEASON CANE ON A 'K' SET SOIL

1. PARTICULARS OF PROJECT

This crop	:	2nd ratoon		
Site	:	Ubombo Ranches Field Block 1		
Region	:	Northern Irrigated (Swaziland)		
Design	:	Randomised block 6 replications		
Soil Set/Series:		'K' Kwezi		
Variety	:	N19		
Fertilizer	:	N	P	K
Total (Kg/ha)		160	40	See treatment

Soil Analysis: 06.11.90

pH	OM%	Clay%	Silt%	Sand%
7.4	3.03	59.5	11.5	20.6

ppm

P	Ko	Cao	Mgo	(Ca+Mg)/K
65	261	6027	1968	31

CEC : 53.5 meq/100g soil
KDI : 0.54

Date : 23.10.90-11.10.91
Age : 11.75 months

Rainfall : 287 mm
Irrigation: 855 mm
Total : 1142 mm

2. OBJECTIVES

2.1 To test the new FAS soil-K threshold for heavy clay soils when growing cane on a summer cycle.

2.2 To monitor leaf-K content during summer in relation to soil-K levels.

3. TREATMENTS

3.1 Potassium

K_o	K_1	K_2
0	175	350 kg K ha^{-1}

Potassium as KCl (50% K) was surface broadcast on 06.11.90, 2 weeks after harvest.

3.2 Notes on Treatments

Nitrogen as Urea (46% N) at the rate of 140 kg N ha^{-1} and MAP (11% N) at the rate of 20 kg N ha^{-1} was topdressed on the cane row on 06.11.90, 2 weeks after harvest.

Phosphorous as MAP (22% P) at the rate of 40 kg P ha^{-1} was surface broadcast on 06.11.90, 2 weeks after harvest .

3.4 Notes on soil sampling

Topsoil : 40 cores were taken in each plot at a ratio of 16 on row to 24 interow (i.e. 1:1,5).

Subsoil : 20 cores were taken from 3 selected plots in each of the control and the 350 kg K ha^{-1} treatment at a ratio of 8 on row to 12 interow (1:1,5).

4. RESULTS

4.1 Soil Analysis

Table 1: Properties of the soil profile - November 1990

Depth (cm)	Clay%	OM%	CEC meq/100g soil	TCEC meq/100g clay	KDI
0-15	59.5 (0.3)	3.0 (0.2)	53.50 (0.48)	89.9	0.54 (0.007)
20-30	62.3 (1.8)	2.6 (0.03)	58.29 (2.37)	93.6	0.64 (0.047)
40-50	61.7 (0.5)	2.2 (0.10)	64.06 (2.16)	103.8	0.66 (0.024)

( ) Standard error
Note: Samples taken from 3 control plots.

Table 2: K, Ca and Mg status (ppm) of the soil profile - November 1990

Depth (cm)	Control K	Ca	Mg	(Ca + Mg)/K	350 kg K ha^{-1} K	Ca	Mg	(Ca+Mg)/K
0-15	283 (40)	6057 (505)	1925 (45)	28	232 (27)	6000 (535)	2033 (64)	35
20-30	209 (23)	7527 (433)	2008 (121)	46	230 (27)	7770 (251)	1984 (50)	42
40-50	174 (20)	8213 (775)	2095 (118)	59	232 (13)	8373 (615)	2049 (17)	45

( ) Standard error
Note: Samples taken before fertilization from 3 plots in each of the control and 350 kg K ha^{-1} treatments.

Table 3: K, Ca and Mg status (ppm) of the topsoil - October 1991

Treatment	K	Ca	Mg	(Ca+Mg)/K
K_0 Control	273	6953	1897	32
K_1 175 kg K ha^{-1}	311	6553	1922	27
K_2 350 kg K ha^{-1}	348	7100	1837	26
LSD (0.05)	79	935	197	
(0.01)	112	1329	280	
Significance	NS	NS	NS	
Mean	311	6869	1886	
SE one plot	61	727	153	
CV%	19.7	10.6	8.1	

4.2 Harvest Data

No harvest data was available as this trial was cut in error by the Estate.

4.3 Leaf Analysis

Table 4: Third leaf analysis (% dm) at 3.5 months of age in February

Treatments	N	P	K	Ca	Mg
K_0 Control	1.66[D]	0.27	1.31	0.34	0.16
K_1 175 kg K ha^{-1}	1.67[D]	0.27	1.37	0.29	0.15
K_2 350 kg K ha^{-1}	1.67[D]	0.27	1.42	0.34	0.15
LSD (0.05)	0.070	0.007	0.13	0.070	0.012
(0.01)	0.10	0.018	0.18	0.10	0.017
Significance	NS	NS	NS	NS	NS
Mean	1.67	0.27	1.37	0.33	0.15
SE one plot	0.050	0.011	0.101	0.056	0.016
CV%	3.0	4.0	7.4	17.1	10.7

[D] Deficient

Table 5: Third leaf analysis (% dm) at 4.75 months of age in March

Treatments	N	P	K	Ca	Mg
K_0 Control	1.63	0.22	1.22	0.24	0.14
K_1 175 kg K ha^{-1}	1.62	0.22	1.23	0.25	0.16
K_2 350 kg K ha^{-1}	1.62	0.22	1.35	0.24	0.13
LSD (0.05)	0.041	0.006	0.11	0.030	0.014
(0.01)	0.058	0.009	0.16	0.050	0.019
Significance	NS	NS	*	NS	NS
Mean	1.62	0.22	1.27	0.24	0.14
SE one plot	0.024	0.008	0.088	0.018	0.017
CV%	1.5	3.6	7.0	7.5	12.2

5. COMMENTS

5.1 Soil Analysis

Soil-K status of the control was above the new FAS threshold for soils containing more than 40% clay, but the (Ca + Mg)/K ratio was high, indicating that the availability of K might be limited by the high content of Ca + Mg.

K treatments tended to increase soil-K content but the differences between the control and additional K rates were not significant.

Sampling at depth showed that there tended to be no difference in K content between the topsoil and the subsoil (Table 2). It was noted, however, that the TCEC values increased with depth, indicating that the mineralogical composition of the clay fraction changed. This means that the subsoil could contain a higher proportion of K bearing minerals than the topsoil and therefore the lack of difference in K content cannot necessarily be attributed to leaching of K.

If K moves downwards it is more likely to be because of the self mulching property of this swelling clay soil than through leaching.

It was of interest to note that while K remained more or less constant, the Ca and Mg content increased with depth. This resulted in an increase in the (Ca + Mg)/K ratio, indicating decreasing availability of K with depth.

5.2 Leaf Analysis

Leaf analysis at 3.5 and 4.75 months showed K content of the control to be well above threshold, thus confirming that the soil-K status was adequate. The K treatments were reflected in the leaf-K content and in March the response was significant.

The leaf content of the other nutrients was also found to be above threshold except for N which appeared to be suboptimal in February.

6. CONCLUSIONS

* Harvest data were not available for this trial and only leaf-K analysis could be used as an index of cane response.

* Leaf-K content in the control was found to be above threshold, confirming that the soil-K status of this soil was adequate and response to K would have been unlikely.

* Sampling at depth showed the subsoil to contain substantial reserves of K. Although mineralogical differences between subsoil and topsoil might account for the subsoil K reserves, the self mulching property of swelling clay soils is also likely to provide a means to replenish the root zone by a process of natural incorporation of surface applied fertilizer.

* This trial has been continued and is now in its 3rd ratoon.

PCH/vnm
16.03.92

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CAT No: 1831

TITLE: LEVELS OF POTASSIUM APPLICATION FOR LATE SEASON CANE ON A 'K' SET SOIL

1. PARTICULARS OF PROJECT

This crop	:	3rd ratoon			
Site	:	Ubombo Ranches Field Block 1			
Region	:	Northern Irrigated (Swaziland)			
Design	:	Randomized blocks 6 replications			
Soil Set/Series	:	'K' Kwezi			
Variety	:	N19			
Fertilizer	:	N	P	K	
Total (kg/ha)		160	-	See Treatment	

Soil Analysis: 23/10/91 (*May 1991)

pH	OM%	Clay%	Silt%	Sand%
6.9	2.6	62.0	12.6	24.0

ppm

P	K_o	Ca_o	Mg_o	(Ca+Mg)/K
81	257	6953	1897	34

CEC : 55.3 meq/100g soil*
KDI : 0.67*

Date : 11/10/91-28/08/92
Age : 11.6 months

Rainfall : 313 mm
Irrigation: 1286 mm
Total : 1599 mm

2. OBJECTIVES

2.1 To test the new FAS soil-K threshold for heavy clay soils when growing cane on a summer cycle.

2.2 To monitor leaf-K content during summer in relation to soil-K levels.

3. TREATMENTS

3.1 Potassium

K_o	K_1	K_2
0	175	350 kg K ha^{-1}

Potassium as KCl (50 % K) was surface broadcast and lightly incorporated with a springtine cultivator on 24/10/91, two weeks after harvest.

3.2 Notes on Treatments

Nitrogen as Urea (46 % N) at the rate of 160 kg N ha^{-1}, subdivided into two equal amounts of 80 kg N h^{-1} was topdressed on the cane row at 2 weeks and 2.7 months after harvest respectively.

3.3 Notes on Soil Sampling

Topsoil: 40 cores were taken in each plot at a ratio of 16 in row to 24 interow (ie. 1:1.5).

4. RESULTS

4.1 Soil Analysis

Table 1: K, Ca and Mg Status (ppm) of the Topsoil before and after Fertilization in October 1991 and May 1992 Respectively

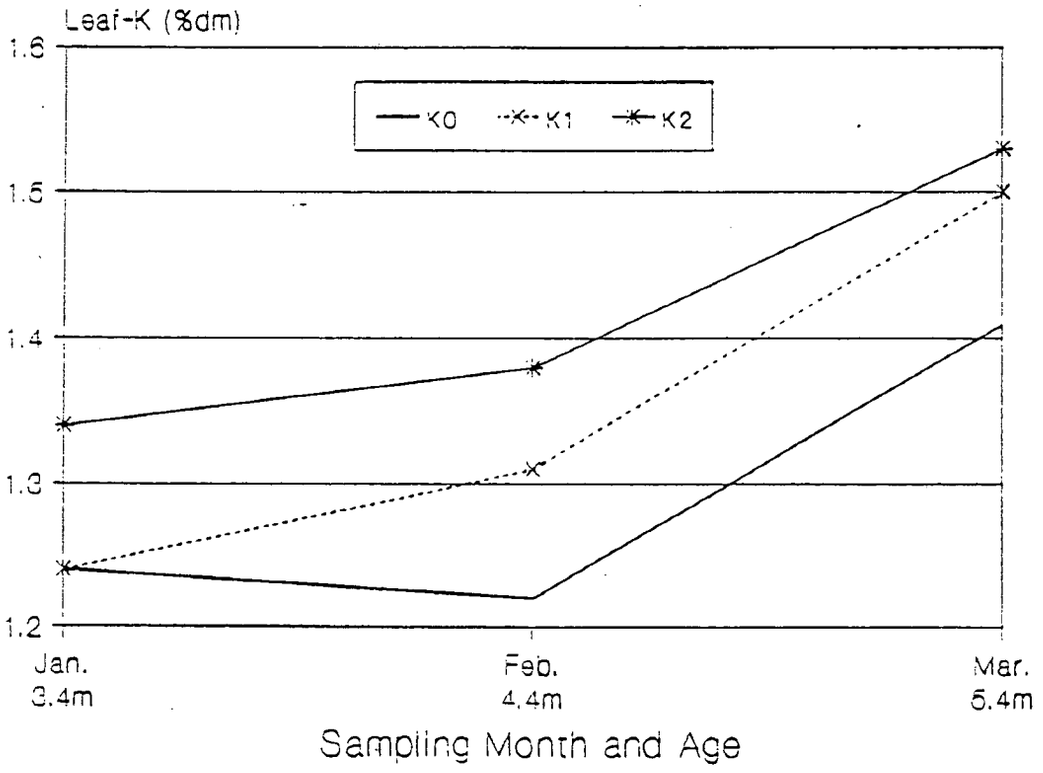
Treatment	October 1991				May 1992			
	K	Ca	Mg	(Ca+Mg)/K	K	Ca	Mg	(Ca+Mg)/K
K_0 Control	274	6953	1897	34	211	7530	1800	46
K_1 175 kg K ha^{-1}	311	6553	1923	28	243	7128	1871	38
K_2 350 kg K ha^{-1}	348	7100	1838	26	303	7248	1733	31
LSD (0.05)	79	934	197	9	37	634	261	6
Significance	NS	NS	NS	NS	**	NS	NS	**
Mean	311	6869	1886	29	252	7302	1802	38
S.E.D.	35.4	419.4	88.3	4.0	16.5	284.7	117.3	2.9
CV %	10.7	10.6	8.1	23.6	11.3	6.8	11.3	13.2

4.2 Leaf Analysis

Table 2: General Third Leaf Analysis (% dm) at 4.4 Months in February

Treatment	N	P	K	Ca	Mg
K_0 Control	1.50	0.30	1.22	0.26	0.19
K_1 175 kg K ha^{-1}	1.47	0.28	1.31	0.26	0.17
K_2 350 kg K ha^{-1}	1.46	0.28	1.38	0.31	0.18
LSD (0.05)	0.10	0.04	0.13	0.13	0.03
Significance	NS	NS	*	NS	NS
Mean	1.48	0.29	1.30	0.28	0.18
SE of Diff.	0.04	0.02	0.06	0.06	0.01
CV %	5.5	7.8	7.6	37.0	9.6

Figure 1: Effect of Season and Age on Third Leaf-K Content



4.3 Harvest Data

Table 3: Cane Yield, Cane Quality and Sucrose Yield

Treatment	TC ha^{-1}	Sucrose % Cane	T Suc ha^{-1}
K_0 Control	125	15.39	19.2
K_1 175 kg K ha^{-1}	116	15.80	18.3
K_2 350 kg K ha^{-1}	116	15.58	18.1
LSD (0.05)	11	0.65	1.4
Significance	NS	NS	NS
Mean	119	15.59	18.6
SE of Difference	5.2	0.29	0.6
CV %	7.5	3.3	6.0

5. COMMENTS

5.1 Soil Analysis

Soil K status of the control treatment was above the new F.A.S. threshold of 225 ppm for this soil (Table 1). The Ca+Mg/K ratio was also relatively high due to high Ca and Mg saturation. Soil K levels correctly reflected the different rates of K applied.

Soil analysis in May, 6,5 months after K application showed that the K level in the control had fallen below the threshold value. K levels also declined in the fertilized treatments but levels remained above the threshold value.

5.2 Leaf Analysis

Leaf analysis at 4,4 months of age in February showed that K, P, Ca and Mg content was satisfactory in all treatments but that N levels were apparently deficient. (Note Var. N19 has ±7% lower leaf N content than NCo376).

Leaf K content in the control treatment was above the threshold value at all sampling dates. K application increased leaf K content and correctly reflected the rates of K applied. (Note Var. N19 has ±6% higher leaf K content than NCo376).

5.3 Harvest Data

There were no statistically significant effects of K fertilizer application on cane yields in this trial although yields of the control tended to be higher than where K was applied. Sucrose content was not affected consistently by the treatments and effects on sucrose yields were therefore similar to the effects on cane yields.

6. CONCLUSIONS

* Soil and leaf K levels in the control treatment were above current threshold levels in this trial. There were no responses to applied K indicating that the threshold values were adequate under these conditions.

* Care should be taken in interpreting the leaf K levels in this trial since the variety was N19 and nutrient levels have been found to be different to NCo376.

* This trial has been terminated.

AGK/DMZ/fkn
27.10.92

Appendix 1 Effect of Season on Leaf-K, Ca and Mg

Sampling Date	January				February				March			
Cane Age (months)	3.4 m				4.4 m				5.4 m			
Treatment	K	Ca	Mg	(Ca+Mg)/K	K	Ca	Mg	(Ca+Mg)/K	K	Ca	Mg	(Ca+Mg)/K
K_0 Control	1.24	0.33	0.22	0.46	1.22	0.26	0.19	0.37	1.41	0.29	0.14	0.31
K_1 175 kg K ha^{-1}	1.24	0.33	0.24	0.47	1.31	0.26	0.17	0.33	1.50	0.29	0.14	0.29
K_2 350 kg K ha^{-1}	1.34	0.33	0.22	0.42	1.38	0.31	0.18	0.38	1.53	0.30	0.13	0.29
LSD (0.05)*	0.12	0.06	0.04	0.08	0.13	0.13	0.03	0.15	0.12	0.07	0.01	0.06
Significance	NS	NS	NS	NS	*	NS	NS	NS	NS	NS	*	NS
Mean	1.27	0.33	0.23	0.45	1.30	0.28	0.18	0.36	1.48	0.30	0.14	0.30
SE of Difference	0.05	0.03	0.02	0.04	0.06	0.06	0.01	0.07	0.05	0.03	0.004	0.03
CV %	7.3	13.2	10.5	13.3	7.6	37.0	9.6	32.2	5.9	17.2	5.7	14.7