

SOUTH AFRICAN SUGAR INDUSTRY AGRONOMISTS' ASSOCIATION

CODE: VK2/01/Sw/Sim 'R'
CAT : 2204

VARIETAL RESPONSE TO K FERTILIZER ON AN 'R' SET SOIL

1. PARTICULARS OF PROJECT

This crop	: 2 nd Ratoon	Soil Analysis	: Date	May 2003		
Trial crop	: Terminated	pH	OM %	Clay %	Silt %	Sand %
Site	: RSSC (Simunye)	7.25	-	-	-	-
Field	: 604, Panel 3		ppm			
Region	: Northern Irrigated (Swd)	P	K	Ca	Mg (Ca+Mg)/K	
Soil Set	: 'R'	31	176	2912	1038	23
Design	: Randomised blocks with split plots, 4 reps	Age	: 12.1 months			
Variety	: NCo376, N23, N25	Date	: 17/10/2003-20/10/2004			
Fertilizer	: N P K	Irrigation	: Fully irrigated (surface drip)			
	180 - Treatment					

2. OBJECTIVES

- To determine the relative K fertilizer requirements of N23, N25 and NCo376 on an 'R' set soil in an early season cycle.
- To validate interim leaf K threshold correction factors for N23 and N25.
- To develop leaf K threshold values for N23 and N25 from variety x potassium yield response curves.

3. TREATMENTS

- Varieties and potassium treatments in this trial were as follows:

Potassium (main plots)

Kg K/ha
0
75
150
225
300

Varieties (sub plots)

NCo376
N23
N25

- Potassium (KCL, 50% K) was broadcast on the cane row 4 weeks after harvest.

4. FERTILIZERS AND SOIL SAMPLING

- Nitrogen (Urea, 46% N) at the rate of 180 Kg N/ha was applied in two applications: 100 Kg N/ha was applied on the cane row 4 weeks after harvest, followed by a top-dressing of 80 Kg N/ha 16 weeks after harvest.
- Top soil samples for the analysis of P, K, Ca and Mg were taken in October before fertilizer application.

5. RESULTS AND DISCUSSION

Soil Analysis

- The soil K levels were above the current SSA summer threshold of 150 ppm for all treatments. According to SSA fertilizer recommendations, no response could therefore be expected. There were no significant differences in the levels of P, K, Ca and Mg amongst treatments (Table 1).

Table 1: P, K, Ca and Mg status (ppm) of the topsoil before fertilization – October 2003

Treatment (Kg N/ha)	ppm					(Ca+Mg)/K
	P	K	Ca	Mg	Ca+Mg	
Control	30	183	3288	1046	4334	24
75 K	31	169	2843	1071	3914	23
150 K	33	189	2744	1018	3762	20
225 K	32	163	2844	1006	3850	24
300 K	28	178	2843	1049	3892	22
Mean	31	176	2912	1038	3950	23
LSD (0.05)	NS	NS	NS	NS	-	-
CV%	25.1	12.7	22.9	6.4	-	-

Leaf Analysis

- Results from leaf samples in February and March indicated that levels of N, P, K, Ca and Mg were adequate and above the SSA threshold values (Table 2). There were no significant differences in nutrient levels among treatments for all nutrients.
- The third leaf K values for February and March were above the threshold making it less precise to predict yield response.

Table 2: Third leaf nutrient analyses (%dm) in January to March

Treatment (kg K/ha)	N			P			K			Ca			Mg		
	Jan. (2.7m)	Feb. (3.7m)	Mar. (4.8m)	Jan. (2.7m)	Feb. (3.7m)	Mar. (4.8m)	Jan. (2.7m)	Feb. (3.7m)	Mar. (4.8m)	Jan. (2.7m)	Feb. (3.7m)	Mar. (4.8m)	Jan. (2.7m)	Feb. (3.7m)	Mar. (4.8m)
Control	1.89	1.87	1.86	0.23	0.23	0.25	0.82	1.07	1.28	0.30	0.32	0.26	0.28	0.27	0.31
75 K	1.87	1.88	1.88	0.22	0.23	0.24	0.76	1.03	1.27	0.32	0.31	0.24	0.28	0.25	0.3
150 K	1.88	1.88	1.88	0.23	0.23	0.24	0.80	1.08	1.43	0.31	0.32	0.22	0.27	0.24	0.27
225 K	1.90	1.88	1.87	0.22	0.23	0.24	0.81	1.14	1.34	0.30	0.32	0.22	0.28	0.26	0.27
300 K	1.89	1.88	1.87	0.23	0.23	0.24	0.81	1.07	1.36	0.30	0.32	0.22	0.26	0.25	0.27
Mean	1.89	1.88	1.87	0.23	0.23	0.24	0.80	1.08	1.34	0.31	0.32	0.23	0.27	0.25	0.28
LSD(0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
LSD(0.01)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CV%	1.5	1.6	1.5	2.8	3.2	3.8	6.8	3.9	5.8	8.7	5.7	23.5	10.2	6.3	10.7

Growth Measurements

- There were no significant differences in stalk population among varieties and treatments at harvest, suggesting that K treatments had no effect on stalk population.
- There were no significant differences in stalk height among varieties and treatments at harvest. This implies that K treatments did not improve stalk height. Although not significant, K applied at 75Kg K/ha produced the tallest stalks.

Table 3: Growth measurements at various ages

Stalk population ('000/ha)																												
Variety	Jan. (2.8m)						Var.	Apr. (6.2m)						Var.	Jun. (8.0m)						Var.	Aug. (10.1m)						Var.
	Cont.	75K	150K	225K	300K	Mean		Cont.	75K	150K	225K	300K	Mean		Cont.	75K	150K	225K	300K	Mean		Cont.	75K	150K	225K	300K	Mean	
NCo376	203	205	204	223	224	212	135	136	134	136	145	137	133	126	124	129	120	126	138	121	125	123	131	128				
N23	173	202	169	179	195	184	130	137	141	138	126	134	121	112	116	130	130	122	129	125	130	125	125	127				
N25	200	213	185	186	209	199	128	111	124	117	132	122	123	117	124	115	124	121	119	108	115	116	128	117				
Mean	192	207	186	196	209	198	131	128	133	130	134	131	126	118	121	125	125	123	129	118	123	121	128	124				
Interaction	NS						NS						NS						NS									
K Trt(0.05)	NS						NS						NS						NS									
LSD (0.01)	-						-						-						-									
Var. (0.05)	15						10						NS						NS									
LSD (0.01)	20						NS						-						-									
CV %	11.4						11.7						13.4						12.4									
Stalk height (cm to TVD)																												
Variety	Jan. (2.8m)						Var.	Apr. (6.2m)						Var.	Jun. (8.0m)						Var.	Aug. (10.1m)						Var.
	Cont.	75K	150K	225K	300K	Mean		Cont.	75K	150K	225K	300K	Mean		Cont.	75K	150K	225K	300K	Mean		Cont.	75K	150K	225K	300K	Mean	
NCo376	53	48	45	47	45	48	234	219	245	230	214	228	279	269	274	265	253	268	276	274	269	266	258	269				
N23	51	52	52	55	49	52	221	231	226	216	219	223	264	275	272	249	256	263	259	279	263	247	263	262				
N25	51	52	54	53	60	54	231	232	228	226	229	229	253	267	266	261	268	263	266	269	267	265	272	268				
Mean	52	51	50	52	51	51	229	227	233	224	221	227	265	270	271	258	259	265	267	274	266	259	264	266				
Interaction	NS						NS						NS						NS									
K Trt(0.05)	NS						NS						NS						NS									
LSD (0.01)	-						-						-						-									
Var. (0.05)	4						NS						NS						NS									
LSD (0.01)	5						-						-						-									
CV %	11.1						8.2						5.3						4.2									

* = statistically significant (P=0.05)

** = statistically significant (P=0.01)

Pests and Diseases

- All varieties were affected by eldana at harvest and there were no statistical differences among varieties (Table 4).
- NCo376 had significantly higher smut levels than the other varieties.

Table 4: Eldana damage at harvest and smut levels in February

Variety	Eldana	% Smut whips
	% Int. damaged	Feb. (3.7m)
NCo376	0.18	2.36
N23	0.10	0.03
N25	0.08	0.47
Mean	0.12	0.95
LSD (P=0.05)	NS	0.39
LSD (P=0.01)	-	0.52
CV %	164.2	62.9

Harvest Results

- All varieties responded negatively to potassium application in terms of cane yields. This implies that K treatments significantly reduced cane yields, suggesting that as indicated in the soil nutrient levels, no K needed to be applied. While NCo376 and N23 were statistically similar, N25 produced significantly higher cane yields.
- Potassium application did not significantly improve the cane quality (sucrose % cane and erc % cane) of all varieties. While the cane quality of NCo376 and N25 was the same, N23 had significantly the highest cane quality. There was no interaction.
- There were no significant differences in sucrose and erc yields among treatments, implying that potassium application did not improve yields, but instead decreased both sucrose and erc yields (Table 5). N25 produced significantly higher sucrose and erc yields than the other varieties, which were statistically similar.

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

Treatment	Tone/ha					Suc. % cane					Tone/ha					Erc % cane					Tone/ha									
	Cont	75K	150K	225K	300K	Var. Mean	Cont	75K	150K	225K	300K	Var. Mean	Cont	75K	150K	225K	300K	Var. Mean	Cont	75K	150K	225K	300K	Var. Mean						
NCo376	109	98	101	95	98	100	15.9	15.3	16.0	16.2	16.0	16.0	17.4	15.6	16.1	15.5	15.7	16.1	14.5	14.2	14.6	14.9	14.7	14.6	15.3	14.2	14.7	14.2	14.4	14.7
N23	106	101	100	92	96	99	17.2	16.6	16.5	17.1	16.8	16.8	18.2	16.8	16.3	15.8	16.2	16.7	15.9	15.2	15.1	15.8	15.4	15.5	16.8	15.4	15.1	14.6	14.9	15.4
N25	125	116	116	115	120	118	15.9	15.5	16.0	16.3	16.4	16.0	19.8	17.9	18.5	18.7	19.7	18.9	14.4	14.0	14.6	14.8	15.1	14.6	18.0	16.3	16.9	17.0	18.1	17.3
Mean	115	105	106	101	105	106	16.3	16.0	16.2	16.5	16.4	16.5	18.5	16.8	17.0	16.7	17.2	17.2	14.9	14.5	14.8	15.2	15.1	14.9	16.9	15.3	15.6	15.3	15.8	15.8
Interaction	NS					NS					NS					NS														
LSD Potassium (0.05)	7					NS					NS					NS														
LSD Potassium (0.01)	NS					-					-					-														
LSD Variety (0.05)	7					0.3					1.0					0.33														
LSD Variety (0.01)	9					0.4					1.4					0.44														
LSD subplot in same whole plot (0.05)	NS					NS					NS					NS														
LSD subplot in diff. whole plot (0.05)	NS					NS					NS					NS														
CV%	9.3					2.8					9.2					3.4														

6. CONCLUSIONS

- Potassium application at all rates in this trial reduced sucrose and erc yields. Cane yields were also reduced by potassium treatments.
- Soil K levels of all treatments were above the SSA threshold value and statistically similar among treatments, making it less likely to expect yield responses. Leaf K levels from February to March were above threshold values for all treatments, making it difficult to predict yield responses from K application.
- This trial has been terminated.

7. APPENDIX

Appendix 1: Sample data

Potassium Treatment	Fresh wt. (g/stalk)						Moisture (% cane)						Dry wt. (g/stalk)					
	Cont.	75 K	150 K	225 K	300 K	Var. Mean	Cont.	75 K	150 K	225 K	300 K	Var. Mean	Cont.	75 K	150 K	225 K	300 K	Var. Mean
NCo376	813	842	843	815	770	817	69.3	69.8	69.8	69.3	70.3	69.7	249.8	254.6	255.1	250.1	229.6	247.8
N23	786	793	746	766	797	778	69.5	69.8	69.0	69.8	70.0	69.6	239.7	239.8	231.3	232.2	239.0	236.4
N25	1074	1090	996	969	972	1020	70.3	70.0	69.5	69.8	69.8	69.9	319.6	327.0	302.9	292.3	293.6	307.1
Mean	891	908	862	850	846	871	69.7	69.9	69.4	69.6	70.0	69.7	269.7	273.8	263.1	258.2	254.1	263.8
Interaction	NS						NS						NS					
LSD Potassium (0.05)	NS						NS						NS					
LSD Potassium (0.01)	-						-						-					
LSD Variety (0.05)	52						NS						16.53					
LSD Variety (0.01)	70						-						22.29					
LSD subplot in same whole plot (0.05)	NS						NS						NS					
LSD subplot in same whole plot (0.01)	-						-						-					
LSD subplot in diff. whole plot (0.05)	NS						NS						NS					
LSD subplot in diff. whole plot (0.01)	-						-						-					
CV%	9.2						1.8						9.7					
Potassium Treatment	Purity (% cane)						Sucrose (% cane)						Ere (% cane)					
	Cont.	75 K	150 K	225 K	300 K	Var. Mean	Cont.	75 K	150 K	225 K	300 K	Var. Mean	Cont.	75 K	150 K	225 K	300 K	Var. Mean
NCo376	90.4	91.1	90.8	91.6	90.8	90.9	15.9	15.5	16.0	16.2	16.0	16.0	14.5	14.4	14.6	14.9	14.7	14.6
N23	91.7	91.7	91.1	91.8	91.6	91.6	17.2	16.6	16.5	17.1	16.8	16.8	15.9	15.2	15.1	15.8	15.4	15.5
N25	89.2	89.6	91.0	89.7	91.7	90.2	15.9	15.5	16.0	16.3	16.4	16.0	14.4	14.0	14.6	14.8	15.1	14.6
Mean	90.4	90.8	91.0	91.0	91.4	90.9	16.3	16.0	16.2	16.5	16.4	16.3	14.9	14.5	14.8	15.2	15.1	14.9
Interaction	NS						NS						NS					
LSD Potassium (0.05)	NS						NS						NS					
LSD Potassium (0.01)	-						-						-					
LSD Variety (0.05)	0.85						0.30						0.33					
LSD Variety (0.01)	NS						0.40						0.44					
LSD subplot in same whole plot (0.05)	NS						NS						NS					
LSD subplot in same whole plot (0.01)	-						-						-					
LSD subplot in diff. whole plot (0.05)	NS						NS						NS					
LSD subplot in diff. whole plot (0.01)	-						-						-					
CV%	1.5						2.8						3.4					
Potassium Treatment	Sucrose wt. (g/stalk)						Ere wt. (g/stalk)						Sucrose (% dm)					
	Cont.	75 K	150 K	225 K	300 K	Var. Mean	Cont.	75 K	150 K	225 K	300 K	Var. Mean	Cont.	75 K	150 K	225 K	300 K	Var. Mean
NCo376	129.4	133.1	134.9	132.2	123.6	130.6	117.7	121.7	123.2	121.4	113.0	119.4	51.8	52.3	53.0	52.9	53.9	52.8
N23	135.5	131.0	123.5	130.9	133.5	130.9	124.8	120.4	113.2	120.6	122.7	120.3	56.5	54.8	53.4	56.7	56.0	55.5
N25	170.6	169.4	158.9	157.1	160.0	163.2	154.2	153.4	145.2	142.3	147.2	148.5	53.5	51.7	52.4	53.8	54.4	53.2
Mean	145.2	144.5	139.1	140.1	139.0	141.6	132.2	131.8	127.2	128.1	127.6	129.4	53.9	52.9	52.9	54.5	54.8	53.8
Interaction	NS						NS						NS					
LSD Potassium (0.05)	NS						NS						NS					
LSD Potassium (0.01)	-						-						-					
LSD Variety (0.05)	8.83						8.31						1.83					
LSD Variety (0.01)	11.91						11.21						NS					
LSD subplot in same whole plot (0.05)	NS						NS						NS					
LSD subplot in same whole plot (0.01)	-						-						-					
LSD subplot in diff. whole plot (0.05)	NS						NS						NS					
LSD subplot in diff. whole plot (0.01)	-						-						-					
CV%	9.7						10.0						5.3					