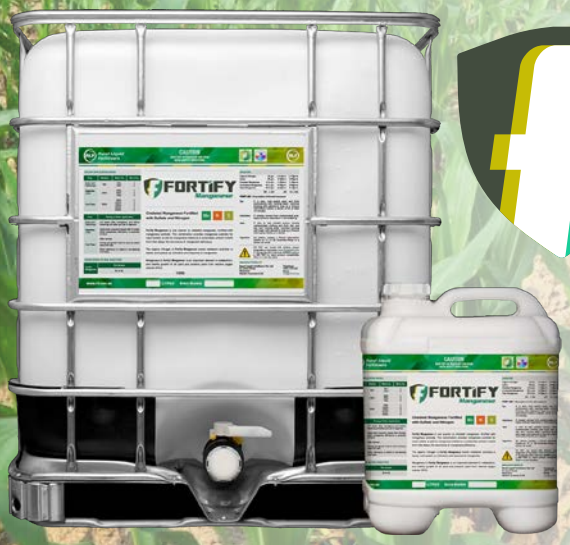

FORTIFY Manganese

Liquid Fertiliser

FOLIAR APPLICATION RATES

Crop	Dilution	Water/ha	Mn/L/ha
Grain and Field crops	50X	50L 100L	1 2
Vegetable crops	250X	250L 500L 750L	1 2 3
Fruit trees	500X	500L 1000L 1500L 2000L 2500L	1 2 3 4 5

Crop	Timing for Foliar Application
Grain and Field crops	4-5 weeks after emergence and before flowering and after pod set in legumes
Vegetable crops	Apply when required, repeat after 2 weeks when manganese deficiency is expected to recur
Fruit trees	After harvest. During spring leaf flush as soon as leaves reach full size. When deficiency is noted in non-bearing fruit trees.

FERTIGATION OR SOIL INJECTION

Fortify Manganese	Per hectare
	2L to 5L

Chelated Manganese Fortified with Sulfate and Nitrogen

Mn N S

Fortify Manganese is one quarter as chelated manganese, fortified with manganese sulphate. This combination provides manganese sulphate for rapid uptake, as well as manganese chelate as a sustainable, phloem-mobile form that delays the recurrence of manganese deficiency.

The organic nitrogen in **Fortify Manganese** boosts metabolic activities in leaves, and speeds up utilisation and response to manganese.

Manganese in **Fortify Manganese** is an important element in metabolism, and healthy growth of all plant and prevents plant from Reactive Oxygen Species (ROS).

Analysis	AU
Organic Nitrogen	
Sulfur	
Chelated Manganese	
Unchelated Manganes	
Total Manganese	
SG Density (g/mL)	

FORTIFY Manganese

Chelated Manganese Fortified with Sulfate and Nitrogen

Mn N S

Why Manganese is an Important Plant Element

Manganese (Mn) is a transitional element with 11 valencies measuring from -3 to +7. The common valencies are 1, 2, 4 and 7. This high valency range enables manganese to catalyse many oxidation-reduction reactions in plants.

The most important of these is its structural role in water-splitting enzyme system of photosystem II (PSII), made of a cluster of 4 manganese and one calcium associated with amino acids and proteins in the thylakoid membrane of chloroplast.

(NOTE: *The valency of an element is determined by the number of outer shell (valence) electrons. This is in the range of +1 to +3 for metals and in the range of -1 to -3, (for 7, 6 and 5 electron in outer shell respectivley for non-metals. Carbon and silicon can have -4 or +4 valency, noble gases have 0 valency since their outer shell is complete having 2 or 8 electrons).*

This water splitting system is the heart of the reaction centre in which light energy is converted into electrochemical energy. This results in the production of molecular oxygen and reduced co-factors that is needed to make sugar from carbon dioxide. All living organisms depend on water splitting (photolysis) to oxygen and hydrogen. The hydrogen separates to electron and proton and feeds electron to the electron transport system of chloroplast, making ATP from ADP. Eventually, proton and electron reach oxidised co-factor (NADP), reducing it to NADPH. The latter reduces CO2 to sugars in dark reactions of photosynthesis.

Manganese is also required as a structural component in superoxide dismutase and acid phosphatase. It also is required as an activator of a few dozens of enzymes in the dehydrogenase, decarboxylase and kinase groups.

Manganese is therefore an important element in metabolism, and healthy growth of all plants and prevents plant injury from Reactive Oxygen Species (ROS).

Manganese is absorbed primarily as divalent form (Mn+2). It is the most abundant trace element in soil after iron, therefore its deficiency results from low availability in alkaline soils, or its tie-up with soil organic matter.

Manganese accumulates at toxic levels in plants under flooded conditions, or strongly acidic soils that often have low calcium and magnesium.

Manganese deficient corn in a paddock having alkaline soils and high organic matter

Manganese Deficiency

When tissue manganese is below 18 to 30 PPM on dry weight basis, manganese deficiency symptom appears as interveinal chlorosis due to greener cells bordering veins.

This happens since cells near the veins grab Mn before other leaf cells as Mn moves through the xylem sap of leaves.

Mn