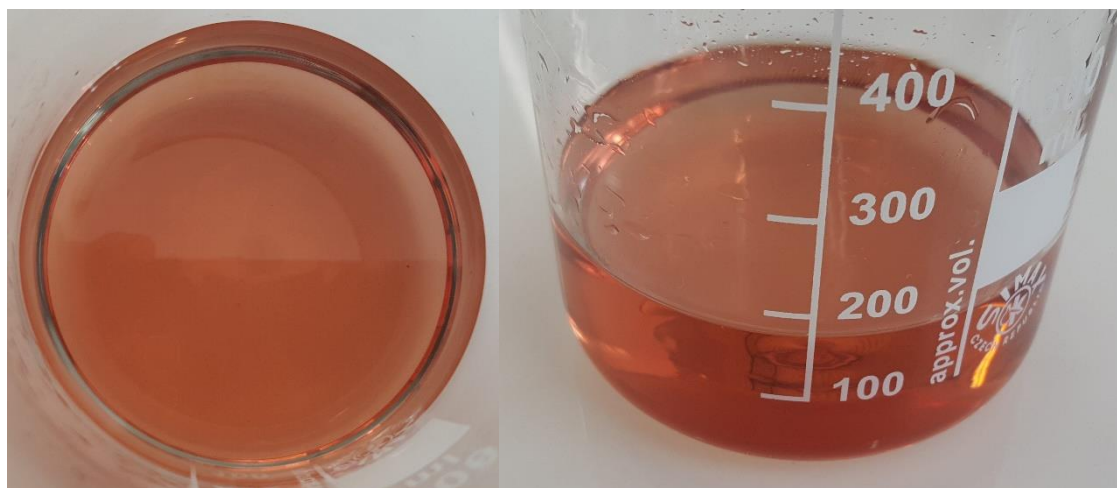


## Technical Data Sheet

### Manganese Ammonium Citrate

**Manganese Ammonium Citrate** is a concentrated and easily assimilated form of manganese. The manganese is chelated with organic acids. Its intended use is to correct plant and soil deficiencies of this key micronutrient.

**Manganese Ammonium Citrate** contains 10.3% manganese (W/V) chelated with organic acids, plus 6.4% nitrogen and 6.0% sulphur. **Manganese Ammonium Citrate** is a salmon pink coloured liquid with a mild ammonium odour (also available as a spray-dried powder if required for powder blending).



#### Why choose **Manganese Ammonium Citrate**?

While manganese sulphate and synthetic aminopolycarboxylate chelates (e.g. EDTA) are widely used to correct micronutrient deficiencies, **Manganese Ammonium Citrate** provides a number of benefits over conventional manganese fertilizer formulations:

- Aminopolycarboxylates have questionable biodegradability and thus the synthetic molecule can build up in soil if used over successive growing cycles. Thus **Manganese Ammonium Citrate** is more in balance with natural processes and is readily biodegraded to leave no harmful residues.
- *Systemic action:* **Manganese Ammonium Citrate** utilises citrates, which are the organic acids that plants naturally use to absorb and transport manganese. Therefore, **Manganese Ammonium Citrate** is faster acting and more potent than manganese sulphate, which struggles to be transported around plants once absorbed.

- Manganese sulphate is acidic in solution which makes it unsuited for alkaline formulations or growing conditions.
- Manganese-EDTA contains sodium ions carried over from the manufacturing process which are toxic to plants.
- Manganese-EDTA is comparatively expensive.
- **Manganese Ammonium Citrate** contains significant amounts of useful nitrogen and sulphur which boosts growth and provides additional protection against chlorosis.

For distributors: Both Manganese-EDTA and manganese sulphate are widely available, while **Manganese Ammonium Citrate** is an exciting and novel new product for 2017, thus allowing distributors to achieve and maintain significant market share quickly.

## Manganese deficiencies explained

Manganese is an essential micronutrient which is a key component of many important metabolic processes. In particular, it is crucial for the enzymatic catalysis of many redox reactions in photosystem II and nitrogen assimilation.

In a similar situation to deficiencies in iron, manganese becomes unavailable to plants as the soil pH rises. Therefore, deficiencies in these two micronutrients are common in neutral to alkali soils. In fact they are two of the most common nutrient deficiencies found in crops globally.

Manganese deficiencies are now also common in crops that have been genetically modified to resist the herbicide glyphosate. This is due to a combination of the direct inhibition of the plants absorption and translocation system (10-50% reduction compared to normal capacity) and the glyphosate anion binding the manganese cation in the soil thus immobilizing it (AKA 'lock up'). This means that manganese fertilizer rates need to be elevated by around 50% and chelated foliar applications are additionally required when excessive glyphosate levels are present in the soil. It is not just the crop that is affected by glyphosate application, with beneficial soil microorganisms also harmed by glyphosate inhibiting their uptake and use of the essential manganese nutrient. Therefore, even in non-GM crops, if glyphosate is being used as pre-emergence or spot applied herbicide significant manganese deficiencies can occur.

Manganese is also largely xylem mobile and thus plants can also suffer deficiencies in these nutrients if the xylem sap is not flowing such as during periods of soil water deficits. This will result in symptoms appearing in young leaves, and should be addressed by foliar applications.

Crops particularly susceptible to manganese deficiencies include acid-loving (ericaceous) crops and cereals, especially barley.

Some typical symptoms of manganese deficiency include interveinal chlorosis or mottling and/or the browning of leaf margins. An extreme example is shown below on rocket leaves (*Eruca sativa*).



## Application protocol

**Manganese Ammonium Citrate** is suitable for application to all crops.

Ideally apply before symptoms of deficiency appear.

**Manganese Ammonium Citrate** is suitable for application as a foliar spray, root drench or dosed into fertigation streams.

For foliar applications **Manganese Ammonium Citrate** should be applied at a rate of 1.0 – 2.0 litres/ha. Apply using a sprayer fitted with a nozzle that produces a fine mist. Apply sufficient solution to coat the leaves with a film of moisture with little or no run-off. Re-apply weekly.

For soil applications in field crops increase application rate five to ten fold.

For hydroponic application add 20mL for every 1000L of fertigation solution.

Tank mix compatible with most co-products (pesticides, biostimulants and other fertilizers). Always conduct a bucket test to confirm with new mixes.

**Manganese Ammonium Citrate** is a newly developed product. As such, further research work will provide additional application recommendations for a range of different crops.

Health and Safety: for guidance on safe transport, storage, use and disposal of the product please refer to the relevant Plater-Bio Safety Data Sheet (SDS).