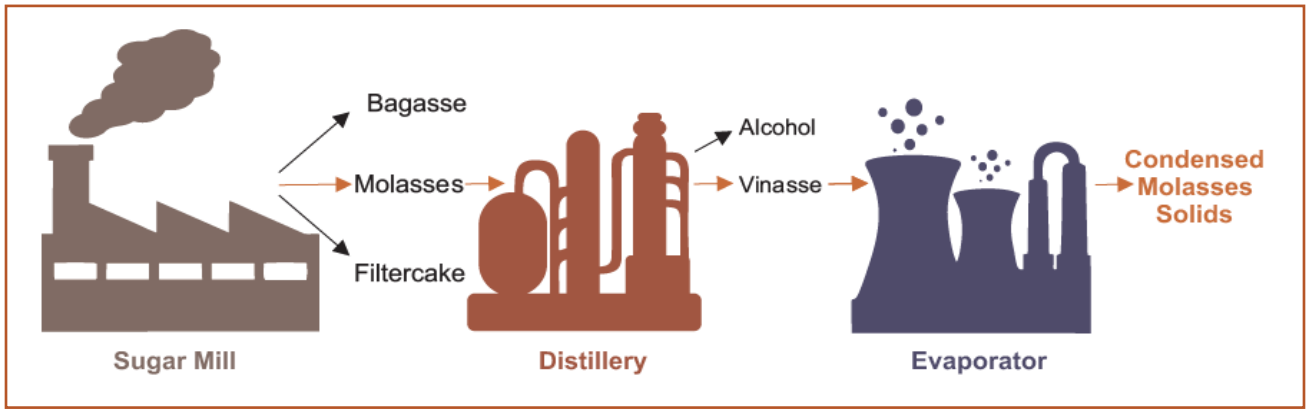
Information Sheet

7.20 Condensed Molasses Solids (CMS)

A large proportion of the potassium (K) fertiliser used on sugarcane ends up in the sugarcane stalk. During the sugar milling process, sucrose is extracted from the stalk and the nutrients end up in the by-products (bagasse, molasses, filtercake). During alcohol production, only the sugars in the molasses are converted to alcohol and the nutrients remain in the vinasse. Vinasse contains 75 to 95% water and is therefore very bulky to transport as a nutrient source. To transport this product more economically, its volume is reduced through evaporation to produce Condensed Molasses Solids/Stillage/Solubles (generically called CMS).



CMS is used extensively as a potassium fertiliser in the sugar industry in southern Africa. Because of its reduced volume, CMS can be profitably applied in the field even when transported over long distances. CMS also provides smaller quantities of nitrogen, phosphorus, calcium, magnesium, sulphur and micronutrients. The product may be applied to both plant and ratoon cane.

Table 1: Nutrient content in CMS (and the equivalent nutrient content in 3 tons of the material).

Constituent	Analysed content	Content in 3 tons or 2.4 m^3 CMS
pH	4.5	4.5
N	1.0 %	30 kg
P	0.16 %	5 kg
K	5.0 %	150 kg
Cl	3.8 %	114 kg
Ca	1.0 %	30 kg
Mg	0.8 %	24 kg
S	1.1 %	33 kg
Organic Matter	40 %	1200 kg
Water	45 %	1350 kg

Molasses, vinasse and CMS are rich in potassium (K) and are regarded as a cost-effective alternative source of K compared to conventional fertilisers. The typical nutrient composition of CMS is shown in Table 1. CMS is approximately equivalent to a N:P:K fertiliser with the ratio of 7:1:38.

This becomes important when determining the quantities of product to be applied in a fertiliser programme. Due to the variability in the composition of CMS, it is advisable to have it analysed at a reputable laboratory (such as SASRI's Fertiliser Advisory Service) in order to apply the correct amount.

Application rates

Always start by referring to the nutrient requirements recommended in your soil test report.
When calculating the amount of CMS to apply, one should use the K requirement as a starting point. This is because K is the nutrient with the highest concentration in CMS. The CMS applied will satisfy your total K requirement, and partially satisfy your nitrogen (N) and phosphorus (P) requirement. Additional quantities of N and P will be necessary to satisfy the total nutrient requirement. This is best demonstrated by way of example.

Calculating amounts of CMS to apply

Example: *Your FAS soil test report recommends the following: N: 130 kg/ha P: 20 kg/ha K: 150 kg/ha:*

Start with the K requirement of 150 kg/ha.
From Table 1 we know that the K concentration in CMS is 5.0%. Therefore, the amount of CMS required can be calculated as follows:
5.0 ÷ 100 x CMS required = 150 kg K/ha
∴ CMS required = 150kg K /ha x (100 ÷ 5.0) = 3 000 kg (3.0 tons).

Note: Generally, CMS is applied on a volume basis. To convert the mass (tons) of CMS required to volume you will divide the mass by the specific density of the CMS (average of 1.25 ton/m^3, where 1m^3 is about 1000 L) e.g. 3 tons ÷ 1.25 ton/m^3 = 2.4 m^3 CMS

Using the proportions given in Table 1, we can establish that 3 tons (or 2.4 m^3) of CMS will provide the amounts of nutrients shown in that same table. Thus, a further 100 kg/ha of N and 15 kg/ha of P will have to be applied to bring the nutrient balance up to the levels recommended in the laboratory test report in the above example.

Equipment to apply CMS

The biggest problem associated with CMS is its corrosiveness. Spraying equipment should therefore be made of corrosion-resistant material. Unlike molasses, the viscosity (ability to flow) of CMS is not a problem. It can be applied easily with conventional spraying equipment mounted on any type of tanker. On fields with steep slopes, knapsacks should be used to apply CMS.

▲ An example of conventional spraying equipment mounted on a tanker.

▲ Knapsacks used to apply CMS.

Fortification of CMS

Instead of applying the N and P separately, CMS is occasionally fortified with urea or anhydrous ammonia and phosphoric acid to produce a balanced N:P:K product. Because CMS is a thick concentrated product, it is difficult to dissolve any substance in it. The integration of additives into CMS must be left to professional companies who have the proper equipment and the necessary skills. Growers should therefore not attempt to integrate additives into CMS themselves in the hope of reducing costs, as this could result in an uneven application of the additive. If you wish to make CMS tank mixes on the farm, you must invest in proper corrosion resistant continuous agitation systems.

CMS infiltration into soil

CMS will infiltrate faster into soils with larger pores (sandy soils) compared to those with smaller pores (clayey soils) due to its high viscosity (or thickness). Thus, when applied to clayey soils, CMS will remain on the surface for longer. Additionally, as with many other N-carriers, the longer the carrier is exposed to the elements (left on the surface) the higher is the possibility of N loss due to volatilisation. CMS should therefore be treated as any other N carrier with the objectives of minimising N losses due to volatilisation.

Although CMS will stick to surface residue, it will not prevent K from this source to be taken up by the crop. Trials conducted on K deficient soils have shown that, even in a drought year, K uptake supplied with CMS was similar to K from KCl fertiliser.

Cautionary notes

- CMS should not be applied to soils that are poorly drained (i.e. some alluvial soils with distinct differential textural layers, valley bottom soils, and soils with a high water table), as it might lead to the development of anaerobic conditions and a build-up of salts in subsurface layers. Thus, CMS may be applied to well-drained alluvial soils (and all other soils) with no sign of an occasional water table.
- CMS has a high oxygen demand which means that it will consume significant portions of oxygen in water should it end up there, and this may lead to the suffocation of most aquatic life. Care should therefore be taken to avoid spillage of large quantities into waterways, rivers, streams and dams.
- Application of large volumes of CMS will require special application equipment. Also, there is a risk of corrosion when CMS is applied through a centre pivot.
- Due to the low pH of CMS, growers might be concerned that it will contribute to soil acidity problems. However, field trials conducted on Glenrosa and Shortlands soils showed no worsening of soil acidity measured over three crops and six years in the midlands. CMS will therefore not impact negatively on acidification of soils.

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