SOUTH AFRICAN SUGAR INDUSTRY

AGRONOMISTS' ASSOCIATION

TRIAL RESULTS

CODE: Cult/E8b/88/SW/IYSIS Zd&H

Cat.No.: 1847

TITLE: DEEP CULTIVATION TRIAL

## 1. PARTICULARS OF PROJECT

This crop : R2 + R3

Site : Block E8b
Ricelands Estate

Region : Northern Irrigated
(Swaziland)

Soil Set : Zd & H

Design : Randomized blocks,
2 replications

Variety : NCO 376

Fertilizer:

| Kg/ha | N | P | K |
|---|---|---|---|
| 1990 | 160 | 0 | 125 |
| 1991 | 160 | 0 | 150 |

Date R2 : 25/7/90 - 26/6/91
R3 : 26/6/91 - 08/6/92

Age R2 : 11 months
R3 : 11,5 months

Irrigation: Furrow

## 2. OBJECTIVE

To determine the effect of various deep cultivation techniques on cane yields.

## 3. MOTIVATION

Observations of better cane growth over areas where sub-surface drains have previously been laid have led to the idea that the deep disturbance of the soil profile has tended to lower bulk densities throughout. This result is an increased rooting depth and therefore greater readily available water capacity. By either deep ripping alone to one meter, ripping plus applying gypsum at this depth, or deep ploughing to 45-50 cm, an increase in cane growth and therefore yield might be seen due to lower bulk densities.

## 4. TREATMENTS

1. Control : 5t/ha gypsum ripped to 45-50 cm, followed by a 1020 disc (i.e. normal IYSIS practice).

2. Deep Ploughing : 5t/ha gypsum applied to surface and ploughed in to 45-50 cm. 5t/ha then applied to surface and disced in with a 1236 inch disc followed by light 1020 disc.

3. Deep ripping + gypsum : Deep ripping to approx. 85-90 cm with a simple tyne, at 1.5 m intervals, with 5t/ha gypsum poured directly. into rip behind tyne to 80 cm depth. 5t/ha applied to surface and disced in as per standard.

4. Deep ripping only : As (3) but no gypsum poured behind type. 10 t/ha gypsum applied to surface and disced as per standard.

Notes:
* Treatments were applied in July 1988 prior to planting.
* In deep ripping plots planting occurred directly on top of ripped portion.

## 5. RESULTS

### 5.1 Harvest Data

Table 1: Cane Yield, Sucrose % and Sucrose Yield

| Treatments | Cane t/ha 1991 | Cane t/ha 1992 | Sucrose % 1991 | Sucrose % 1992 | Sucrose t/ha 1991 | Sucrose t/ha 1992 |
|---|---|---|---|---|---|---|
| 1. Control | 90.9 | 96.6 | 16.66 | 14.91 | 15.14 | 14.41 |
| 2. Deep Plough | 94.9 | 101.5 | 16.69 | 15.06 | 15.85 | 15.29 |
| 3. Deep rip + Gypsum | 93.6 | 91.1 | 16.40 | 15.63 | 15.33 | 14.24 |
| 4. Deep rip only | 91.3 | 86.8 | 16.61 | 15.66 | 15.17 | 13.60 |
| Treat Mean | 92.7 | 94.0 | 16.59 | 15.31 | 15.37 | 14.38 |
| Significance | NS | NS | NS | NS | NS | NS |
| CV% | 5.2 | 9.0 | 2.86 | 2.73 | 5.95 | 8.27 |
| SE one plot | 4.8 | 8.4 | 0.47 | 0.42 | 0.91 | 1.22 |

Table 2: Cumulated Sucrose Yield (Plant to Third Ratoon)

| Treatment | Sucrose t/ha |
|---|---|
| 1. Control | 61.95 |
| 2. Deep plough | 60.73 |
| 3. Deep rip + gypsum | 60.17 |
| 4. Deep rip only | 58.80 |

5.2 Leaf Analysis

Table 3: Third leaf nutrient content % dm in November 1990 and 1991 at 4 and 5 months of age respectively

| Treatment | N | | P | | K | | Mg | | Ca | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 1991 | 1990 | 1991 | 1990 | 1991 | 1990 | 1991 | 1990 | 1991 |
| Control | 2.06 | 2.04 | 0.26 | 0.26 | 1.00 | 0.84 | 0.25 | 0.19 | 0.54 | 0.32 |
| Deep plough | 2.10 | 2.05 | 0.27 | 0.24 | 1.22 | 0.92 | 0.26 | 0.18 | 0.48 | 0.33 |
| Deep rip + gypsum | 2.13 | 2.00 | 0.22 | 0.23 | 1.06 | 0.84 | 0.24 | 0.18 | 0.43 | 0.31 |
| Deep rip only | 2.08 | 1.93 | 0.23 | 0.23 | 0.90 | 0.75 | 0.26 | 0.20 | 0.48 | 0.33 |
| Mean | 2.10 | 2.01 | 0.25 | 0.24 | 1.05 | 0.83 | 0.25 | 0.19 | 0.49 | 0.32 |
| Significance | NS | NS | NS | NS | * | NS | NS | NS | NS | NS |
| CV% | 3.23 | 5.04 | 10.84 | 5.05 | 5.13 | 6.62 | 6.97 | 8.04 | 8.92 | 9.72 |
| SE one plot | 0.063 | 0.10 | 0.027 | 0.012 | 0.054 | 0.055 | 0.017 | 0.015 | 0.043 | 0.031 |

## 6. COMMENTS

### 6.1 Cane Yield

In 1991 cane yield appeared to be better in all the plots that had been cultivated deeply. In 1992 only the yield associated with the deep ploughing treatment was better than control. None of the responses were statistically significant (Table 1).

### 6.2 Cane Quality

The effects of treatments on sucrose content were variable and non-significant.

### 6.3 Sucrose Yield

Sucrose yield reflected the effect of the treatments on cane yield but the responses were not significant.

6.4 Leaf Analysis

Third leaf nutrient content in November 1990 was above thresholds for NCO376, except for K in the control and deep ripping only treatments (Table 3). In 1991 K was below threshold in all treatments.

There were differences in the effect of treatments on leaf-K content. While deep ploughing increased the uptake of K deep ripping only tended to depress it. In 1990 the effects were not significant. There were no statistical differences between treatments in the content of the other nutrients.

## 7. DISCUSSION

Results of the last two seasons indicated a trend for sucrose yield to be better in the deep ploughing treatment. Foliar analysis showed leaf-K to be marginal in the control while deep ploughing stimulated K uptake. This suggests that the apparent benefit of deep ploughing on yield was nutrient related. Chemical analysis of the profile of Z & H set soils have shown that, contrary to the majority of the other sugar belt soils, the K content of the subsoil can be higher than that of the top soil. When deep ploughing, the soil profile is effectively inverted which, in the case of the Z & H set sets, means that the top part of the root zone is enriched in K. This enrichment of the root zone in K could in turn explain the high leaf K content associated with the deep ploughing treatment.

## 8. CONCLUSION

* Results of this trial have shown that in the last two seasons deep ploughing tended to give the best sucrose yields. The cumulated results for four seasons (Table 2), however, clearly show that on the whole there was no advantage from any of the deep cultivation practices. Moreover if the cost of carrying out these operations are allowed for, the control appears more economical.

* Leaf analysis data suggested that the better performance of the deep ploughing treatment in the last two seasons was related to an increase in K uptake. The observation implied that the subsoil of Z & H set soils may be high in available K and that by bringing it to the soil surface, deep ploughing may assist in alleviating K deficiencies.

* Measurements taken in the plant crop showed that deep cultivation tended to increase bulk density which was contrary to expectation. High rainfall prevailed during the land preparation phase of the trial and the bulk density measurements and lack of yield responses

demonstrate that to be beneficial subsoiling has to be carried out when the soil is sufficiently dry.

* This trial has been terminated.

9. *RECOMMENDATIONS*

* Analysis of the K content of the soil profile will have to be conducted in order to verify whether the assumption regarding deep ploughing and enhanced K nutrition is correct.

* It is important that the reason which lead to better growth above drainage trenches be clarified. It is recommended that this trial be repeated at another site. In any repetition care will have to be taken that conditions conducive to soil shattering are met and that measurements include bulk density, root distribution, AMC and water table height.

P.C. HENRY
SOILS AGRONOMIST

17/07/1992