



# FoliMAX<sup>®</sup>

## NUTREX<sup>™</sup> DELIVERY TECHNOLOGY



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*Liquid nutrition at its best*



# FoliMAX Nutrex™ Delivery Technology

## What is NUTREX™ DELIVERY TECHNOLOGY

Nutrex™ Delivery Technology is a novel technology designed to enhance foliar uptake of liquid nutrition products, and optimise internal mobility of the applied nutrient. This vastly improves the efficiency of applications of fertilizer formulations containing the Nutrex™ Delivery Technology, resulting in minimal nutrient loss and optimum plant response. Nutrex™ Delivery Technology is included in key FoliMAX formulations to maximise the efficiency of applied nutrient.

Nutrients applied to the foliage in raw form are often not absorbed efficiently by the plant leaf, and may take an extensive period of time to move into plant tissue. This can result in significant environmental losses of applied nutrient, and poor post application response from the plant. Nutrex™ Delivery technology works by complexing the relevant nutrient with a plant-derived carbohydrate. The carbohydrate molecule is recognised by the plant as a desirable compound and is efficiently taken into the leaf and mobilised throughout the plant's vascular system.

### The key advantages of Nutrex™ Delivery Technology are:

- Enhanced uptake and nutrient delivery to the plant's vascular system.
- Integrated surfactant package for optimised surface spreading, further enhancing foliar uptake.
- Natural humectants within the formulation prolong drying time on the leaf to extend the uptake window.
- Improves internal mobility of applied nutrients, getting the nutrient to where it needs to be faster, and with less expense of energy to the plant.
- Provides a source of energy to the plant as the carbohydrate is metabolised internally.

### Foliar product considerations:

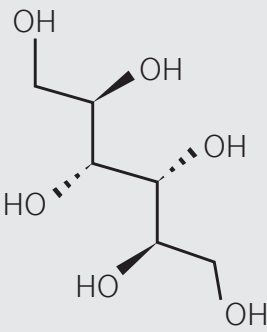
- Solubility/molecular size
- Spreading
- Sticker/humectants to extend drying time
- Cuticular penetration/pH
  - Absorption/diffusion
  - Phloem mobility

### The Nutrex™ carbohydrate complex

Nutrex™ technology harnesses a specific plant-derived carbohydrate called glucitol ( $C_6H_{14}O_6$ ) to act as a chelate within the formulation. The glucitol carbohydrate is synthesised within several plant species, and performs various functions in internal moisture management. With several points of polarity on the glucitol molecule, a complex is easily formed with the desired nutrient making it an efficient complexing / chelating agent. The small size and compact structure of the Nutrex™ molecule are unique among chelating compounds, making it an extremely efficient uptake catalyst. The result is a superior chelate option compared to other commonly used nutrient carriers which are generally much larger and can hinder foliar absorption.

Name	Glucitol
Class	Carbohydrate
Structure	$C_6H_{14}O_6$
Mass	182 mol

Nutrient Carrier	Molar Mass (mol)
Nutrex™	182
Glucoheptonate	248
EDTA	292
Lignosulphonate	>500
Fulvic Acid	>1,000
Humic Acid	>10,000



### Enhanced foliar uptake

The **small size** of the Nutrex™ molecule makes it conducive to foliar uptake, allowing it to easily enter via the stomata or through the leaf cuticle. Other chelating compounds are generally larger, often inhibiting foliar absorption.

The **integrated surfactant package** assists in spreading the solution over the leaf surface. This ensures optimum nutrient to foliage contact, facilitating efficient uptake. The surfactant package is a natural, plant-derived compound and does not possess the potential burning characteristics of many synthetic surfactants.

The **acidic (low pH)** nature of Nutrex™ formulations also assists with foliar penetration. Turf plants have a natural wax cuticle coating the foliage that is designed to repel water. Acidic compounds help to disrupt the cuticle; this allows the Nutrex™ molecule to pass into the plant tissue unrepelled. As the solution is not a strong acid, the disruption of the cuticle is subtle, and does not compromise plant health.

**Natural humectants** within the formulation help to prolong drying time on the leaf. This allows the applied nutrient to remain in solution for longer, extending the timeframe in which the plant can absorb the nutrient. In combination with the surfactant properties, the extension of leaf activity provides unsurpassed foliar absorption.

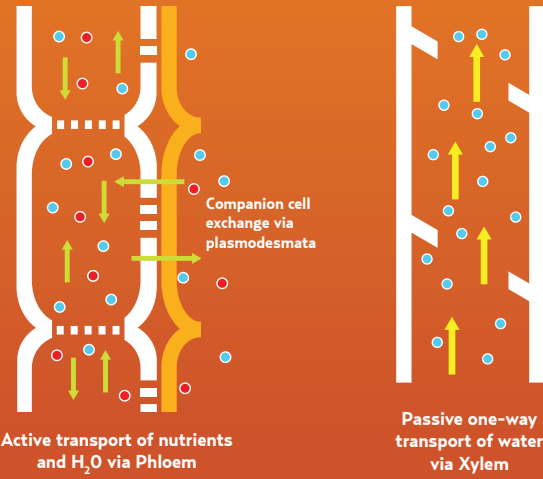
### Mobility within plants

Once applied to the foliage the Nutrex™ molecule acts as a catalyst to carry the nutrient into the plant's vascular system. As the plant recognises the Nutrex™ molecule as an energy compound it immediately assimilates it into the phloem where it can be transported throughout the entirety of the plant. Phloem is a significant nutrient transport system, and many of the major elements required by plants are more efficiently transported through phloem as opposed to xylem.

### Comparison of phloem and xylem exudates from *Nicotiana glauca* (Marschner, 2012).

Nutrient	Phloem	Xylem	Ratio Phloem/Xylem
	$\mu\text{g/mL}^{-1}$		
Amino compounds	10,808	283	38.2
Ammonium	45.3	9.7	4.7
Potassium	3,673	204.3	18
Phosphorus	434.6	68.1	6.4
Chloride	486.4	63.8	7.6
Sulphur	138.9	43.3	3.2
Calcium	83.3	189.2	0.44
Magnesium	104.3	33.8	3.1
Sodium	116.3	46.2	2.5
Iron	9.4	0.6	15.7
Zinc	15.9	1.47	10.8
Manganese	0.87	0.23	3.8
Copper	1.2	0.11	10.9

Phloem is an active transport system, selectively transporting nutrients and photosynthetic compounds throughout the plant to perform various functions. Mobility within the phloem allows the plant to transport the Nutrex™ molecule both upwards and down, to wherever it is required for immediate use. Once active within the phloem the Nutrex™ carbohydrate complex is metabolised, releasing the nutrient as well as the carbon, hydrogen and oxygen ions that comprise the molecule. Xylem on the other hand functions as a passive system, operating automatically under the capillary forces of water molecules, and so cannot selectively determine the location to which the nutrient will be sent. Traditionally, soil nutrients are up taken by the plant roots and move only upwards within the xylem, where they are taken to nutrient sinks and utilised or stored.



## Products containing NUTREX™ DELIVERY TECHNOLOGY

The FoliMAX Range couples essential plant nutrients with Nutrex Delivery Technology to enhance the efficiency of which the nutrient is absorbed and utilised within the plant.



**6% Fe** **Rate: 20-50L/ha**

**FoliMAX Iron +** is a liquid fertiliser solution containing 6% iron with Nutrex Delivery Technology. The Nutrex delivery system harnesses plant carbohydrates within the solution as a catalyst to optimise nutrient uptake through the foliage, maximising application efficiency.



**0.24% B, 0.06% Cu, 0.06% Mg, 1.08% Mn, 5.7% Zn** **Rate: 10-20L/ha**

**FoliMAX Trace +** is a complete liquid trace element package delivering essential micronutrients with Nutrex Delivery Technology for optimum foliar uptake. It contains boron, copper, magnesium, manganese and zinc, supplying the building blocks for healthy turf.



**15% Ca** **Rate: 10-20L/ha**

**FoliMAX Calcium +** is a liquid fertiliser solution containing 15% calcium with Nutrex Delivery Technology. The Nutrex delivery system harnesses plant carbohydrates within the solution as a catalyst to optimise nutrient uptake through the foliage, maximising application efficiency. For the prevention and correction of calcium deficiencies.



**5% Mg, 6% N** **Rate: 20-50L/ha**

**FoliMAX Magnesium +** is a liquid fertiliser solution containing 5% magnesium with Nutrex Delivery Technology, and 6% nitrogen as nitrate. The Nutrex delivery system harnesses plant carbohydrates within the solution as a catalyst to optimise nutrient uptake through the foliage, maximising application efficiency. For the prevention and correction of magnesium deficiencies.



**6% Mn, 8% N** **Rate: 10-30L/ha**

**FoliMAX Manganese +** is a liquid fertiliser solution containing 6% manganese with Nutrex Delivery Technology, and 8% nitrogen for optimised plant response. The Nutrex delivery system enhances nutrient uptake through the foliage, optimising application efficiency. For the prevention and correction of manganese deficiencies.