AV

SOUTH AFRICAN SUGAR INDUSTRY

AGRONOMISTS' ASSOCIATION

EXPERIMENT RESULT 1993
AND TERMINAL REPORT

CODE: VM 4/88/SW/Ubo 'V'
CAT. NO.: 1714

TITLE: VERTICAL MULCHING IN SOILS WITH POOR PHYSICAL PROPERTIES

1. PARTICULARS OF PROJECT

This crop	: 4th Ratoon				
Site	: Ubombo Ranches Field Citrus				
Region	: Northern Irrigated (Swaziland)				
Soil Set	: 'V'				
Design	: Randomised Blocks 3 replications				
Variety	: N14				
Fertilizer (kg/ha)	: N :160	P -	K 150		

Soil Analysis: Date 01/12/92

pH	OM%	Clay %
7.4	2.5	66

ppm (control)

P	K	Ca	Mg	(Ca+Mg)/K
113	236	9374	1249	48

CEC : 60.51 meq/100g soil

Age : 12.2 months
Dates : 19/11/92 - 26/11/93

Rainfall : 195 mm
Irrigation : 1076 mm (overhead)
Total : 1271 mm

2. OBJECTIVES

2.1 To establish whether the practice of vertical mulching can improve production of sugarcane on soils which have poor physical properties.

2.2 To determine which of the most freely available materials (top-soil, sand or milo) is the more suitable to use as a vertical mulch.

2.3 To determine the importance of adequate drainage for vertical mulched crops.

3. TREATMENTS

The following treatments were applied to undrained (Do) and drained (D1) subtreatments in the plant crop. In the drained subtreatments the vertical mulched channels were connected to sand filled slotted drains to create a mole drain effect.

1. Control - no mulching.
2. Vertical mulching with top soil fed down the profile.
3. Vertical mulching with 150 tons/ha of river sand fed down the profile.
4. Vertical mulching with 150 tons/ha of fresh milo fed down the profile.
5. Vertical mulching with 10 tons/ha of gypsum fed down the profile.

3.1 Notes on Treatments

Planting ridges (as practised in Simunye) were made prior to the application of treatments.

Sand, milo and gypsum were evenly spread by hand into the furrow on top of the ridge in the appropriate plots and incorporated with a rotary hoe prior to drawing the alubuster (implement with which mulching material was fed down the soil profile).

The VM + top soil treatment was also rotavated.

Control plots were left undisturbed.

3.2 Notes on Fertilizers

Nitrogen (Urea, 46% N) at 160kg N/ha was banded on the cane row 2 weeks after harvest.

Potassium (KCl, 50% K) at 150kg K/ha was broadcast 2 weeks after harvest.

3.3 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) 2 weeks after harvest.

Subsoil: 20 cores were taken from 3 selected plots in the control and milo treatment at a ratio on 8 on row to 12 interrow (1:1.5),2 weeks after harvest.

4. RESULTS

4.1 Soil Analysis

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

	P			K			Ca			Mg			(Ca+Mg)/K		
Treatment	D0	D1	Mean	D0	D1	Mean	D0	D1	Mean	D0	D1	Mean	D0	D1	Mean
Control	76	61	69	252	207	229	9240	9967	9603	1364	1284	1324	45	56	50
VM + topsoil	67	187	127	240	194	217	9723	8973	9348	1294	1470	1382	47	54	50
VM + river sand	68	65	66	254	246	250	8750	8043	8397	1094	1260	1177	41	43	42
VM + milo	173	177	175	287	251	269	9107	0117	9612	1301	1317	1309	41	49	45
VM + gypsum	160	94	127	209	217	213	9717	0103	9910	1100	1001	1050	52	52	52
Mean	109	117	113	248	223	236	9307	9441	9374	1231	1266	1249	45	51	48

Table 2: K, Ca and Mg status (ppm) of the soil profile - December 1992

Depth	Control					150 tons/ha Milo				
(cm)	P	K	Ca	Mg	(Ca+Mg)/K	P	K	Ca	Mg	(Ca+Mg)/K
0 - 15	59	251	9580	1143	43	103	254	9787	1265	44
20 - 30	30	204	9567	1305	53	87	231	10413	1339	51
40 - 50	18	192)	9313	1510	56	42	191	9260	1422	56

4.2 Leaf Analysis

Table 3: Third leaf nutrient analysis (% dm) in February at 2.8 months

Treatment	N			P			K			Ca			Mg		
	D0	D1	Mean	D0	D1	Mean	D0	D1	Mean	D0	D1	Mean	D0	D1	Mean
Control	1.94	1.83	1.89	0.22	0.21	0.22	0.78	0.95	0.86	0.53	0.50	0.52	0.34	0.28	0.31
VM + topsoil	1.97	1.91	1.94	0.20	0.21	0.20	0.83	0.90	0.87	0.54	0.49	0.52	0.32	0.30	0.31
VM + river sand	1.91	1.89	1.90	0.21	0.20	0.21	0.93	0.88	0.90	0.45	0.53	0.49	0.28	0.30	0.29
VM + milo	1.88	1.97	1.93	0.22	0.21	0.22	0.94	0.90	0.92	0.41	0.52	0.46	0.28	0.30	0.29
VM + gypsum	1.91	1.93	1.92	0.21	0.21	0.21	0.85	0.85	0.85	0.49	0.47	0.48	0.30	0.31	0.31
Mean	1.92	1.91	1.92	0.21	0.21	0.21	0.87	0.90	0.88	0.49	0.47	0.49	0.31	0.30	0.30

4.3 Growth Data

Table 4: Cane measurements at 2.6 and 8.2 months of age

Treatment	Stalk height (cm to TVD)		Stalk population (*1000/ha)	
	February (2.6 m)	July (8.2 m)	February (2.6 m)	July (8.2 m)
Control	50	196	254	119
VM + topsoil	48	196	252	119
VM + river sand	48	201	259	122
VM + milo	50	208	247	126
VM + gypsum	51	193	249	110
Mean	49	199	252	119

4.4 Harvest Data

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

Treatment	Tons Cane/ha			Sucrose % Cane			Tons Sucrose/ha		
	D0	D1	Mean	D0	D1	Mean	D0	D1	Mean
Control	56	53	55	14.65	14.89	14.77	8.2	8.0	8.1
VM + topsoil	56	60	58	14.50	15.11	14.81	8.2	9.1	8.6
VM + river sand	63	55	59	14.83	14.86	14.84	9.4	8.3	8.8
VM + milo	61	62	61	14.39	14.58	14.49	8.7	9.2	8.9
VM + gypsum	61	57	59	14.41	15.00	14.71	8.9	8.5	8.7
Mean	59	57	58	14.56	14.89	14.72	8.7	8.6	8.6
LSD Treatment (0.05)		10			0.43			1.6	
SED ±		4.9			0.21			0.8	
LSD Drainage (0.05)		7			0.27			1.0	
SED ±		3.1			0.13			0.5	
Significance: Treatment		NS			NS			NS	
Drainage		NS			NS			NS	
Interaction (Treatment * Drainage)		NS			NS			NS	
LSD Specific Eff. (0.05)		15			0.61			2.3	
SED ±		6.9			0.29			1.1	
CV %		14.5			2.4			15.4	

5. COMMENTS

5.1 Soil Analysis

Soil analysis in December 1992 before fertilizers were applied showed that levels of Phosphorus and Potassium were satisfactory under these conditions (table 1). Vertical mulching with milo and gypsum significantly increased soil P and Ca levels.

5.2 Leaf Analysis

Third leaf nutrient analysis in February at 2.8 months of age showed that N and P levels were satisfactory but that K was deficient in spite of high soil K levels (table 3).

Treatments of vertical mulching, particularly with milo, tended to increase N, P, and K content in the early stages of growth. The effects were not always statistically significant.

5.3 Growth Data

Both stalk heights and populations tended to be higher in the VM+milo treatments, particularly in the later stages of growth, although these differences were not statistically significant (table 4).

5.4 Harvest Data

Cane yields were very low in this 4th ratoon of this trial, probably owing to the prevalent drought conditions in the past season (table 5). Yield responses to VM and drainage were small, inconsistent and were not statistically significant. The milo treatment was only slightly better than the other treatments.

Vertical mulching treatments and drainage had no statistically significant effect on sucrose content.

Sucrose yields were low this year compared to that of the previous crop due to low cane yields. Vertical mulching treatments and drainage had no statistically significant effect on sucrose yield.

6. CONCLUSIONS

- Even though cane and sucrose yields were low in this crop, residual benefits to vertical mulching with milo and river sand were observed but were no longer statistically significant.
- The residual effects of vertical mulching treatments (TSuc/ha) can be summarised as follows:

Treatment	1st R	2nd R	3rd R	4th R	Cumulated Resp.
VM + topsoil	0.1	2.6	0.7	0.5	2.3
VM + river sand	1.4	3.1	1.7	0.7	6.0
VM + milo	1.9	1.2	1.5	0.8	7.7
VM + gypsum	-0.2	1.0	0.3	0.6	-0.3

- Drainage had no statistically significant effect on sucrose yields of the different treatments under these conditions.
- This trial has been terminated and a summary of results for the plant crop to 4th ratoon is attached.

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TERMINAL REPORT SUMMARY: VM4/88/SW/Ubo 'V'
Plant to 4th ratoon

Table 1: Soil analysis - plant to 4th ratoon

a) Nutrient status (ppm) of the soil

Season	Crop	Analysis date	ppm						
			P	K	S	Ca	Mg	Zn	Na
1988/89	Plant	19/12/89	50	261	241	9760	1142	3	422
1989/90	1st R	19/12/89	50	261	241	9760	1142	3	422
1990/91	2nd R	13/06/91	115	237	241	9682	1106	-	-
1991/92	3rd R	13/06/91	115	237	241	9682	1106	-	-
1992/93	4th R	01/12/92	113	236	241	9374	1249	-	-

b) Effect of milo on chemical and physical properties of the soil profile

Season	Crop	Analysis Date	Treatment	Depth (cm)	pH	OM%	Clay%	CEC/100g soil	KDI	PDI	EC MS/m	SAR
1990/91	2nd R	May 1991	Control	0-15	7.3	2.5	-	60.7	0.64	0.50	87	1.83
				20-30	7.4	2.4	-	63.3	0.71	0.33	138	3.80
				40-50	7.4	2.2	-	64.3	0.69	0.27	164	5.57
			Milo	1-15	7.3	3.8	65.7	60.3	0.64	0.06	68	1.54
				21-30	7.5	3.0	65.6	64.3	0.65	0.41	80	3.14
				41-50	7.7	2.4	66.8	64.0	0.76	0.28	191	13.15

Table 2: Rainfall and irrigation figures plant to 4th ratoon

Crop	Season	Period	Rainfall (mm)	Irrigation (mm)	Total (mm)
Plant	1988/89	20/09/88-24/11/89	513	1041	1554
1st R	1989/90	24/11/89-10/11/90	259	772	1031
2nd R	1990/91	10/11/90-11/11/91	282	619	901
3rd R	1991/92	11/11/91-19/11/92	364	1123	1487
4th R	1992/93	19/11/92-26/11/93	195	1076	1271
Mean			323	926	1249

Table 3: Third leaf nutrient analysis (% dm) at various ages - plant to 4th ratoon

Season	Crop	Month sampled	Age (mths)	Nutrient	Treatment				Mean
					Control	VM + soil	VM + sand	VM + gypsum	
1988/89	Plant	Jan	3.7	N	2.00	2.04	1.97	2.02	2.04
		Feb	5.1		1.72	1.71	1.60	1.72	1.72
		Jan	3.7	P	0.24	0.23	0.22	0.23	0.23
		Feb	5.1		0.19	0.20	0.19	0.19	0.20
		Jan	3.7	K	1.25	1.10	1.32	1.23	1.29
		Feb	5.1		1.33	1.31	1.29	1.36	1.30
		Jan	3.7	Ca	0.37	0.39	0.37	0.40	0.30
		Feb	5.1		0.29	0.29	0.29	0.30	0.20
		Jan	3.7	Mg	0.21	0.21	0.20	0.21	0.21
		Feb	5.1		0.19	0.20	0.19	0.19	0.19
1989/90	1R	Feb	2.3	N	1.91	1.93	1.95	1.92	1.92
		Apr	4.4		1.77	1.73	1.77	1.70	1.77
		Feb	2.3	P	0.22	0.22	0.22	0.22	0.23
		Apr	4.4		0.19	0.20	0.20	0.20	0.20
		Feb	2.3	K	1.25	1.21	1.22	1.24	1.27
		Apr	4.4		1.21	1.23	1.21	1.27	1.26
		Feb	2.3	Ca	0.35	0.33	0.34	0.34	0.33
		Apr	4.4		0.32	0.31	0.32	0.32	0.31
		Feb	2.3	Mg	0.24	0.24	0.24	0.23	0.24
		Apr	4.4		0.19	0.19	0.20	0.19	0.19
			3.7	N	1.93	1.91	1.92	1.90	1.92
			3.7	P	0.18	0.10	0.10	0.10	0.10
1990/91	2R	Feb	3.7	K	1.09	1.15	1.11	1.11	1.14
			3.7	Ca	0.47	0.45	0.42	0.46	0.44
			3.7	Mg	0.27	0.27	0.25	0.26	0.26
1991/92	3R	Feb	3.0	N	1.70	1.79	1.74	1.70	1.76
		Mar	4.4		1.61	1.63	1.54	1.61	1.60
		Feb	3.0	P	0.22	0.21	0.21	0.23	0.22
		Mar	4.4		0.21	0.21	0.21	0.21	0.21
		Feb	3.0	K	0.91	0.94	0.00	0.99	0.94
		Mar	4.4		0.94	0.95	0.92	1.02	0.97
		Feb	3.0	Ca	0.37	0.46	0.37	0.36	0.37
		Mar	4.4		0.35	0.36	0.35	0.32	0.34
		Feb	3.0	Mg	0.26	0.25	0.25	0.23	0.25
		Mar	4.4		0.26	0.26	0.24	0.26	0.25
1992/93	4R	Jan	1.0	N	2.03	2.10	2.16	2.14	2.12
		Feb	2.0		1.09	1.94	1.90	1.92	1.92
		Jan	1.0	P	0.29	0.29	0.20	0.29	0.29
		Feb	2.0		0.22	0.20	0.21	0.21	0.21
		Jan	1.0	K	0.60	0.72	0.60	0.75	0.74
		Feb	2.0		0.06	0.07	0.90	0.05	0.00
		Jan	1.0	Ca	1.32	1.30	1.22	1.27	1.20
		Feb	2.0		0.52	0.52	0.49	0.40	0.49
		Jan	1.0	Mg	0.54	0.52	0.50	0.50	0.50
		Feb	2.0		0.31	0.31	0.29	0.31	0.30

Table 4: Cane yield, sucrose % cane and sucrose yield, plant to 4th ratoon

	1989		1990		1991		1992		1993		Mean	
	D0	D1	D0	D1	D0	D1	D0	D1	D0	D1	D0	D1
Cane yield (t/ha)												
Control	136	125	99	100	74	74	107	101	56	53	94	91
VM + soil	124	113	100	102	77	98	109	110	56	60	95	97
VM + sand	135	117	110	110	93	84	122	111	63	55	105	95
VM + milo	146	151	110	115	79	85	121	115	61	62	103	106
VM + gypsum	118	119	101	100	77	82	114	106	61	57	94	93
Sucrose % cane												
Control	15.7	16.5	15.1	15.0	16.9	15.7	15.3	16.2	14.7	14.9	15.5	15.7
VM + soil	15.2	16.0	14.8	15.0	16.4	16.9	15.4	15.9	14.5	15.1	15.5	15.8
VM + sand	15.4	16.5	15.0	14.9	17.3	16.9	15.4	15.7	14.8	14.9	15.6	15.8
VM + milo	15.2	16.3	14.5	15.5	16.5	15.7	14.8	15.4	14.4	14.6	15.1	15.5
VM + gypsum	15.3	16.7	15.0	14.6	16.2	16.6	14.8	15.4	14.4	15.0	15.1	15.2
Sucrose yield (t/ha)												
Control	21.4	20.6	15.0	15.0	12.5	11.6	16.4	16.3	8.2	8.0	14.7	14.3
VM + soil	20.1	18.6	14.8	15.4	12.6	16.6	16.7	17.5	8.2	9.1	14.5	15.4
VM + sand	20.8	19.3	16.6	16.3	16.1	14.1	18.7	17.4	9.4	8.3	16.3	15.1
VM + milo	22.1	24.5	16.0	17.8	13.0	13.4	18.0	17.7	8.7	9.2	15.6	16.5
VM + gypsum	18.1	19.9	15.1	14.5	12.5	13.5	16.9	16.5	8.9	8.5	14.3	14.6

Note: D0 = No drains installed
D1 = Drains installed

SOUTH AFRICAN SUGAR INDUSTRY

AGRONOMISTS' ASSOCIATION

EXPERIMENT RESULT

CODE: K4/88/Sw BBSE 'K'
CAT.NO.: 1714

TITLE: LEVELS AND TIMING OF POTASSIUM APPLICATION FOR EARLY SEASON CANE ON A 'K' SET SOIL

1. PARTICULARS OF PROJECT

This crop	:	20th ratoon	
Site	:	Big Bend Sugar Est Field 1A	
Region	:	Northern Irrigated (Swaziland)	
Design	:	Randomised blocks (6 replications)	
Soil Set/Series:		'K'	
Variety	:	NCo376	
Fertilizer Total (kg/ha)	:	N 160	P 40 K Treatment

Soil Analysis : 27/05/1988

pH	OM%	Clay %	KDI
7.70	-	>40	0.67

ppm

P	K	Ca	Mg	S
79	290	9863	843	-

Dates : 27/5/88 - 11/5/89
Age : 11.5 months
Rainfall :
Irrigation:
Total :

2. OBJECTIVES

2.1 To determine whether delayed potassium dressings would benefit yield if applied just prior to the period of apparent K deficiency (Sept-Oct)

2.2 To establish whether reduced levels of K can achieve yield response of higher rates if applied during periods of high K demand

2.3 To establish whether third leaf K (%dm) values can be used to identify this period to optimize K utilisation.

2.4 To define more accurately the K threshold for this soil

3. TREATMENTS

3.1 Control : No Potassium

3.2 K1/E : 150 kg K/ha top-dressed on the 27th May

3.3 K2/E : 300 kg K/ha top-dressed on the 27th May

3.4 K1/L : 150 kg K/ha top-dressed on the 17th August

3.5 K2/L : 300 kg K/ha top-dressed on the 17th August

Notes on Treatments

* Potassium was applied as a single dressing over the cane row in the form of muriate of potash (50% K)

* Phosphate was applied as single supers (10.5 %P) on the 7th July at the rate of 40 kg P/ha

* Nitrogen application was split and 50 kg N/ha as urea (46 %N) was top-dressed on the 7th July and 110 kg N/ha as urea (46 %N) was applied on the 5th September

* Chemical ripening of this site was not carried out as potassium treatments may influence cane quality

4. RESULTS

4.1 Growth Data

Table 1: Stalk Height and Population Count at 7.5 and 10.5 Months of Age

Treatments	Stalk (cm to TVD)		Population (1000 * ha)	
	7.5 m	10.5 m	7.5 m	10.5 m
Control	103	189	148	133
150 kg K May	110	196	183	136
300 kg K May	115	206	194	153
150 kg K Aug	111	201	182	137
300 kg K Aug	113	206	158	136

4.2 Harvest Data

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

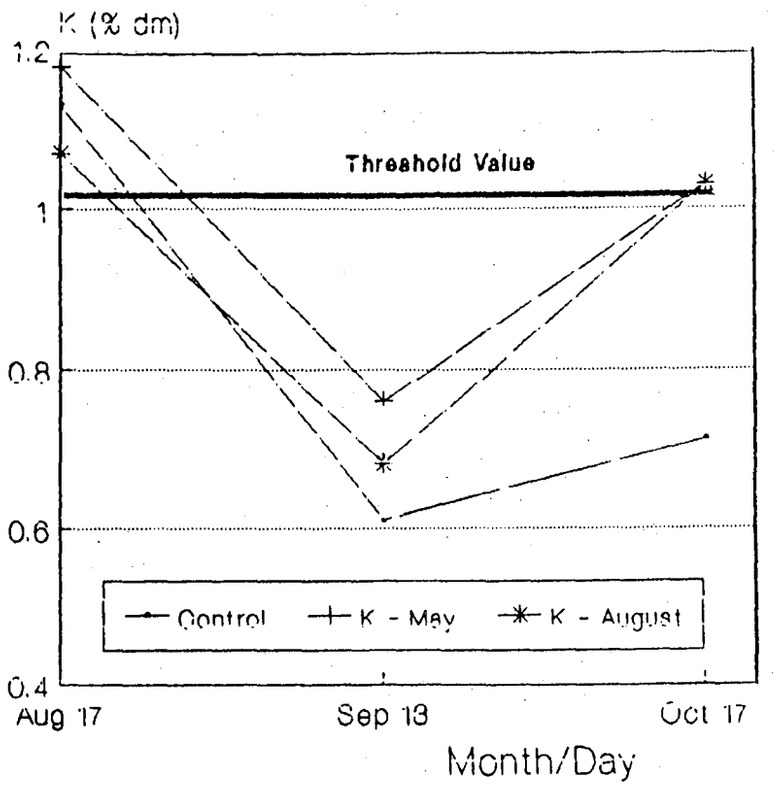
Treatments	T Cane/Ha	% Sucrose	T Suc/Ha
Control	70	15.01	10.5
150 kg K May	78	15.66	12.3
300 kg K May	89	15.34	13.6
150 kg K Aug	83	15.07	12.5
300 kg K Aug	86	15.32	13.2
LSD			
0.05*	15	0.53	2.4
0.01**	20	0.72	3.3
Significance	NS	NS	NS
Mean Trial	81	15.28	12.41
CV %	15	2.9	16.0

Table 3: Mean Differences Between Treatments and Control

Treatments	T Cane/Ha	% Sucrose	T Suc/Ha
150 kg K May	8 NS	0.65 *	1.8 NS
300 kg K May	19 *	0.33 NS	3.1 *
150 kg K Aug	13 *	0.06 NS	2.0 NS
300 kg K Aug	16 *	0.31 NS	2.7 *

** Significant of (P = 0.01) NS: Not significant
* Significant of (P = 0.05)

Fig 1: The Effect of Time on the Mean Content of K (% dm) in Third Leaf



5. COMMENTS

5.1 Yield of cane

Yield of cane tended to respond to applications of K. The higher rate of application produced a better response than the lower rate. The effects of different times of application were variable and the application of the lower rate early in the season was apparently less effective than the other treatments.

5.2 Quality

Quality tended to be increased by applications of K although the only significant response was obtained with the low rate of K when applied in May.

5.3 Yield of Sucrose

Yield of sucrose was increased by the application of K but responses were significant only for the high rates irrespective of application dates.

5.4 Foliar Analysis

Leaf samples were sensitive to the applications of K since leaf K contents of treated plots were higher than in the control. Delaying the application until August failed to prevent the decline in K levels in September and the benefits of it were only apparent in October, ± 2 months after application.

In terms of the current leaf threshold value, the sample in October was the only one useful for predicting a yield response to K. In August all treatments were above threshold including the control while in September all treatments were below threshold.

6. CONCLUSION

* Sucrose yields were significantly increased by applications of K in this trial despite the fact that soil levels averaged 290 ppm. These results confirm the need to revise soil K thresholds on these soils where harvesting takes place in winter.

* Best response was achieved at 300 kg K/ha and there was little difference between early and delayed applications.

* The responses in this trial may have been influenced by the unusually cool, overcast and wet weather during the spring months of 1988.

* The effects of the decline in leaf K in September on yields could not be measured in this trial and will require further investigation.

* This trial has been terminated but investigations will continue on another site.

PCH/aw/ynm
24 May 1990