

SOUTH AFRICAN SUGAR INDUSTRY

A (vii)

AGRONOMISTS' ASSOCIATION

Code : VM 2/87
Cat no: 1812

Title: To test the principle of vertical mulching in soils with inherently poor physical properties.

1. Particulars of project:

This crop	: 2nd ratoon	Soil analysis Date: 16/05/90				
Site	: Mt. Elias	pH	O.M%	Clay %	P.D.I	
Region	: Midlands North	5.05	-	17	-	
Soil system	: Umzinto - Midlands					
Soil form/series	: Longlands/Glenrosa	ppm				
Design	: Randomized block	P	K	Ca	Mg	Zn Al
Variety	: N12	57	124	219	46	- 10
Fertilizer	N P K	Age: 18.1 months				
(kg/ha)	: 143 28 143	Dates: 16/05/90 - 20/11/91				
		Rainfall: 1106mm				
		L.T.M. : 1133mm				

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 establish from some materials (filtercake and sand) those most suitable to use as a vertical mulch.

3. Treatments

- 3.1 Control - planting with minimum tillage
- 3.2 Vertical mulching with only topsoil down the profile
- 3.3 Vertical mulching with sand at 150 t/ha fed down the profile
- 3.4 Vertical mulching with filtercake at 100 t/ha fed down the profile

4. Growth

No significant stalk height or population responses was recorded in the second ratoon for any one of the vertical mulched (VM) treatments compared with the control (Table 1). Since the plant crop there has been a steady decrease in stalk height and an increase in population in all treatments. The first two crops was harvested at the age of 19 months and the third crop at 18 months. The plant crop and second ratoon crop was harvested in summer and the first ratoon in winter. The rainfall showed a constant decrease of about 300 mm per crop (Table 2).

Table 1: Summary of stalk heights and counts: VM at Mt. Elias

Treatment	Stalk height (mm)			Stalk count (x 10 ³ ha)		
	Plant 19.2 months	1ratoon 19.0 months	2ratoon 18.1 months	Plant 19.2 months	1ratoon 19.0 months	2ratoon 18.1 months
Control	1750	1590	1540	153	162	168
Top soil	1770	1690	1600	151	156	174
Sand	1820	1650	1640	162	170	171
Filtercake	1820	1650	1580	151	164	163

5. Yield

VM with sand was the only VM treatment of the second ratoon to show a significant 18 % response when compared with the control and it was also the treatment that had come out on top when the cumulative response over three crops was calculated (Table 2). As in the case of stalk height, yields measured both in terms of tc/ha and ts/ha, showed a constant decrease with each crop in all treatments to show a good correlation with the amount of rainfall recorded per crop.

Table 2: Yield calculated with the end plots (1,8,9 and 16) treated as a replicate (Mt. Elias - mean of 4)

Treatment	Plant Feb'87 - Oct'88		1st ratoon Oct'88 - May'90		2nd ratoon May'90 - Nov'91		Cumulative response	
	tc/ha	ts/ha	tc/ha	ts/ha	tc/ha	ts/ha	tc/ha	ts/ha
Control	103	14.5	79	9.6	74	8.4	-	-
VM + Topsoil	108	14.9	88*	10.6	81	9.4	21	2.4
VM + Sand (150 t/ha)	114	15.6	84	10.2	86*	9.9*	27	3.2
VM + Filtercake (100 t/ha)	106	13.9	87	10.4	79	9.1	16	0.9
Mean	108	14.7	85	14.7	10	9.2		
LSD (0.05)	13	1.3	8	1.7	9	1.1		
Rainfall (mm)	1715+		1437		1106			
Long term mean (mm)	1325 (18 months)							

6. Leaf analysis

Leaf analysis from the plant crop to the second ratoon showed no deficiencies. As could be expected VM with filtercake had higher N, P, K, and Ca leaf values when compared with the other VM treatments and the control (Table 3). With the yields obtained in mind, it is clear the plant did not benefit from the higher nutrient status.

Table 3: Leaf analysis

	N %			P %			K %			S %			Ca %			Mg %		
	P	1R	2R	P	1R	2R	P	1R	2R	P	1R	2R	P	1R	2R	P	1R	2R
CONTROL	1.8	1.71	1.78	0.19	0.18	0.19	1.38	1.28	1.34	0.15	0.15	0.17	0.2	0.25	0.22	0.18	0.19	0.16
TOPSOIL	1.82	1.72	1.79	0.19	0.18	0.18	1.36	1.32	1.29	0.15	0.16	0.17	0.2	0.23	0.21	0.18	0.19	0.17
SAND	1.84	1.71	1.8	0.19	0.18	0.18	1.43	1.29	1.33	0.15	0.16	0.17	0.19	0.24	0.21	0.18	0.22	0.17
FILTERCAKE	1.95	1.84	1.84	0.21	0.2	0.2	1.43	1.42	1.37	0.16	0.16	0.18	0.23	0.29	0.25	0.19	0.2	0.14
MEAN	1.85	1.75	1.81	0.19	0.18	0.19	1.4	1.33	1.33	0.15	0.16	0.17	0.2	0.25	0.22	0.18	0.2	0.17
LSD (0.05)	0.15	0.09	0.08	0.02	0.01	0.02	0.12	0.09	0.17	0.02	0.01	0.02	0.04	0.03	0.05	0.04	0.02	0.02
LSD (0.01)	0.22	0.13	0.11	0.02	0.20	0.28	0.18	0.13	0.24	0.02	0.01	0.29	0.06	0.40	0.66	0.06	0.03	0.27

7. Root growth

Root growth was quantified a week after harvest, using the core technique to sample the roots and the line intersection method via the root length meter to obtain root length values. Four samples at three depths (0-20, 20-40 and 40-60 cm) were taken at each treatment. The mean results for each treatment and depth are presented in Figure 1. It is clear from the graph that:

- Most of the roots in the control treatment (77 %) can be found in surface soil layer (0-20 cm). This is maybe not totally unexpected because the control was the only treatment where the subsoil was left undisturbed before plant. What could, however, be unexpected is that the subsoil, which was disturbed (ripped) 5 years ago, is still having a beneficial effect on root development.
- The root distribution of the VM treatments are about the same except for the VM with sand treatment which had a little less roots in the last soil layer (40 - 60 cm) when compared with that of the other VM treatments.
- When the rooting density (L_v , cm/cm^3) values in Figure 1 are converted to root length index (L , cm/cm^2) and added up to give the total root length index (L_t , cm/cm^2) per profile, then the cane VM with filtercake has produced the most roots ($48.68 \text{ cm}/\text{cm}^2$) followed in decreasing order by VM with sand (46.28), VM with top soil (46.22) and the control ($44.72 \text{ cm}/\text{cm}^2$).

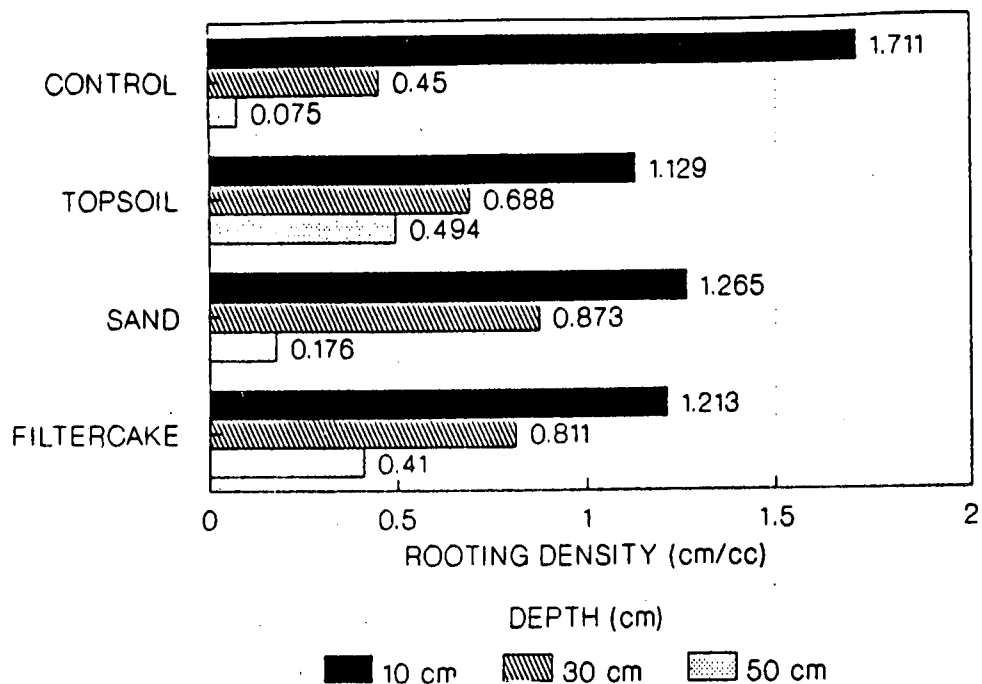


Fig. 1: Rooting density (mean of four replications) at three depths for each treatment as determined by the core technique. The depth indicated are for the middle of each soil layer (2nd ratoon - Mt. Elias).

8. Soil bulk density

Soil bulk density was measured with the Troxler nuclear gauge to a depth of 30 cm. The mean results per treatment was 1698, 1657, 1698 and 1678 kg/m³ for the control, VM with topsoil, VM with sand and VM with filtercake respectively. The highest mean density values corresponded with the treatments that had the least roots in the 40 - 60 cm layer, viz control and VM with filtercake.

9. Soil water use

Soil water use was quantified with the aid of Bouyoucos gypsum blocks at depths of 30, 60 and 90 cm. Because results from the blocks installed at 90 cm did not show great differences, only those from 30 and 60 cm are displayed in Figure 2. This graph shows the results since October 1988 to May 1991 and in this period it is clear that cane VM with filtercake has made better use of the available soil water when compared with the control.

10. Future work

Although this trial has been terminated it could be of value if only the yields are collected for the third ratoon.

Gypsum block readings, Mt. Elias, variety N12, 3/10/88-3/5/91

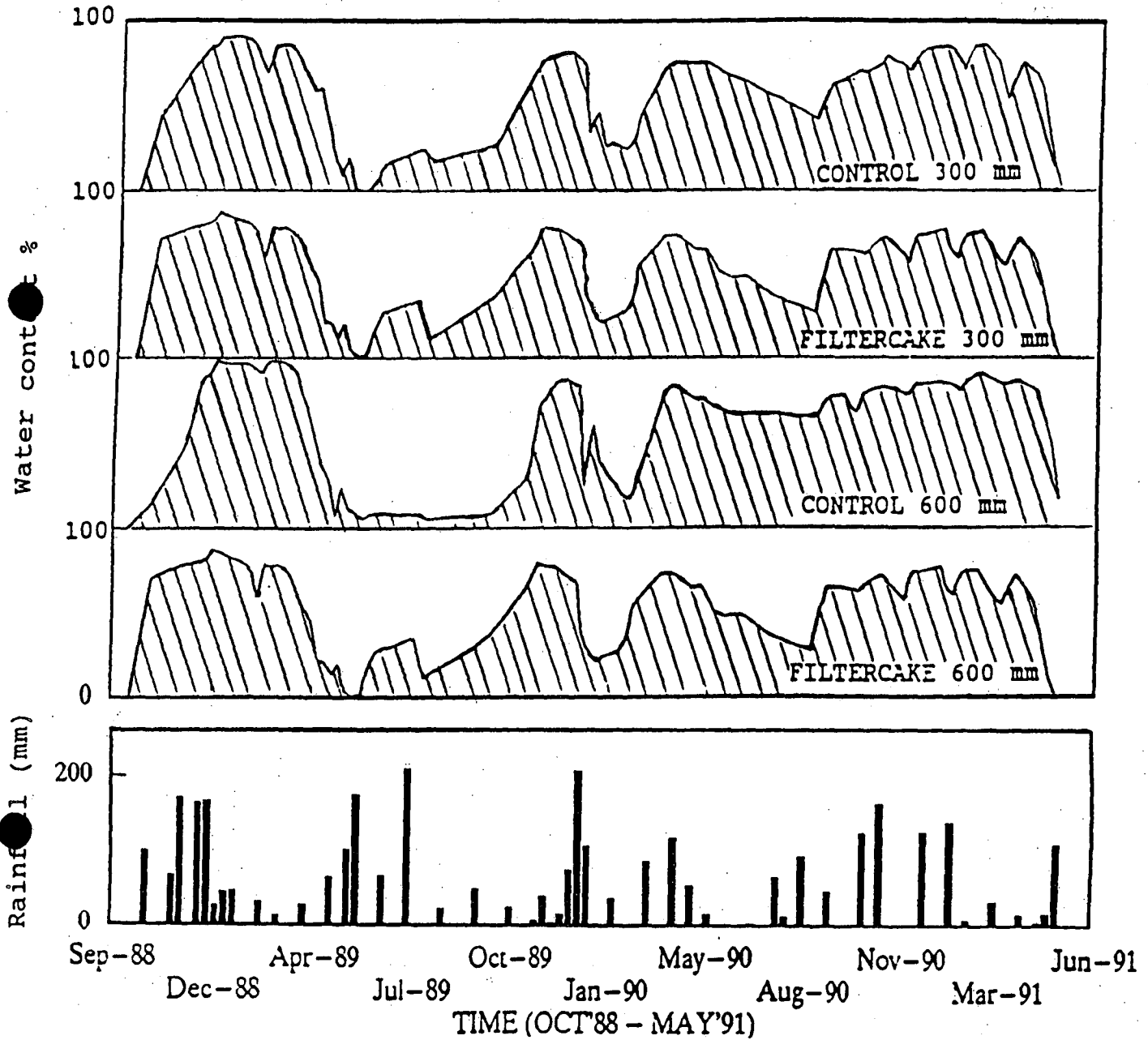


FIGURE 2: Effect of vertical mulching with filtercake compared with conventional tillage on water use of cane to a depth of 600 mm (shaded areas indicate relative percentage crop available water).