



Information Sheet

7.10 Manganese management



Sugarcane requires about 30 grams manganese (Mn) per ton of cane harvested (a typical 100 t/ha sugarcane crop removes about 3 kg Mn/ha). Manganese is involved in chlorophyll production, thus playing a role in photosynthesis. It also has functions in nitrogen chemistry and respiration and is required for efficient germination and plant maturity. It has close associations with other micronutrients in several enzymatic processes in the plant. Deficiency is not common, though more likely on the **irrigated, alkaline soils** of the Lowveld. Toxicity is mainly associated with acidic soils and may also occur in waterlogged soils. The aeration status and pH of the soil are key drivers of availability, but in most soils Mn will exist as insoluble oxide forms. Soil microorganisms have been suggested to have a strong effect on Mn availability for crop uptake. Plant uptake is typically in Mn^{2+} form.

Deficiency symptoms

- Pale interveinal stripes develop on younger leaves first.
- In severe deficiency entire leaf becomes bleached and chlorotic
- Leaf blades may split and fray in the wind.

Deficiency is characterised by yellowing of younger leaves, and interveinal chlorosis. ►



Impact of excess manganese

While excess Mn is not a common problem, but it may occur in acidic or waterlogged soils. While specific toxicity symptoms have not been reported, in other crops it is reported to present as brown or black dead (necrotic) spots on older leaves.

Factors affecting manganese availability

Manganese occurs mainly as insoluble oxides, but is affected by aeration status and pH. In well-aerated soils, availability is controlled mostly by pH, complexes with organic matter, and soil microorganisms. Other factors that play a role are competitive interaction with other elements such as Fe and reduced availability under dry and cold soil conditions.

pH

Maximum solubility of Mn occurs in very acidic soils, though optimal plant availability occurs at between pH 5 and 7.5. At pH values >8, Mn availability decreases sharply due to the formation of various insoluble Mn compounds.

Other factors

Dry and cold soil conditions have also been implicated in plant unavailability leading to short term deficiency. Occasionally imbalance with other elements such as Ca, Mg and other micronutrients can lead to deficiency in the crop.

Manganese application guidelines

Soil treatment

While not the most effective treatment, soil application of manganese sulphate has been reported to result in improved crop response, particularly in alkaline soils. The following guidelines apply:

- Soil testing is not an adequate indicator of Mn supply, but soil test values **below 2 mg/L** may be indicative of potential supply problems.
- **Leaf testing** is a better indicator if the crop can take up sufficient Mn. Test values **below 15 ppm** indicate the need for amelioration.
- Top dress or furrow apply **20 – 30 kg Mn/ha** as manganese sulphate or chloride.
- Where deficiency is due to alkaline soil (pH >7.5), top dress or furrow apply acidifying fertiliser or furrow apply elemental sulphur.
- Where toxicity is due to acidity, liming may improve availability, though caution not to over-lime is necessary. Avoid liming to pH greater than 7.5 (ideal it between 4.5 and 5.5).



▲ Leaf test for Mn availability by regularly submitting leaf samples to the FAS Agricultural Lab.

Foliar spray

Foliar application is the preferred treatment where deficiency is detected from leaf analysis (**<15 ppm**). The following guidelines apply (plant or ratoon):

- Apply a foliar application of **0.5 to 1%** manganese sulphate (or Mn-chelate solution) and a suitable wetter, using a knapsack spray rate of 300 to 400 L/ha.
- This can be applied as soon as there is sufficient leaf material (5 to 6 leaf stage) and preferably during warmer spells to promote uptake.
- If deficiency symptoms do not disappear with about 3 weeks of treatment a second application may be required.

Precautions for Mn use

Where Mn compounds are to be applied through irrigation systems or knapsack sprayers, ensure that compatibility with other compounds to be added and ensure water is not alkaline. Manganese will complex and precipitate to form scales and block nozzles and pipes. Acid or oxidant flushing may be necessary to remove these build-ups.

Available manganese fertiliser formulations

Source/product	Mn%	Solubility	Notes
Manganese sulphate	33	Moderate	Soil or foliar application
Manganese chelate	12	High	Soil or foliar application

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October 2022

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