

# Turf Hardener

Maxwell Turf Hardener is an advanced chelated calcium formulation designed to strengthen turf and increase the plant's ability to withstand stress and pathogens.

Advanced source of bioavailable calcium (15% CaO w/v) containing natural plant growth stimulants to facilitate optimum calcium uptake and translocation within the grass plant



## Why choose Maxwell Turf Hardener?

- Uniquely chelated** with natural acid technology that is not present in other products on the market, making Maxwell Turf Hardener highly bioavailable to the plant with increased calcium movement through the xylem and into the cell walls where it is needed.
- The **balanced nitrogen level** in Maxwell Turf Hardener has been carefully constructed to allow plant tissues to be optimally activated, just enough to absorb the calcium, but not to excess, **thereby not stimulating** excessive, weak vegetative growth which is more susceptible to turf diseases such as *Microdochium nivale*.
- Competing products** often use calcium carbonate (lime), which leads to a higher pH which is less conducive for turf grass plant health.
- Foliar application** allows calcium to be absorbed efficiently and reach the growing points rapidly. This helps prevent negative interactions in the soil where calcium can inhibit the absorption of boron, magnesium and phosphorus, and lead to the vaporisation of nitrogen.
- Formulated with the addition of three** complementary plant elements to facilitate maximum uptake efficiency and grass plant function in a natural way.
  - Mg<sup>2+</sup> Magnesium** – included to prevent an imbalance in calcium-magnesium ratio.
  - Zn Zinc** – maximises auxin synthesis, the essential hormone for calcium uptake into actively growing plant cells.
  - B Boron** – corrects deficiencies arising from stressful conditions when xylem flow has been restricted. Like calcium, boron is immobile in the phloem, so both calcium and boron deficiencies are most commonly occur under similar conditions.
- Significantly less hazardous** to human health than competing products (see associated safety data sheets for further information).

### Application

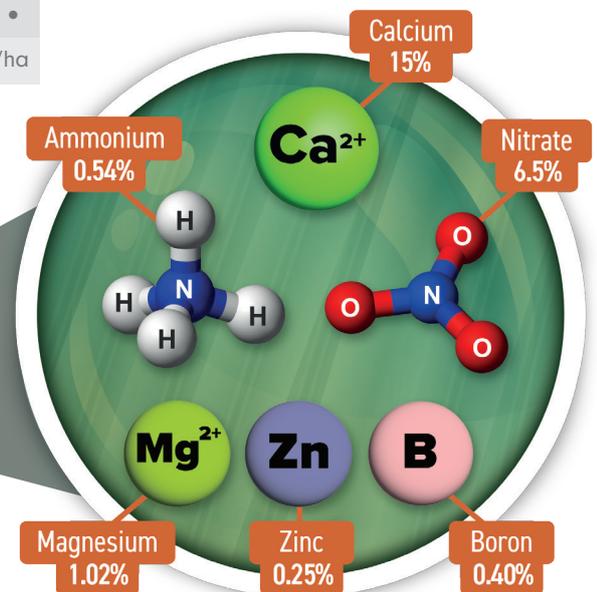
	J	F	M	A	M	J	J	A	S	O	N	D
	•	•	•	•	•	•	•	•	•	•	•	•
<b>Rate:</b>	20-40 L/ha						<b>Volume:</b>	300-450 L/ha				

✓  
**Naturally chelated**  
– for optimised foliar application and absorption

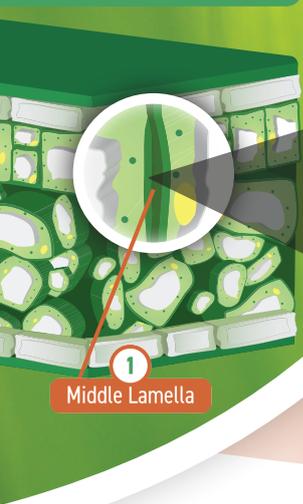
✓  
**Highly mixable**  
– with other plant strengthening elements as part of an ITM approach.

✓  
**Low nitrogen formulation**  
– carefully balanced to maximise uptake and activate plant function without stimulating lush susceptible growth.

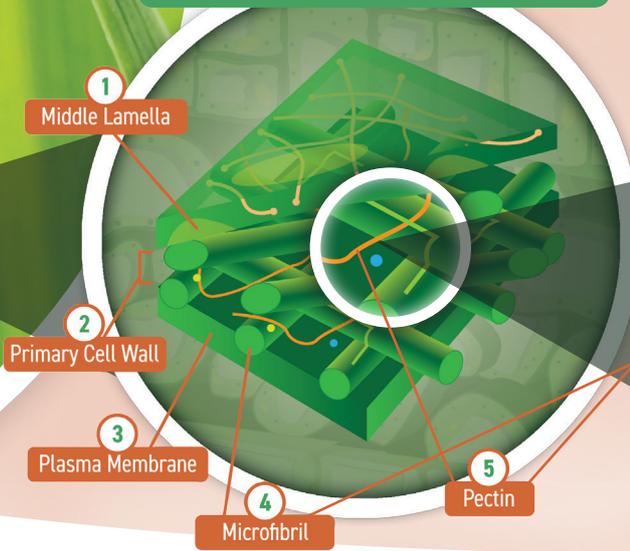
✓  
**Year round application**  
– Turf Hardener can be applied all year round.



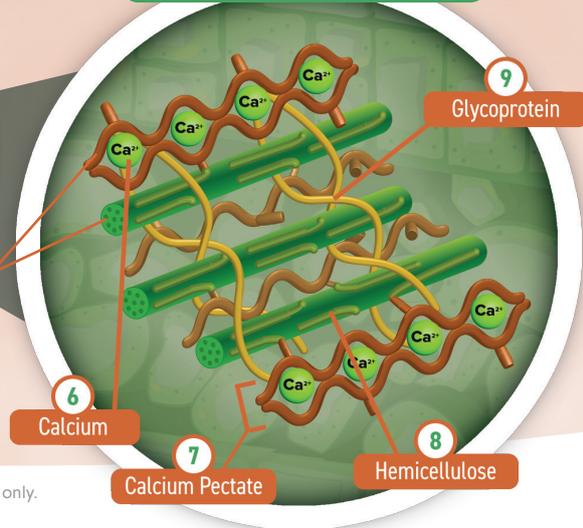
## Grass Leaf Cross-section



## Cell Wall Structure



## Location of Calcium Pectate



Diagrams for illustrative purposes only.

## Cell Wall Function

### Cell Wall

Plant cell walls provide the cell with structural support and protection. They are predominantly comprised of the carbohydrates cellulose, hemicellulose and pectin.

### 1 Middle Lamella

A thin layer which sits between adjacent cells mainly comprised of calcium pectate. Due to the cross bridging of calcium pectate in this area, the middle lamella functions as a cementing layer, binding and adhering adjacent cell walls together and thus the overall plant structure.

### 2 Primary Cell Wall

The first boundary formed as a cell increases in size during the growing process. The primary cell wall is built from a number of carbohydrates and proteins.

### Secondary Cell Wall

Contains a wide range of compounds that vary from one family of plants to the other. In the Gramineae family, which includes turf grasses, the secondary cell wall includes silicate crystals which further aid cell strength and resilience.

### 3 Plasma membrane

Also referred to as the cell membrane, this effectively acts as the skin of the cell, providing mechanical support and separating the interior of the cell from the outside world. The cell membrane is selectively permeable and facilitates the

passage of materials either into, or out of, the cell as needed for its survival.

### 4 Microfibril

A chain like arrangement of cellulose molecules orderly arranged into strand structures. Microfibrils are twisted together like strands in a rope and collectively form macrofibrils which create a criss-crossing lattice arrangement within the primary cell wall and provide tensile strength.

### 5 Pectin

Pectin acts as the glue which holds plant cells together. It is formed of polysaccharide carbohydrates which are rich in galacturonic acid, forming long repeating chains of simple sugar molecules. They have a negative charge causing them to bind with a positively charged calcium cation thus forming calcium pectate.

### 6 Calcium $Ca^{2+}$

A secondary macronutrient required by plants in significant quantities. The calcium ion is a positively charged cation, primarily utilised by plants in the construction of cell walls, where it forms a strong association with pectin to form calcium pectate.

### 7 Calcium Pectate

A pectate salt which helps to keep cell walls both ridged and resilient. Calcium pectate is present in both the primary cell wall and middle lamella where it facilitates the binding together of adjacent cell walls and significantly contributes towards overall cell

strength increasing tolerance to biotic (organism) and abiotic (environmental) stress. It also forms a gel like matrix that fills the spaces between the microfibril cellulose-hemicellulose network, holding them together as part of what is termed the pectin matrix. Calcium pectate is constructed of pectin chains arranged in a helix formation with a calcium cation residing in the central space between the two strands.

### 8 Hemicellulose

Hemicellulose describes a number of polysaccharide carbohydrates with glucuronoarabinoxylan being particularly abundant in grass plants. Unlike pectin, they form short branched chains which are less resilient to degradation. In the plant cell wall, hemicellulose binds to the cellulose microfibrils and acts as a tether to form the cellulose-hemicellulose network.

### 9 Glycoprotein

Glycoprotein is used to describe a range of proteins with a specific molecular structure. Numerous glycoproteins are present in plant cell walls where they perform a range of metabolic functions.

## Suitable for Tank Mixing with:



Distributed exclusively by:



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For non-pesticidal disease suppression as part of an Integrated Turf Management approach.