SOUTH AFRICAN SUGAR INDUSTRY

AGRONOMISTS' ASSOCIATION

EXPERIMENT RESULT

CODE: K10/90/SW/SIM 'S'
CAT.NO. : 1828

TITLE: LEVELS OF POTASSIUM APPLICATION FOR EARLY SEASON CANE ON AN 'S' SET SOIL

1. PARTICULARS OF PROJECT

This crop	:	11th ratoon		
Site	:	Simunye Field 608		
Region	:	Northern Irrigated (Swaziland)		
Design	:	Randomised block with split plots, 6 replications		
Soil Set/Series:		'S' Somerling		
Variety	:	NCo376		
Fertilizer	:	N	P	K
Total (Kg/ha)		160	10	See treatment

Soil Analysis: 09.07.90

pH	OM%	Clay%	Silt%	Sand%
6.7	3.77	43.9	13.2	40.4

ppm

P	K_o	Ca_o	Mg_o	(Ca+Mg)/K
43	267	2652	1053	14

CEC : 25.5 meq/100g soil
KDI : 0.63

Date : 21.06.90-06.06.91
Age : 11.5 months

Rainfall : ?
Irrigation: Full
Total : -

2. OBJECTIVES

2.1 To test the new FAS soil-K threshold for winter cut cane grown on a heavy clay soil under irrigated conditions.

2.2 To determine the effect of low leaf-K content in Sept. - Oct. on yield and confirm the validity of downgrading leaf-K threshold for winter harvested cane.

2.3 To compare the efficiency of granular potassium fertilizer to that of a foliar solution to overcome low leaf-K content of Sept - Oct sampled leaves.

3. TREATMENTS

3.1 Whole plots (granular application)

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

Potassium as KCl (50% K) was surface broadcast on 09.07.90, 2.5 weeks after harvest.

3.2 Subplots (foliar application

F_o	0 kg K ha^{-1}	
F_2	10 kg K ha^{-1}	on 18.08.90
	15 kg K ha^{-1}	on 19.11.90
Total	35 kg K ha^{-1}	

Foliar solutions were 10% with respect to KCl (54% K commercial grade) and 0.7% with respect to Reverseal 10 (wetting agent).

3.3 Notes on Treatments

Nitrogen as Urea (46% N) at the rate of 80 kg N ha^{-1} was topdressed on the cane row on 13.07.90 and 15.10.90, 3.5 weeks and 3.75 months after harvest respectively.

Phosphorous as Single Supers (10.5%P) at the rate of 10 kg P ha^{-1} was surface broadcast on 31.07.90, 5 weeks after harvest .

Potassium foliar solutions were applied using a hand held spraying boom operating at 2.3 - 3 bars and fitted with twin jets TJ 60 - 8004 or TJ 60 - 6004 ('Teejet') depending on cane height.

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 - July 1990

Depth (cm)	pH	Clay%	OM%	CEC meq/100g soil	TCEC meq/100g clay	KDI
0-15	6.6 (0.09)	43.9 (0.46)	3.77 (0.26)	25.53 (0.39)	58.15	0.63 (0.017)
20-30	6.8 (0.044)	46.7 (1.06)	2.87 (0.09)	25.93 (1.02)	55.52	-
40-50	7.0 (0.017)	49.7 (2.97)	2.10 (0.06)	28.69 (1.35)	57.73	-

( ) Standard error
Note: Samples taken in 3 control plots

Table 2: K, Ca and Mg status (ppm) of the soil profile - January 1991

Depth (cm)	Control K	Ca	Mg	(Ca + Mg)/K	350 kg K ha^{-1} K	Ca	Mg	(Ca + Mg)/K
0-15	242 (32)	3090 (21)	817 (8)	16	280 (34)	3007 (208)	789 (17)	13
20-30	197 (4)	3087 (158)	841 (80)	20	227 (18)	2804 (176)	774 (10)	16
40-50	118 (3)	3323 (220)	888 (115)	36	146 (10)	3510 (78)	791 (20)	26

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

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

Treatment	K	Ca	Mg	(Ca+Mg)/K
K_0 Control	238	3017	911	16.5
K_1 175 kg K ha^{-1}	285	3100	757	13.5
K_2 350 kg K ha^{-1}	277	2889	806	13
LSD (0.05)	35	440	168	
(0.01)	50	626	239	
Significance	*	NS	NS	
Mean	267	3002	825	
SE one plot	27	342	130	
CV%	10.3	11.4	15.8	

4.2 Harvest Data

Table 4: Cane Yield, Sucrose % and Sucrose Yield

Treatment	TC ha^{-1}			% Sucrose			T Suc ha^{-1}		
	F_0	F_1	Whole plot	F_0	F_1	Whole plot	F_0	F_1	Whole plot
K_0 Control	141	151	146	15.09	15.34	15.23	21.3	23.2	22.2
K_1 175 kg K ha^{-1}	145	151	148	14.95	15.05	15.00	21.6	22.8	22.2
K_2 350 kg K ha^{-1}	149	149	149	15.11	15.24	15.17	22.4	22.8	22.6
Mean	145	151	148	15.05	15.22	15.13	21.8	22.9	22.3
Interaction F x K rates	NS			NS			NS		
LSD Whole plots (0.05)	7			0.53			1.2		
(0.01)	10			0.75			1.7		
Significance	NS			NS			NS		
LSD Sub plots (0.05)	12			0.29			1.8		
(0.01)	16			0.41			2.5		
Significance	NS			NS			NS		
LSD Sub plots in same (0.05)	21			0.51			3.1		
Whole plot (0.01)	28			0.71			4.3		
LSD Sub plots (0.05)	17			0.64			2.5		
in diff. whole plot (0.01)	23			0.90			3.6		
SE one plot	17			0.41			1.7		
CV%	11.4			2.7			11.2		

4.3 Leaf Analysis

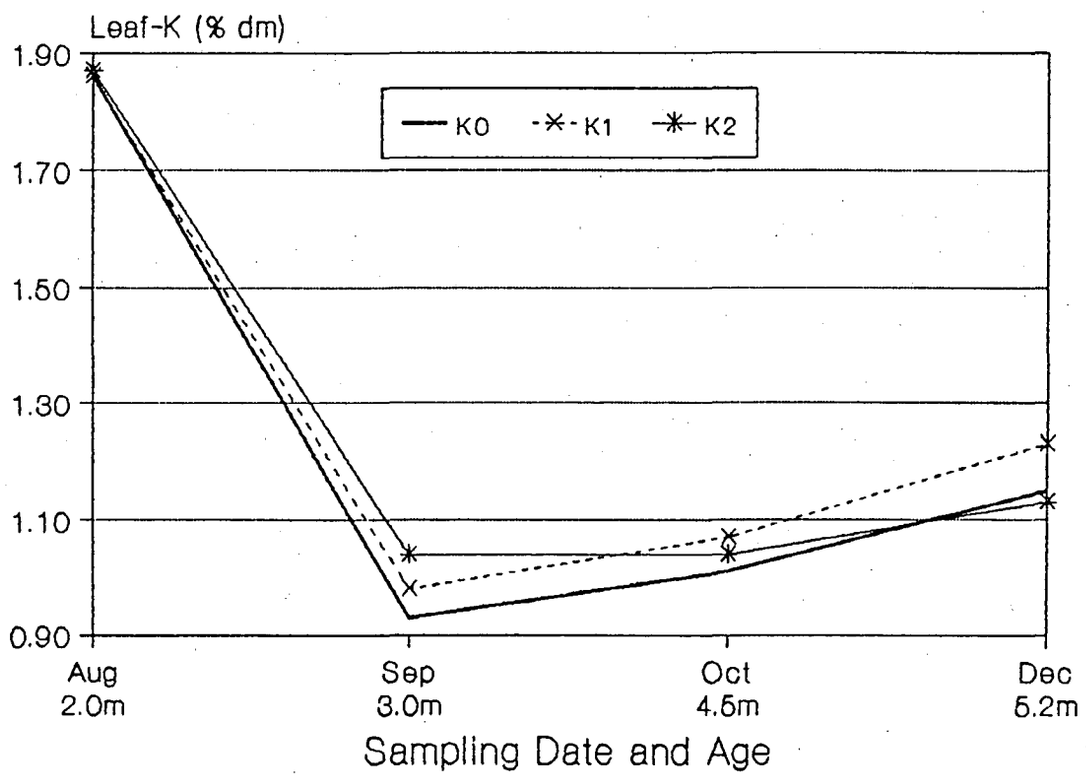
Table 5: Leaf Analysis (% dm) at 4.50 months of age in October

Treatments	N	P	K	Ca	Mg
K_o Control	2.32	0.23	1.01	0.36	0.25
K_1 175 kg K ha^{-1}	2.34	0.24	1.07	0.37	0.26
K_2 350 kg K ha^{-1}	2.30	0.23	1.04	0.39	0.24
LSD (0.05)	0.10	0.081	0.070	0.070	0.032
(0.01)	0.14	0.012	0.10	0.10	0.046
Significance	NS	*	NS	NS	NS
Mean	2.32	0.23	1.04	0.37	0.25
SE one plot	0.074	0.0087	0.070	0.050	0.021
CV%	3.2	3.8	6.7	13.5	8.6

Table 6: Effect of foliar K solution on 3rd leaf-K content (% dm)

Sampling month cane age Spray to sampling	September 3 m 4 weeks	December 5.25 m 3 weeks
F_1 cumulated	10 kg K ha^{-1}	25 kg K ha^{-1}
F_o	0.94	1.14
F_1	1.01	1.20
LSD (0.05)	0.063	0.067
(0.01)	0.088	0.093
Significance	*	NS

Figure 1: The effect of season on leaf-K content



5. COMMENTS

5.1 Soil Analysis

Soil-K status of the control was above the new FAS threshold for soils containing >40% clay.

Increasing K rates increased the soil-K status. The differences between the control and additional rates was significant. It is noted, however, that the high rate of K did not have a larger effect than the intermediate rate and errors in either weighing or application of the fertilizer cannot be ruled out.

Soil-K status of the control was below threshold in the subsoil and the (Ca + Mg)/K ratio increased, indicating decreasing availability of K with depth.

There was a trend for K in the soil profile to be higher where the high rate of K had been applied. The measurements of K content at depth were, however, less accurate in the 350 kg K ha^{-1} treatment than in the control and the differences could therefore be partly due to chance. There was a large difference in K content between the 0-15 cm and 40-50 cm layer indicating that leaching of K was slow. Hence, surface applied K might be positionally unavailable to the bulk of the root system.

5.2 Harvest data

Cane Yield

K treatments had no effect on cane yield.

Foliar application of K tended to increase cane yield but the response was not significant.

Cane Quality

Sucrose content was lower where K was applied but the reduction was not significant.

Foliar application of K tended to increase sucrose content but the difference was not significant.

Sucrose Yield

K treatments had no effect on sucrose yield.

Foliar application of K tended to increase sucrose yield but the response was not significant.

5.3 Leaf Analysis

Leaf K content of the control in October was well above the new FAS threshold. The content of the other nutrients was also above threshold (Table 5).

Leaf K showed the depression characteristic of winter cut cane (Fig 1) but the K content of the control remained above threshold. K treatments tended to increase leaf-K content but the responses were not significant (Appendix 1), confirming that surface applied was ineffective to supply K to the bulk of the root zone.

Foliar application of K tended to increase leaf-K content but the response was significant only in the case of the young cane (Table

6. CONCLUSIONS

* There were no yield response to granular K fertilizer.

* The use of foliar solution of KCL resulted in an apparent improvement of K uptake which tended to increase sucrose yield. It must be emphasized that the response was not significant and is not corroborated by previous experiments on the use of foliar sprays (Fol 1/81, Fol 2/82, K5/90, K6/90, K7/90).

* The new soil-K and leaf-K thresholds appeared to have been adequate for this soil. It was noted, however, that surface applied K might have been positionally unavailable and therefore potential yield responses may not have been realized. This is supported by the fact that yield tended to respond to foliar application.

* Evidence from soil and leaf analysis indicated that surface applied-K was ineffective as means of replenishing K to the bulk of the root system.

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

PCH/vnm
11.03.92

Appendix 1: Effect of season on leaf-K content (% dm)

Sampling date	18.08.90	18.09.90			15.10.90			07.12.90		
Cane age	2 m	3 m			4.50 m			5.25 m		
Treatment	Whole plot	F_0	F_1	Whole plot	F_0	F_1	Whole plot	F_0	F_1	Whole
K_0 Control	1.86	0.91	0.95	0.93	1.02	1.00	1.01	1.13	1.19	1.15
K_1 175 kg K ha^{-1}	1.86	0.98	0.98	0.98	1.09	1.05	1.07	1.23	1.22	1.23
K_2 350 kg K ha^{-1}	1.87	0.92	1.09	1.04	1.02	1.06	1.04	1.07	1.19	1.13
Mean	1.87	0.94	1.01	0.97	1.04	1.04	1.04	1.14	1.20	1.17
Interaction x rate	-	NS			NS			NS		
LSD whole 0.05	0.11	0.091			0.070			0.16		
plot 0.01	0.16	0.13			0.10			0.23		
Significance	NS	NS			NS			NS		
LSD subplot 0.05	-	0.063			0.050			0.067		
plot 0.01	-	0.088			0.069			0.093		
Significance	-	*			NS			NS		
SE one plot	0.088	0.091			0.070			0.097		
CV%	4.7	9.4			6.7			8.2		

Effect of season on leaf Ca content (% dm)

Treatment	W. plot	F_0	F_1	W. plot	F_0	F_1	W. plot	F_0	F_1	W. Plot
K_0 Control	0.42	0.43	0.46	0.44	0.37	0.35	0.36	0.21	0.19	0.20
K_1 175 kg K ha^{-1}	0.41	0.40	0.44	0.42	0.39	0.35	0.37	0.20	0.21	0.20
K_2 350 kg K ha^{-1}	0.41	0.45	0.44	0.44	0.46	0.32	0.39	0.20	0.20	0.20
Mean	0.41	0.43	0.45	0.43	0.41	0.34	0.37	0.20	0.20	0.20

Effect of season on leaf Mg content (% dm)

Treatment	W. plot	F_0	F_1	W. plot	F_0	F_1	W. plot	F_0	F_1	W. Plot
K_0 Control	0.28	0.23	0.24	0.23	0.25	0.24	0.24	0.28	0.28	0.28
K_1 175 kg K ha^{-1}	0.33	0.26	0.27	0.27	0.28	0.24	0.26	0.29	0.31	0.30
K_2 350 kg K ha^{-1}	0.32	0.24	0.25	0.24	0.26	0.22	0.24	0.30	0.29	0.29
Mean	0.31	0.24	0.25	0.25	0.26	0.23	0.25	0.29	0.29	0.29

SOUTH AFRICAN SUGAR INDUSTRY
AGRONOMISTS' ASSOCIATION

EXPERIMENT RESULT

CODE: K10/90/Sw/Sim 'S'
CAT No: 1828

TITLE: LEVELS OF POTASSIUM FOR EARLY SEASON CANE ON AN 'S' SET SOIL

1. PARTICULARS OF PROJECT

This crop	:	12th ratoon
Site	:	Simunye Field 608
Region	:	Northern Irrigated (Swaziland)
Design	:	Randomized block, 6 replications
Soil Set/Series	:	'S' Somerling
Variety	:	NCo376
Fertilizer Total (kg/ha)	:	N 140 - P - K See Treatment

Soil Analysis: 02/08/91 (*09/07/90)

pH	OM%	Clay%	Silt%	Sand%
6.5	-	44.1	14.7	40.2

ppm

P	Ko	Cao	Mgo	(Ca+Mg)/K
33	215	4093	785	23

CEC : 25,5 meq/100g soil*
KDI : 0.63*

Date : 06/06/91-18/06/92
Age : 12.4 months

Rainfall : 487 mm
Irrigation: 1042 mm
Total : 1529 mm

2. OBJECTIVES

2.1 To test the new FAS soil-K threshold for winter cut cane grown on a heavy clay soil under irrigated conditions.

2.2 To determine the effect of low leaf-K content in Sept - Oct on yield and confirm the validity of downgrading leaf-K threshold for winter harvested cane.

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 19/06/91, 1.9 weeks after harvest.

3.2 Notes on Treatments

Nitrogen as Urea (46 % N) at the rate of 140 kg N ha^{-1} was topdressed on the cane row in two amounts of 80 kg N ha^{-1} and 60 kg N ha^{-1}, 3.6 weeks and 3 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).

Subsoil: 20 cores were taken from three selected plots in each of the control and the 350 kg K ha^{-1} treatment at a ratio of 8 in row to 12 interow (1:1.5).

4. RESULTS

4.1 Soil Analysis

Table 1: K, Ca and Mg Status (ppm) of the Soil Profile - August 1991

Depth (cm)	Control				450 kg K ha^{-1}			
	K	Ca	Mg	(Ca+Mg)/K	K	Ca	Mg	(Ca+Mg)/K
0-15	215(13)	4093(191)	785 (28)	23	298(25)	4710(350)	802 (49)	18
20-30	151 (6)	4487(816)	846 (22)	36	174(25)	4719(134)	895 (23)	34
40-50	103 (4)	4670(231)	702(125)	52	121(15)	4803(368)	807 (47)	48

( ) Standard Error
NB: Samples taken after fertilization in 3 plots of each the control and the 350 kg K ha^{-1} treatment.

Table 2: K, Ca and Mg Status (ppm) of the topsoil - January 1992

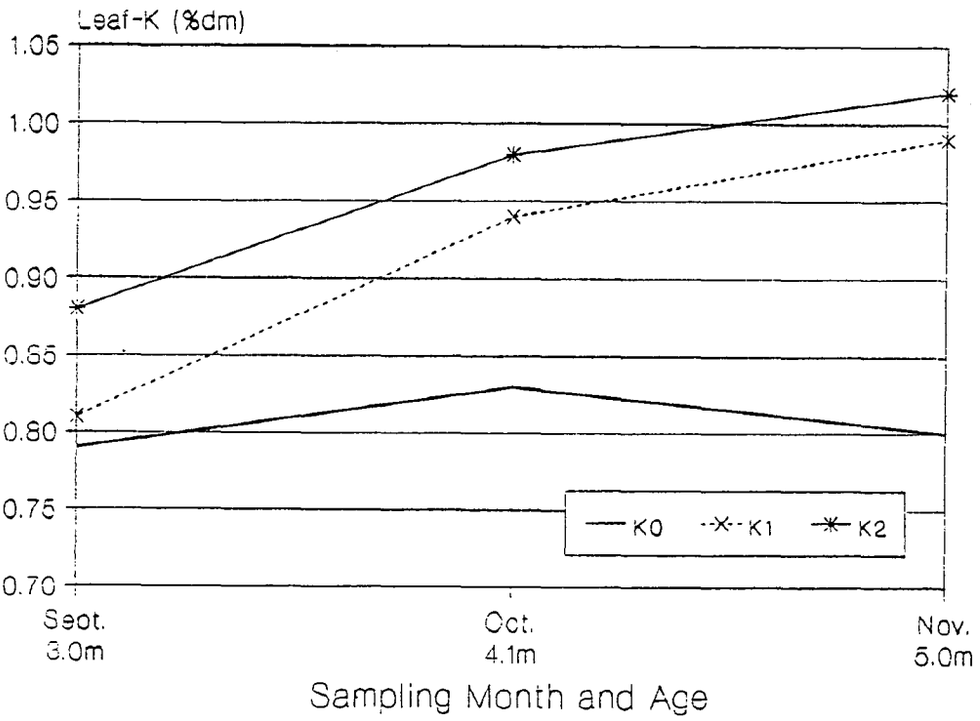
Treatment	K	Ca	Mg	(Ca+Mg)/K
	ppm			
K_0 Control	146	3123	855	28
K_1 175 kg K ha^{-1}	171	2982	831	23
K_2 350 kg K ha^{-1}	218	2951	823	17
LSD (0.05)	21	605	39	5
Significance	**	NS	NS	**
Mean	178	3019	836	23
S.E.D.	9.6	271.4	17.7	2.3
CV %	9.3	15.6	3.7	18.0

4.2 Leaf Analysis

Table 3: General Leaf Analysis (% dm) at 4 months in October

Treatment	N	P	K	Ca	Mg
K_0 Control	2.43	0.23	0.83	0.38	0.31
K_1 175 kg K ha^{-1}	2.47	0.23	0.94	0.38	0.28
K_2 350 kg K ha^{-1}	2.49	0.23	0.98	0.38	0.26
LSD (0.05)	0.06	0.01	0.08	0.06	0.04
Significance	NS	NS	**	NS	*
Mean	2.46	0.23	0.92	0.38	0.28
SE of Diff.	0.03	0.01	0.04	0.03	0.02
CV %	1.9	3.4	6.8	12.5	9.1

Figure 1: Effect of Season on Leaf-K Content



4.3 Harvest Data

Table 4: Cane Yield, Sucrose % Cane and Sucrose Yield

Treatment	TC ha^{-1}	Sucrose % Cane	T Suc ha^{-1}
K_0 Control	150	15.70	23.6
K_1 175 kg K ha^{-1}	149	15.26	22.7
K_2 350 kg K ha^{-1}	143	15.66	22.4
LSD (0.05)	15	0.60	2.5
Significance	NS	NS	NS
Mean	147	15.54	22.9
SE of Difference	6.6	0.27	1.1
CV %	7.7	3.0	8.4

5. COMMENTS

5.1 Soil Analysis

Soil analyses at this site have been variable over the duration of the trial and should be viewed with caution.

	11R		12R		13R	
	July 1990	Jan. 1991	Aug. 1991*	Jan. 1992	June 1992	
K_0	267 ppm	238	215	146 (137)	174	(166)
K_1	258 ppm	285	-	171 -	182	-
K_2	260 ppm	277	298	218 (212)	211	(205)

* Note only 3 out of 6 plots sampled.
( ) same 3 plots.

It appears that the K status of the control was below the threshold value of 225 ppm during the course of this 12th ratoon crop and that the Ca + Mg/K ratio was relatively high indicating a possible inhibition of K uptake (Table 1 and 2).

The reduction of K levels in all treatments to below the threshold by January 1992 is puzzling and seems unlikely considering the amounts of K applied. The subsequent increase in K levels by June 1992 is even more puzzling and casts doubts on the validity of these analyses.

5.2 Leaf Analysis

Levels of all nutrients except K were satisfactory in this trial (Table 1). K levels of the control treatment were low, reflecting the low soil status, and were consistently below the new interim threshold of 0,85% dm, for this time of the year. K levels were increased by the application of K fertilizer and reflected the different rates applied. The differences between the control and fertilized treatments increased with time over the sampling period. The addition of K reduced the uptake of Mg, particularly in October but had no significant effect on any other nutrients.

5.3 Harvest Data

There were no significant differences between treatments in terms of cane yields, sucrose content or sucrose yields in this trial.

6. CONCLUSIONS

* Soil K levels in the control treatments were below the new threshold of 225 ppm, in this trial and yet there were no yield responses to applied K.

* Leaf K levels in the control treatments were 0,79, 0,83 and 0,80 % dm in Sept., Oct. and Nov. respectively and a response would have been predicted using both the current threshold of 0,85% dm and the old threshold of 1,05% dm.

* The results of this trial should be viewed with caution in view of the apparently variable nature of soil K determinations.

* This trial will be observed closely and may be terminated due to variable soil analysis data.

AGK/DMZ/fkn
26.10.92

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

Sampling Date	04-09-91				09-10-91				07-11-91			
Cane Age (months)	3.0 m				4.1 m				5.0 m			
Treatment	K	Ca	Mg	(Ca+Mg)/K	K	Ca	Mg	(Ca+Mg)/K	K	Ca	Mg	(Ca+Mg)/K
K_0 Control	0.79	0.45	0.32	0.99	0.83	0.38	0.31	0.83	0.80	0.28	0.22	0.67
K_1 175 kg K ha^{-1}	0.81	0.46	0.31	0.96	0.94	0.38	0.28	0.71	0.99	0.29	0.20	0.52
K_2 350 kg K ha^{-1}	0.88	0.47	0.28	0.86	0.98	0.38	0.26	0.66	1.02	0.28	0.20	0.48
LSD (0.05)*	0.06	0.09	0.08	0.13	0.08	0.06	0.04	0.12	0.20	0.04	0.04	0.18
Significance	**	NS	NS	NS	**	NS	*	*	NS	NS	NS	NS
Mean	0.83	0.46	0.30	0.94	0.92	0.38	0.28	0.73	0.94	0.29	0.21	0.56
SE of Difference	0.03	0.04	0.04	0.06	0.04	0.03	0.02	0.05	0.09	0.02	0.02	0.08
CV %	5.1	15.4	20.3	11.3	6.8	12.5	9.1	11.9	16.5	12.0	11.5	25.7

SOUTH AFRICAN SUGAR INDUSTRY AGRONOMISTS' ASSOCIATION

Cat. No.: 1828

CODE: K10/90/Sw/Sim 'S'

TITLE: LEVELS OF POTASSIUM APPLICATION FOR EARLY SEASON CANE ON A 'S' SET SOIL

1. PARTICULARS OF PROJECT

This crop	: 13th Ratoon				
Site	: Simunye Field 608				
Region	: Northern Irrigated (Swaziland)				
Soil Set/Series	: 'S' Somerling				
Design	: Randomized blocks 6 replications				
Variety	: NCo376				
Fertilizer	: N	P	K		
Total (kg/ha)	:140	-	Treatment		

Soil Analysis: 22/06/91

pH	OM%	Clay %
6.5	-	44

ppm (control)

P	K	Ca	Mg	(Ca+Mg)/K
34	174	2754	912	21

CEC : 25.5 meq/100g soil
KDI : 0.63*

Dates : 18/06/92 - 14/06/93
Age : 11.9 months

Rainfall : 436 mm
Irrigation : 976 mm
Total :1412 mm

2. OBJECTIVES

2.1 To test the new FAS soil K threshold for winter cut cane grown on a heavy clay soil under irrigated conditions.

2.2 To determine the effect of low leaf K content in Sept - Oct on yield and to confirm the validity of downgrading leaf K threshold for winter harvested cane.

3. TREATMENTS

3.1 Notes on K treatments

K0	K1	K2
0	175	350 kg K/ha

Potassium as KCl (50% K) was broadcast 1 week after harvest.

3.2 Notes on Fertilizers

Nitrogen (Urea, 46% N) was applied on the cane row at the rate of 140 kg N/ha in two dressings: 47kg N/ha, 1 week after harvest and 93 kg N/ha, 3.7 months later.

Phosphorus (Superphosphate, 10.5% P) was applied on the cane row at 20 kg P/ha, 1 week after harvest.

3.3 Notes on Soil Sampling

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

Subsoil: 20 cores were taken in 3 randomly selected plots of the control and high K treatment (K2), at a ratio of 8 on row to 12 interrow (i.e. 1:1.5).

4. RESULTS

4.1 Soil Analysis

Table 1: P, K, Ca and Mg status (ppm) of the soil profile - June 1992

Depth (cm)	Control					350 kg K/ha				
	P	K	Ca	Mg	(Ca+Mg)/K	P	K	Ca	Mg	(Ca+Mg)/K
0 - 15	35	166	2860	1252	25	35	205	2820	1179	20
20 - 30	36	132	3157	1325	34	27	144	2680	1078	26
40 - 50	27	78	3513	1234	61	24	104	3377	1123	43

Samples were taken before fertilization in June

Table 2: P, K, Ca and Mg status (ppm) of the topsoil - June 1992

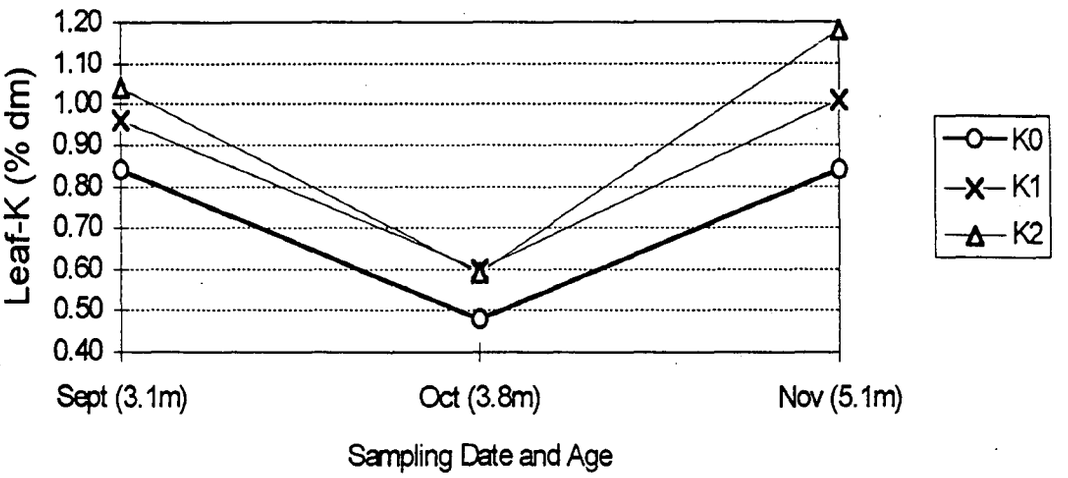
Treatment	ppm				(Ca+Mg)/K
	P	K	Ca	Mg	
Control	34	174	2754	912	21
K1 175 kg K/ha	40	183	2840	911	20
K2 350 kg K/ha	28	212	2647	887	18
Mean	34	190	2747	904	20

4.2 Leaf Analysis

Table 3: Third leaf nutrient analysis (% dm) at various ages

Treatment	% dm														
	September (3.1 months)					October (3.8 months)					November (5.1 months)				
	N	P	K	Ca	Mg	N	P	K	Ca	Mg	N	P	K	Ca	Mg
Control	2.33	0.20	0.84	0.51	0.34	1.85	0.20	0.48	0.44	0.32	2.02	0.21	0.84	0.39	0.33
K1 175 kg K/ha	2.42	0.21	0.96	0.49	0.29	1.92	0.21	0.60	0.44	0.29	2.04	0.22	1.01	0.37	0.30
K2 350 kg K/ha	2.40	0.21	1.04	0.47	0.27	1.87	0.20	0.59	0.43	0.29	2.04	0.22	1.18	0.34	0.26
LSD (0.05)	0.09	0.01	0.12	0.06	0.06	0.07	0.02	0.08	0.06	0.06	0.09	0.01	0.11	0.04	0.06
Significance	NS	NS	**	NS	NS	NS	NS	*	NS	NS	NS	NS	**	NS	*
Mean	2.38	0.21	0.94	0.49	0.30	1.88	0.20	0.56	0.44	0.30	2.03	0.22	1.01	0.37	0.30
SE Diff. ±	0.04	0.01	0.05	0.03	0.03	0.03	0.01	0.04	0.03	0.03	0.04	0.01	0.05	0.02	0.03
CV %	3.0	4.5	9.5	9.6	15.2	3.0	8.1	11.9	11.5	13.1	3.5	4.4	8.3	10.5	13.5

Figure 1: The effect of season on leaf K content



4.3 Growth Data

Table 4: Growth measurements

Treatment	Stalk Height (cm to TVD)			Stalk Population (* 1000/ha)		
	February 7.5 mth	April 9.6 mth	May 10.6 mth	February 7.5 mths	April 9.6 mths	May 10.6 mths
Control	165	232	254	187	120	114
K1 175kg K/ha	172	245	266	184	119	121
K2 350kg K/ha	175	249	263	180	120	119
Mean	171	242	261	184	120	118

4.4 Harvest Data

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

Treatment	TCane /ha	Suc. % Cane	TSuc/ ha
Control	115	15.35	17.6
K1 175 kg K/ha	130	15.15	19.8
K2 350 kg K/ha	132	14.97	19.7
LSD (0.05)	14	0.47	2.5
Significance	*	NS	NS
Mean	126	15.16	19.0
SE Difference ±	6.2	0.21	1.1
CV %	8.6	2.4	10.0

5. COMMENTS

5.1 Soil Analysis

The soil K level of the control was below the FAS threshold of 225 ppm (soil >40% clay) before fertilization, and a yield response was expected.

Soil Ca+Mg/K ratios were high, indicating that K uptake could possibility be inhibited.

Potassium levels of deeper soil layers of in the K2 treatment had been increased by applications of K, presumably as result of K leaching down the soil profile (tables 1&2).

5.2 Leaf Analysis

Third leaf nutrient levels of N, P, Ca and Mg were above their respective thresholds and no deficiencies occurred (table 3).

Leaf K levels of the control were below threshold levels in October and November. Responses to K treatments were therefore expected (table 3). Leaf K levels of treatments receiving K were significantly higher than levels of the control in all three months sampled and higher than the threshold level (0.85 %dm) in October. Differences between K1 and K2 were substantial in September and November and reflected the amounts of K applied.

Leaf K levels of all treatments declined sharply in October (figure 1). Leaf Ca and Mg levels were markedly reduced by K applications in September and November.

5.3 Growth Data

Applications of K improved cane height in February, April and May but effects on stalk population were inconsistent and variable (table 4).

5.4 Harvest Data

Yields in this trial were low compared to the previous season, probably due to irrigation restrictions (table 5).

Cane yields were significantly (P=0.05) improved by applications of K although there were no significant differences between rates of K.

Cane quality was apparently reduced by K treatments and although this response was consistent it was not statistically significant.

Sucrose yields were increased substantially by K treatments but the responses were not statistically significant, possibly due to the apparent negative effect on cane quality.

6. CONCLUSIONS

- Variability in soil P, K and Ca levels was high at this site. The field in which this trial is situated receives water contaminated with factory effluent, which might influence soil K levels. Care should therefore be taken in interpreting the yield trends in terms of the soil analysis.

- Soil and leaf K levels of the control were below threshold levels and responses to K applications were expected.

- Cane yields were significantly (P=0.05) improved by applications of K while increases in sucrose yields were not quite statistically significant.

- Results obtained from this trial confirm the current soil K threshold of 225 ppm.

- Yield results from this trial support leaf K threshold levels for November. Low leaf K levels in October had no apparent negative effect on yield and suggest that threshold levels for October may be too high under certain circumstances.

- This trial has been continued and it is now in its 14th ratoon.

DMZ/AJD/fkn
07.12.93

SOUTH AFRICAN SUGAR INDUSTRY
AGRONOMISTS' ASSOCIATION

CAT. NO.: 1828

CODE: K10/90/Sw/Sim 'S'

TITLE: LEVELS OF POTASSIUM APPLICATION FOR EARLY SEASON CANE ON A 'S' SET SOIL

1. PARTICULARS OF PROJECT

This crop	: 14th Ratoon					
Site	: Simunye Field 608					
Region	: Northern Irrigated (Swaziland)					
Soil Set/Series	: 'S' Somerling					
Design	: Randomized blocks 6 replications					
Variety	: NCo376					
Fertilizer	: N	P	K			
Total (kg/ha)	:140	20	Treatment			

Soil analysis: June 1993

pH	OM%	Clay %
6.5	3.77	44

ppm (control)

P	K	Ca	Mg	(Ca+Mg)/K
31	182	2928	965	21

CEC : 25.5 meq/100g soil
KDI : 0.63

Dates : 14/06/93 - 17/06/94
Age : 12.1 months

Full irrigation (overhead)

2. OBJECTIVES

2.1 To test the new FAS soil K threshold for winter cut cane grown on a heavy clay soil under irrigated conditions.

2.2 To determine the effect of low leaf K content in Sept. - Oct. on yield and to confirm the validity of downgrading leaf K thresholds for winter harvested cane.

3. TREATMENTS

Notes on K treatments

K0	K1	K2
0	175	350kg K/ha

Potassium as KCl (50% K) was broadcast 1 week after harvest.

4. FERTILIZERS AND SOIL SAMPLING

4.1 Notes on Fertilizers

Nitrogen (Urea, 46% N) was applied on the cane row at the rate of 140 kg N/ha in two dressings: 47kg N/ha 1 week after harvest and 93 kg N/ha 3 months after harvest.

Phosphorus (Superphosphate, 10.5% P) was applied on the cane row at 20 kg P/ha, 1 week after harvest.

4.2 Notes on Soil Sampling

Soil samples were taken before fertilization in June.

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

Subsoil: 20 cores were taken **in 3 randomly selected plots** of the control and high K treatment (K2), at a ratio of 8 on row to 12 interrow (i.e. 1:1.5).

5. RESULTS

5.1 Soil Analysis

Table 1: P, K, Ca and Mg status (ppm) of the soil profile - June 1993

Depth (cm)	Control					350 kg K/ha				
	P	K	Ca	Mg	(Ca+Mg)/K	P	K	Ca	Mg	(Ca+Mg)/K
0 - 15	33	150	2833	1079	26	21	202	2700	885	18
20 - 30	34	125	3363	1080	36	34	205	2963	907	19
40 - 50	22	88	3777	1076	55	28	94	3373	990	46

Table 2: P, K, Ca and Mg status (ppm) of the topsoil - June 1993

Treatment	ppm				(Ca+Mg)/K
	P	K	Ca	Mg	
Control	31	182	2928	965	23
K1 - 175 kg K/ha	36	282	2928	990	15
K2 - 350 kg K/ha	37	298	2810	932	13
LSD (0.05)	11	57	344	63	3
Significance	NS	**	NS	NS	**
Mean	35	254	2889	962	17
SE Diff ±	4.9	25.6	154.4	28.3	1.4
CV %	24.4	17.5	9.3	5.1	14.2

5.2 Leaf Analysis

Table 3 a: Third leaf nutrient analysis (% dm) in October and November

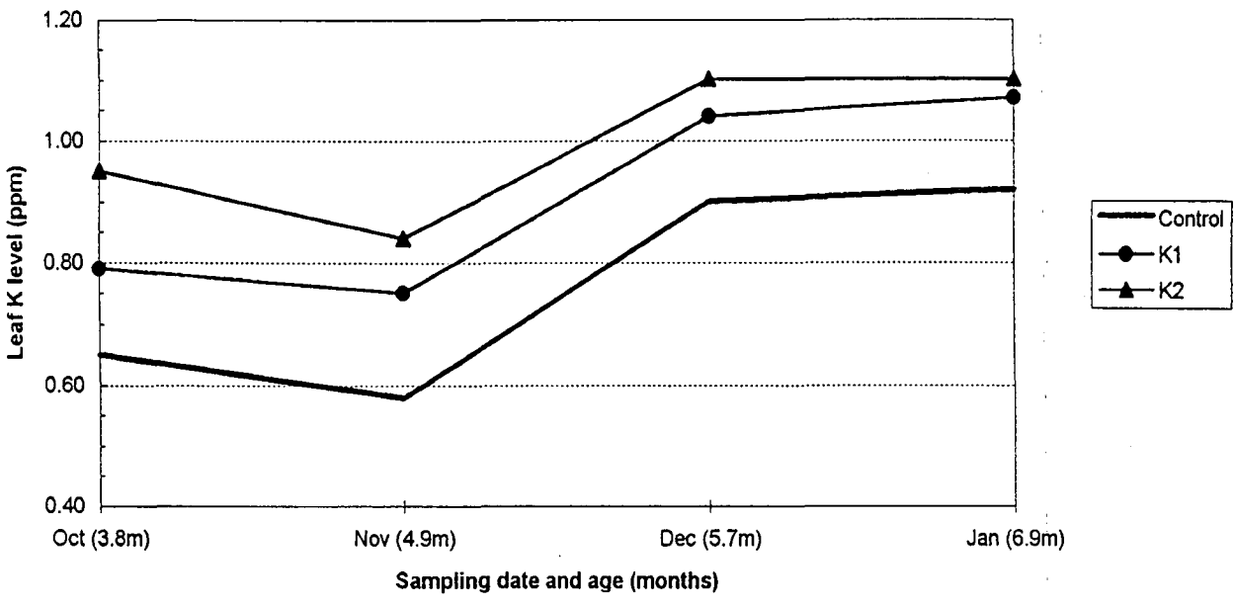
Treatment	% dm									
	October (3.8 months)					November (4.9 months)				
	N	P	K	Ca	Mg	N	P	K	Ca	Mg
Control	2.37	0.25	0.65	0.52	0.39	2.10	0.23	0.58	0.39	0.37
K1 - 175 kg K/ha	2.39	0.26	0.79	0.44	0.33	2.18	0.23	0.75	0.38	0.31
K2 - 350 kg K/ha	2.29	0.26	0.95	0.47	0.31	2.10	0.22	0.84	0.36	0.26
LSD (0.05)	0.09	0.02	0.12	0.08	0.05	0.10	0.02	0.08	0.07	0.05
Significance	NS	NS	**	NS	**	NS	NS	**	NS	**
Mean	2.35	0.26	0.80	0.47	0.34	2.13	0.22	0.72	0.38	0.31
SE Diff. ±	0.04	0.01	0.05	0.03	0.02	0.04	0.01	0.04	0.03	0.02
CV %	3.1	7.2	11.6	12.4	10.2	3.5	7.2	8.6	14.7	11.8

Table 3 b Third leaf nutrient analysis (% dm) in December and January

Treatment	% dm									
	December (5.7 months)					January (6.9 months)				
	N	P	K	Ca	Mg	N	P	K	Ca	Mg
Control	2.05	0.24	0.90	0.33	0.21	1.70	0.26	0.92	0.30	0.23
K1 - 175 kg K/ha	2.07	0.25	1.04	0.29	0.22	1.64	0.25	1.07	0.30	0.22
K2 - 350 kg K/ha	1.99	0.23	1.10	0.28	0.20	1.65	0.26	1.10	0.26	0.19
LSD (0.05)	0.09	0.01	0.13	0.04	0.04	0.10	0.02	0.18	0.04	0.04
Significance	NS	NS	*	NS	NS	NS	NS	NS	NS	NS
Mean	2.03	0.24	1.01	0.30	0.21	1.65	0.25	1.03	0.28	0.21
SE Diff. ±	0.04	0.01	0.06	0.02	0.02	0.04	0.01	0.08	0.02	0.02
CV %	3.5	3.7	9.8	11.5	14.8	4.7	4.8	13.6	11.2	13.3

NB: * Significant (P = 0.05)
** Significant (P = 0.01)

Figure 1: The effect of season on leaf K content



5.3 Growth Data

Table 4: Growth measurements

Treatment	Stalk Height (cm to TVD)		Stalk Population (* 1000/ha)	
	January (7 Months)	March (8.6 months)	January (7 Months)	March (8.6 Months)
Control	141	190	154	142
K1 - 175kg K/ha	154	210	160	147
K2 - 350kg K/ha	154	212	151	145
Mean	150	204	155	145

5.4 Harvest Data

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

Treatment	TCane /ha	Suc. % Cane	TSuc/ ha
Control	126	16.41	20.7
K1 - 175 kg K/ha	140	16.14	22.6
K2 - 350 kg K/ha	141	14.88	21.0
LSD (0.05)	16	2.61	5.2
Significance	NS	NS	NS
Mean	136	15.81	21.5
SE Difference ±	7.2	1.17	2.4
CV %	9.3	12.9	19.0

6. COMMENTS

6.1 Soil Analysis

The soil K level of the control treatment was below the FAS threshold of 225 ppm (soil >40% clay), before fertilization and a yield response was expected (table 2).

Soil K levels of treatments receiving K were above the current soil K threshold before fertilization, possibly as result of K applied during the previous years of running this trial. Soil K levels did not differ significantly from each other.

Ca+Mg levels in the soil were high, indicating that K uptake could possibly be inhibited.

Potassium levels in deeper soil layers of the K2 treatment had been increased by applications of K. This was more obvious at a depth of 20-30 cm than at 40-50 cm, indicating reduced levels of leaching in the deeper soil layers (table 1).

6.2 Leaf Analysis

Leaf N, P, Ca and Mg levels were generally satisfactory and no deficiencies of these nutrients were observed (table 3).

Leaf K levels in the control treatment were below the FAS threshold in all months sampled and a response to applications of K was expected.

Leaf K levels of the K1 treatment were below the current leaf K threshold in October and November (0.85% dm) and leaf K levels of the K2 treatment were below threshold in November. Treatments of K significantly improved leaf K levels in October, November ($P = 0.01$) and December ($P = 0.05$).

Leaf K levels were generally lower in November than in October and increased in December and January (figure 1).

6.3 Growth Data

Stalk height was generally improved by applications of K in January and March ($P = 0.05$), but effects on stalk population was inconsistent and variable (table 4).

6.4 Harvest Data

Cane yields were improved considerably by K treatments, although increases were not quite statistically significant. There was no significant difference between the different rates applied (table 5).

Cane quality was decreased by applications of K in this trial, especially by the K2 treatment. Sucrose yields were increased by applications of K but as result of the negative effect of increased K on cane quality, the yield of the K2 treatment was markedly lower than that of the K1 treatment. Variation in the yield results of both sucrose% cane as well as sucrose yield were high (CV's of 12.9% and 19% respectively) and results should be viewed with the necessary caution.

7. CONCLUSIONS

- Soil and leaf K levels of the control were below their respective thresholds and the responses to applied K that were obtained, were expected.

- Significant responses were obtained from the K1 treatment of this trial (soil K = 228 ppm) which indicate that for this soil the current soil K threshold of 225 ppm is too low and should be increased.

- Despite the fact that lower leaf K levels were observed in the K1 treatment than in the K2 treatment, sucrose yields in the K1 treatment were higher than those obtained from the K2 treatment. This confirms the validity of downgrading leaf K thresholds in October and November.

- This trial has been terminated and a summary of results from the 11th to the 14 th ratoon are attached.

DMZ/AJD/ppd
28.11.94

TERMINAL REPORT: TRIAL K10/90/Sw/Sim/'S'
11th to 14th ratoon

Notes on terminal report:

This trial was situated on a good, productive soil. Soil K levels of the control treatment declined below the FAS soil K threshold (225 ppm for soil >40% clay) after the plant crop, but remained at a steady level thereafter. This indicates that a fair amount of K was mineralized from the soil. Average leaf K levels for October were marginal in the K0 and K1 treatments, indicating that applications of K increased the availability of K to the plant. Yields were generally increased by applications of K except in 1991/92. Sucrose % cane of treatments receiving K were generally lower than those of the control. Sucrose yields were generally increased by applications of K and yields from the K1 treatment were often higher than those of the K2 treatment. This site was irrigated with water to which effluent from the sugar mill was added during the milling season. It is unfortunately not possible to determine the extent to which nutrients present in the water would have influenced results obtained from this trial.

Table 1: Soil analysis at plant

Analysis date	pH	KDI	OM%	CEC meq /100g soil	Clay%	Silt%	Sand%
21/6/90	6.6	0.63	3.77	25.53	44	13	40

Table 2: K, Ca and Mg status of the topsoil - 11 th to 14th ratoon.

Season	Crop	Analysis date	Treatment	ppm			(Ca+Mg)/K
				K	Ca	Mg	
1990/91	11th R	9/7/90 (BF)	K0	238	3017	911	17
			K1	285	3100	757	13.53
			K2	277	2889	806	13
			Mean	267	3002	825	14
1991/92	12th R	2/8/91 (AF)	K0	146	3123	855	28
			K1	171	2982	831	23
			K2	218	2951	823	17
			Mean	178	3019	836	23
1992/93	13th R	10/1/92 (AF)	K0	174	2754	912	21
			K1	183	2840	911	20
			K2	178	2647	887	18
			Mean	178	2747	903	20
1993/94	14th R	21/6/93 (BF)	K0	182	2928	965	23
			K1	282	2928	990	15
			K2	298	2810	932	13
			Mean	254	2889	962	17
			Mean K0	185	2956	911	22
			Mean K1	230	2963	872	18
			Mean K2	243	2824	1040	15

NB: BF = Before fertilization
AF = After fertilization

Table 3. Leaf Nutrients: Average levels for 4 crops - 11th to 14th ratoon

Month	No of crops	Age (mths)	N			P			K			Ca			Mg		
			K0	K1	K2	K0	K1	K2	K0	K1	K2	K0	K1	K2	K0	K1	K2
Sept	1	3	2.33	2.42	2.40	0.20	0.21	0.21	0.84	0.96	1.04	0.51	0.49	0.47	0.34	0.29	0.27
Oct	4	4	2.24	2.40	2.24	0.23	0.23	0.22	0.74	0.85	0.89	0.43	0.41	0.39	0.32	0.29	0.28
Nov	2	5	2.06	2.11	2.07	0.21	0.22	0.22	0.84	1.01	1.18	0.39	0.37	0.30	0.33	0.30	0.26
Mean			2.21	2.31	2.24	0.21	0.22	0.22	0.81	0.94	1.04	0.44	0.42	0.39	0.33	0.29	0.27

Table 4: Cane yield , sucrose % cane and sucrose yield - 11th to 14th ratoon

Crop	T Cane/ha			Sucrose % cane			T Sucrose/ha		
	K0	K1	K2	K0	K1	K2	K0	K1	K2
1990/91	146	148	149	15.23	15.00	15.17	22.2	22.2	22.6
1991/92	150	149	143	15.70	15.26	15.66	23.6	22.7	22.4
1992/93	115	130	132	15.35	15.15	14.97	17.6	19.8	19.7
1993/94	126	140	141	16.41	16.14	14.88	20.7	22.6	21.0
Mean	134	142	141	15.67	15.39	15.17	21.0	21.8	21.4