# 4. HUSBANDRY

## 4.9 Vertical mulching

### Definition

Vertical mulching is the incorporation of an ameliorant through a vertical slot into the soil.

### Reasons for vertical mulching

Poor soil will result in a shallow root system which will:

- limit the soil water and nutrient storage capacity, resulting in frequent plant stress
- cause yield decline and a relatively high replant frequency.

Poor, degraded soils are characterised by:

- a shallow topsoil layer overlying various limiting subsoil horizons, i.e. E horizon, soft and hard plinthite and weathering rock
- a surface crust, causing low intake rate
- a compacted layer or hard plough pan at a depth of between 15 and 25 cm
- low organic matter status
- a high water table in the wet season (see Information Sheet 3.1 on ridging to improve cane growth on soils with a high water table).

### The soils

Soils that will benefit from this tillage practice are generally found on mid to higher slope positions. They are shallow and are from the grey group of soils derived from Dwyka tillite, Table Mountain Sandstone (ordinary) and Middle Ecca sediments. Soil forms suitable for vertical mulching are Longlands, Westleigh, Glenrosa, Mispah, Milkwood, Swartland, Valsrivier, Sterkspruit, Cartref, Estcourt and Kroonstad.

The general physical properties of these soils are high susceptibility to crusting and compaction, low water infiltration rates, high vulnerability to soil erosion, low water and nutrient retention capacity and low organic matter content. At least 40% of the soils under sugarcane fall within this classification.

It is possible that more soils will be included, as vertical mulching trials conducted in Swaziland on soils with a vertic topsoil (Arcadia) showed the best response to vertical mulching with filtercake treatment. The mean response in these trials was 0,31 tons sucrose/ha/an, measured over a period of five years.

### Application time

Vertical mulching may be done at crop establishment, either following minimum tillage or conventional plough-out. There is not sufficient evidence at this stage to recommend it as a ratoon practice.

### The technique

This technique involves the incorporation of an ameliorant into a vertical slot in the soil. The idea is to concentrate the ameliorant in the slot over a maximum soil depth of at least 400 mm in order to improve the rooting depth and water infiltration rate, and to reduce the bulk density of the soil.

The ameliorant may be band placed on the row before incorporation using the vertical mulcher, in which case the tine of the implement will be

pulled through the banded material. Alternatively, a hopper can be fitted onto the toolbar of the vertical mulcher and the ameliorant fed through a 200 mm diameter downpipe directly behind the tine and into the open slot.

## The implement

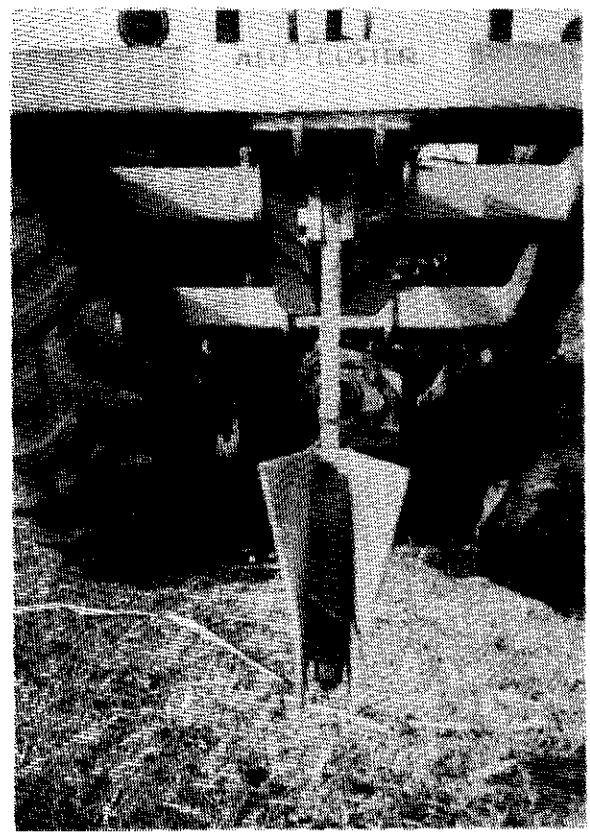
The implement used for vertical mulching is a ripper tine with vertical 'wings' attached. The implement is pulled through the soil to a depth just covering the top part of the wings (about 400 mm) in order to allow the material on the soil surface to flow over the top part of the wings and to fall into the slot kept open by the wings. The design and dimensions for the implement shown should be as follows:

- The opening of the **top** part between the wings (looking at the implement from the back) should be 200 mm and 100-150 mm at the **bottom**. This will ensure that all material on the soil surface will 'flow' into the slot.
- The length of the wings extending away from the tractor should be 400 mm long to ensure that the slot is kept open long enough to allow the material to fall to the bottom of the slot before it is closed.
- The depth of the wings will depend on the depth of the soil. The aim is to increase rooting depth and the implement should be able to create a slot to a depth of at least 500 mm. However, reaching this depth is not always possible in very shallow soils, and 400 mm is therefore a good average depth to allow when attaching the wings to the tine. This means that the depth from the **top of the wings to the tip of the shoe** on the tine must be 400 mm, and 300 mm for the depth of **only the wing**. This will result in an effective slot depth of about 350 mm (50 mm depth is lost because of the wave in front of the tine).

## Problems

The most crucial problem is how to get the ameliorant onto the field in a commercial situation. The following are options for band placing the ameliorant on the strip that is to be vertical mulched:

- Use hand labour with fertiliser bags.
- Moving slowly, offload directly from the trailer through a guide pipe (ID about 250 mm) onto the strip to be cultivated.



- Fit a hopper onto the toolbar of the vertical mulcher, with a 200 mm diameter guide pipe to feed the ameliorant directly into the open slot behind the tine. It may be necessary to use hand labour to force the ameliorant through the downpipe. Alternatively, the hopper could be fitted with a vertical worm for this purpose.

The following are problems encountered, and suggested ways to overcome them:

- Small tractors and 2x4s cannot keep direction accurately, and often pull the vertical mulcher where there is no ameliorant. The tractor to be used should be at least a 50 kW 4x4.
- The ameliorant must be dry and free of clods when applied. If it isn't, then a minimum till rotavator should be used to mix the ameliorant with the topsoil before it is vertically mulched into the soil. Composted filtercake (six months and older) is preferred.

## Ameliorants

The type of ameliorant to be used depends on soil type and the problems associated with it. For example, a sandy soil will require an ameliorant that will improve water retention and structure, and in a clay soil the ameliorant should improve water infiltration and drainage.

Long term trials conducted on a Longlands soil form at Mtunzini and an Arcadia soil form in Swaziland showed that the best responses came from the treatments where filtercake or milo was used. Other ameliorants evaluated in these trials were topsoil and river sand.

Other organic materials that could be used include chicken manure, sawdust, bark chips, chopped trash, bagasse, and wood pith. It is, however, always better to use **well composted material**. This should be chemically analysed to determine the C/N ratio, the maximum quantity to be used, and the additional nutrients to be added. If the C/N ratio is above 25, additional N will be required in accordance with FAS recommendations. Ideally, the C/N ratio of organic materials to be used should be below 20.

Other ameliorants that might be considered are river sand, fly ash, gypsum and lime. These ameliorants should be used only in special circumstances; for example, where soils have a high clay content, high pH or an unacceptably high extractable aluminium index.

## Long term results

A vertical mulching trial was established on the SASEX Mtunzini farm in 1986, with the following treatments:

- Control - conventional flat cultivation
- Vertical mulching with topsoil
- Vertical mulching with river sand at 100 t/ha
- Vertical mulching with filtercake at 100 t/ha.

These treatments were applied once only before planting and never again thereafter, yet yield responses to the various treatments were still being obtained nine years later. The best response came from the vertical mulching with filtercake treatment, where the mean response over the control treatment for the nine year period was 1,4 t suc/ha/an, or 11 t cane/ha/an. Other improvements included increased infiltration rate (three-fold), lower bulk density, increased rooting depth and improved N and P use.

## Cost

It is difficult to give guidelines on the economics of vertical mulching, as many factors affect the cost. These include the type of ameliorant to be used, the availability of the ameliorant, the amount to be applied, transportation and the equipment to be used.

Estimates of the costs and benefits of vertical mulching with filtercake on a farm 20 km from the mill, based on 1996 costs, are:

| | |
|---|---|
| Transportation @ R0,85/t/km | R1700/ha |
| Tractor + implement | R 200/ha |
| | R1900/ha |
| Expected additional response after seven crops | 9,8 t sucrose/ha |
| Gross income @ R850/t sucrose | R8 330/ha |
| Net income after seven crops | R6 430/ha |
| Net income per year | R914/ha/an |
| Break-even period = | about two years. |

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