

# Information Sheet

## 7. NUTRITION

### 7.4 Filtercake

#### Main characteristics

**S**ugarcane juice contains small quantities of potassium, calcium, magnesium, silicon and phosphorus which the sugarcane plant has absorbed from the soil. In the manufacture of sugar, organic compounds such as starch, wax, gums, pectins and colouring matter are precipitated and, after removal by filtration, form a cake of varying moisture content called filtercake or filter mud. On a dry matter basis this is comprised of:

Crude wax and fat	5-14%
Fibre	15-30%
Crude protein	5-15%
Total ash	9-20%
Sugars	2-5%.

nitrogen content can benefit the crop and, in strongly acid soils, the calcium content can help to overcome calcium deficiency. Humic acids released from the organic matter in filtercake can help to ameliorate Al toxicity.

Constituent	Cane diffuser	Bagasse diffuser	Mill tandem rollers
Filtercake % as % cane	2,0 to 3,0	3,0 to 4,0	5,0 to 6,0
Total C % (mainly sugar, fibre, waxes)	35 to 42	36 to 40	30 to 45
Total N % (as protein)	1,0 to 2,0	1,0 to 1,5	1,3 to 1,8
C/N ratio	20 to 35	25 to 35	25 to 30
P % (total)	1,5 to 2,5	0,7 to 1,2	0,5 to 1,0
K %	0,2 to 0,3	0,2 to 0,3	0,2 to 0,3
Ca %	3,0 to 5,0	2,0 to 3,0	1,0 to 2,0
Mg %	0,5 to 1,0	0,2 to 0,6	0,2 to 0,5
S %	0,1 to 0,2	0,1 to 0,2	0,1 to 0,2
Si %	2,0 to 4,0	2,0 to 3,0	1,0 to 2,0
Zn ppm	100 to 200	75 to 125	100 to 150
Cu ppm	75 to 90	40 to 50	50 to 120

#### Mineral composition of filtercake

The composition of filtercake varies according to the amount of soil and extraneous material in the cane delivered, the cane variety, the nature of the milling and clarification process and whether fly ash is incorporated. In general, the moisture content of fresh filtercake ranges from 65 to 75%, but dries out in the field to between 50 and 60% moisture. The detailed mineral composition of filtercake expressed as a percentage of dry matter may vary according to the milling process, as shown in the table in the next column.

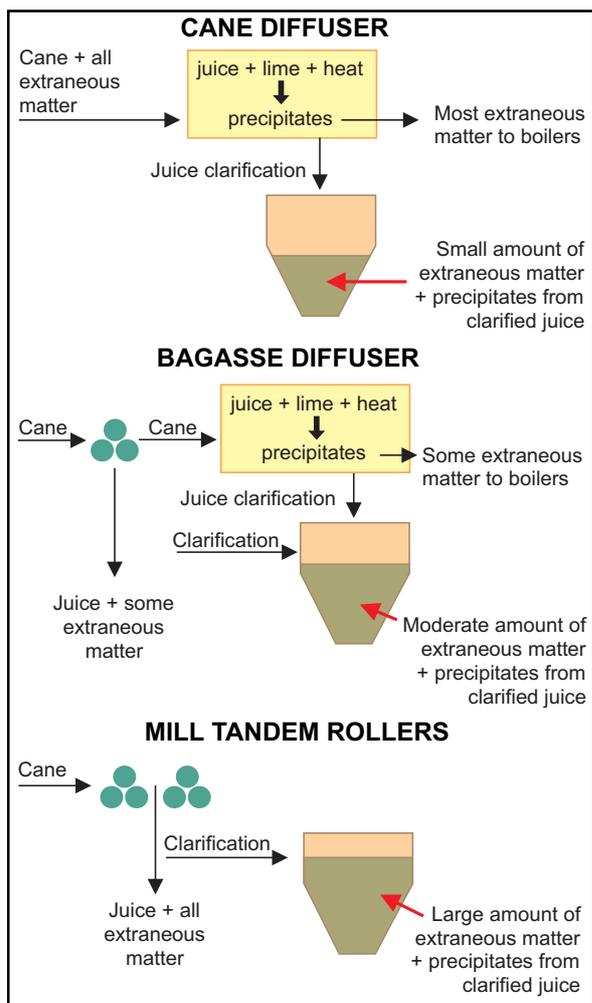
The differences between the three processes currently used to extract sucrose in South African mills are illustrated in the diagram on page 2.

#### Filtercake as a fertiliser

Filtercake has been used by growers mainly as a source of P fertiliser in the furrow at planting. More recently, experiments have indicated that the



*Well decomposed filtercake ready for field application.*



### Nutrient content

Filtercake is normally available in large quantities (400 000 to 500 000 tons/annum), but its use is limited by its bulk and the high cost of transportation. The N:P:K ratio of filtercake is hardly ever ideally suited to sugarcane and, consequently, after a soil sample has been sent to the Fertiliser Advisory Service at SASSEX, balancing with inorganic fertilisers is usually necessary.

Filtercake with an average dry mass composition of 1,6% N, 1,0% P and 0,3% K is the equivalent of a 5:3:1 fertiliser mixture. One ton of filtercake with a moisture content of 65% contains about 5 kg N, 3 kg P and 1 kg K. However, all the N is not immediately available and depends on how well the filtercake is composted. Fresh filtercake has a C/N ratio in excess of 30 and, in well drained humic soils, up to 50% of the total N may be made available during the early stages of crop growth. In less well drained soils, release is slower and only about 30% of the total N may be immediately available to the crop. When filtercake is well composted the C/N ratio is less than 20 and up to 70% of the total N will be immediately available to the crop.

### Application rates

Thirty tons of fresh filtercake (65% water) per hectare in the planting furrow will provide adequate phosphorus and nitrogen for cane planted in Midlands soils, which have a high capacity to mineralise N. To balance the nutrient requirements, potassium chloride only would be required. On many of the soils in other areas, the above application rate would be less appropriate unless the filtercake is well composted (C/N ratio < than 20).

### Example of balancing a filtercake recommendation on a Cartref form soil

Assume a standard FAS fertiliser recommendation is:

$$N = 120 \text{ kg/ha} \quad P = 30 \text{ kg/ha} \quad K = 125 \text{ kg/ha.}$$

Thirty tons of well composted filtercake per hectare at 65% moisture will provide:

$$N = 75 \text{ kg/ha} \quad P = 90 \text{ kg/ha} \quad K = 30 \text{ kg/ha.}$$

To balance the nutrient requirements, the following additional amounts of fertiliser would be required as a top-dressing:

$$45 \text{ kg N from } 100 \text{ kg/ha urea}$$

$$95 \text{ kg K from } 200 \text{ kg/ha potassium chloride}$$

OR

$$250 \text{ kg/ha } 2:0:3(49).$$

Phosphorus supplied from the filtercake is sufficient to meet the requirements of the plant, first and second ratoon crops. Where filtercake is broadcast and incorporated before planting, about twice the in-furrow rate will be required.

### Filtercake as a soil conditioner

The results of recent research have shown that decomposed filtercake can also act as a very effective conditioner of hard-setting duplex soils and shallow grey soils. Trials have shown that vertical mulching with filtercake to a depth of 450 mm in the planting row following minimum tillage, resulted in significantly higher yields and an increased number of ratoon crops (see Information Sheet 4.9 Vertical mulching).

The main benefit appeared to be the aggregating effect of organic matter from the filtercake binding soil particles and effecting an eight-fold improvement in the soil infiltration rate. Additional benefits were improved moisture holding and cation exchange capacities, an increased potential for nitrogen release, lower soil bulk density and increased rooting depth.



### Reclaiming saline-sodic soils

In saline/sodic soil conditions the incorporation of filtercake at a rate of 350 tons/ha to a depth of 300 mm has been used successfully to leach out excessive levels of harmful sodium salt from both the topsoil and the subsoil. Buried filtercake lasts considerably longer than filtercake incorporated into the soil surface.

### Other characteristics of filtercake

#### Yield response to filtercake

The results of many experiments over the years have indicated that the response to filtercake incorporated to plough depth is greatest on the following soils:

Soil group	Plant crop (tc/ha)
High P-fixing Midlands Mistbelt soils	20,2
Coastal clay loams and clays	10,0
Natal Group Sandstone soils	8,0
Recent Sands	3,0

Only in Midlands Mistbelt soils has a substantial residual response been measured in the first ratoon crop to filtercake applied at planting.

#### Effect on sucrose % cane

Sucrose % cane may be lowered quite substantially following the application of filtercake, as the N is released gradually and this can delay ripening. When using filtercake the rate of applied N fertiliser **must** be reduced, particularly in Midlands Mistbelt soils.

#### Winter planting

Filtercake can also be used for winter and early spring planting as its high moisture content ( $\pm 70\%$ ) protects the seedcane from desiccation.

#### Effect on eldana

For the same reason it is essential to avoid excessive levels of N, which could lead to high infestation by eldana.

#### Nematicidal effect

This effect is temporary and of limited value. Filtercake is **not** an alternative for a nematicide.

#### Fly ash

At a number of mills, fly ash may be incorporated into the filtercake, which reduces the N and P contents and therefore its nutrient value, as shown in the following example in the next column.

Material	N %	P %	K %	Ca %	Mg %
Filtercake	1,60	1,00	0,30	1,75	0,46
Filtercake + fly ash	0,84	0,60	0,30	1,05	0,40
Fly ash only	0,11	0,18	0,70	0,30	0,34

#### Ratoon chlorosis

To reduce the risk of ratoon chlorosis in cane growing on neutral to alkaline soils, do not apply high pH filtercake produced by factories where refinery filtercake ( $\text{CaCO}_3$ ) is mixed with mill filtercake, or filtercake containing fly ash.

#### Application rates

Because of the variable nutrient content of filtercake, it is recommended that representative samples should be submitted in sealed containers to the Fertiliser Advisory Service for analysis in order to obtain advice on optimum application rates and the need for balancing with additional fertiliser.

#### Priority and management of filtercake

A knowledge of soils can assist in deciding where best to apply filtercake (see table overleaf).

#### Further reading on filtercake

*Analysis of filtercake from South African mills* by KEF Alexander. In: SASTA Proceedings No. 45, page 149 (1971).

*The effect of filtercake on soil fertility and yield* by G Roth. In: SASTA Proceedings No. 45, page 142 (1971).

*Filtercake – a field and glasshouse evaluation* by PK Moberly and JH Meyer. In: SASTA Proceedings No. 52, page 131 (1978).

*The effect of different extraction processes on the nutrient content of filtercake* by RA Wood. In: SASTA Proceedings No. 55, page 177 (1981).

*Composting filtercake from a sugar factory* by HW Bernhardt and P Notcutt. In: SASTA Proceedings No. 57, page 185 (1983).

*A review of the effectiveness of gypsum, filtercake and deep ploughing for ameliorating irrigated duplex soils in Swaziland* by PC Henry and W Rhebergen. In: SASTA Proceedings No. 58, page 59 (1984).

Copies of these papers are available from the SASEX librarian.



## RECOMMENDATIONS FOR THE USE OF FILTERCAKE IN DIFFERENT SOIL GROUPS

Main group	Terrain	Main soil forms	Requirements and reasons
Grey	Crest to mid-slope	Mispah Glenrosa Cartref	Vertical mulching to a depth of 400 mm with 100 tons/ha filtercake will increase yields, water infiltration rate and rooting depth.
	Lower slope to bottomland	Estcourt Sterkspruit Klapmuts Vilafontes Longlands Oakland Swartland Valsrivier Westleigh Katspruit Kroonstad	Salinity/sodicity hazard. Instead of gypsum, filtercake at 350 tons/ha can be incorporated to a depth of 300 mm in sodic soils for reclamation purposes.
Red and yellow-brown	Well drained	Augrabies Bainsvlei Hutton/Oakleaf Clovelly Griffin	In Midlands soils with low P status and virgin soils, apply 30-40 tons/ha filtercake or 5-8 tons/ha poultry manure in the furrow at planting. If broadcast, about twice the in-furrow rate will be required.
		Shortlands	To improve tilth of cloddy soils, apply 20-30 tons/ha filtercake in the furrow at planting.
	Moderately drained	Avalon Glencoe Bloemdal Constantia Pinedene	For P deficient soils, apply 30-40 tons/ha filtercake or 5-8 tons/ha poultry manure in the furrow at planting.
Brown humic and organic	Inland	Inanda Kranskop Lusiki Magwa Nomanci	In P deficient and/or high P fixing soils, apply 30-40 tons/ha filtercake or 5-8 tons/ha poultry manure in the furrow at planting. If broadcast, twice the in-furrow rate will be required.
Black	Crest to lower slope	Arcadia Bonheim/Inhoek Mayo Milkwood	Where heavy clay soils with cloddy tilth are encountered, in both categories, planting with 20-30 tons/ha filtercake in the furrow will be beneficial as it envelops the cane setts and reduces air pockets in the seedbed.
	Bottomland	Rensburg Willowbrook	Salinity/sodicity hazard is likely in both soil categories. Filtercake at 350 tons/ha can be incorporated to a depth of 300 mm in sodic soils for reclamation purposes.

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