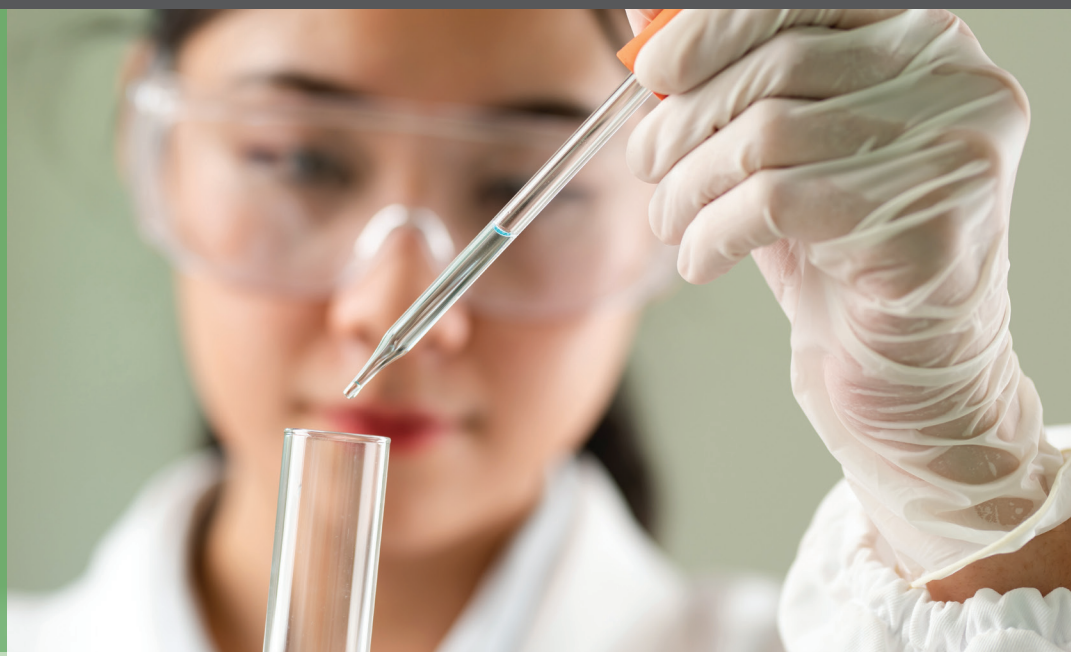
# PiNT mode of action and the importance of nitrogen

Our PiNT™ technology optimises nitrogen delivery to plants, encouraging better establishment, rooting and growth.



## Benefits of PiNT technology

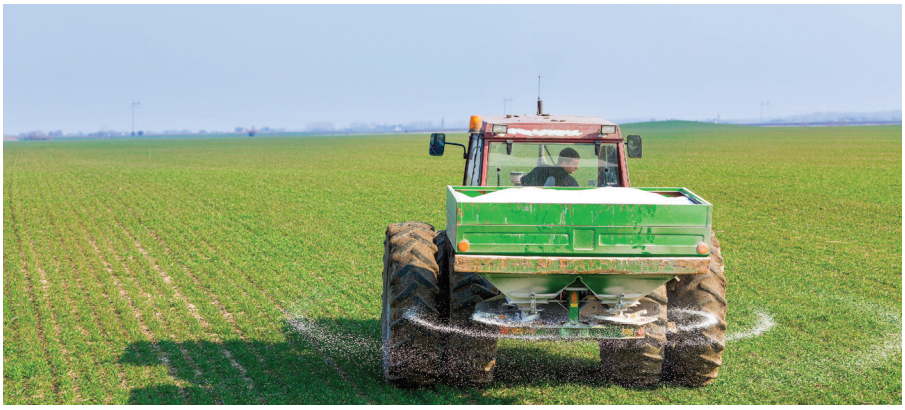
- ✓ Gradual nitrogen release for sustained nutrition
- ✓ Better rooting and establishment
- ✓ Better growth habit, with shorter and more compact plants
- ✓ Increased (marketable) yield
- ✓ Formulated with calcium (Ca), potassium (K) or magnesium (Mg)
- ✓ Compatibility with other agrochemical foliar sprays

## PiNT gives gradual nitrogen release

PiNT products are formulated as liquids, which rely on a ureic/cation complex (Ca, K or Mg) to provide a gradual release of ammonium ($NH_4^+$), and in turn nitrate ($NO_3^-$). This cation complex serves to reduce leaching and volatilisation, while making the nitrogen (N) available to meet the needs of the crop/turf. Some formulations also contain nitrate to give more immediate nitrogen availability. While for turf it is often used as the primary nitrogen source, in horticulture and agriculture PiNT products are typically used as low volume foliar applications.

## The importance of nitrogen

Nitrogen is a very important macronutrient in plants, with many functions, and therefore is needed in large quantities. For example, nitrogen is vital to build chlorophyll (essential for photosynthesis), proteins and enzymes. As such, adequate nitrogen is essential to optimise plant growth and development.



While the application of inorganic nitrogen is essential in modern agricultural practice, it is estimated that 50-70% of it is lost, and not utilised by crops. Hence there is a need to improve nitrogen use efficiency, to help ensure that crop needs are met, and minimise losses to the environment. Locking up the nitrogen too strongly can reduce efficacy and product performance, however a rapid flush of nitrogen can result in a lot of environmental losses.

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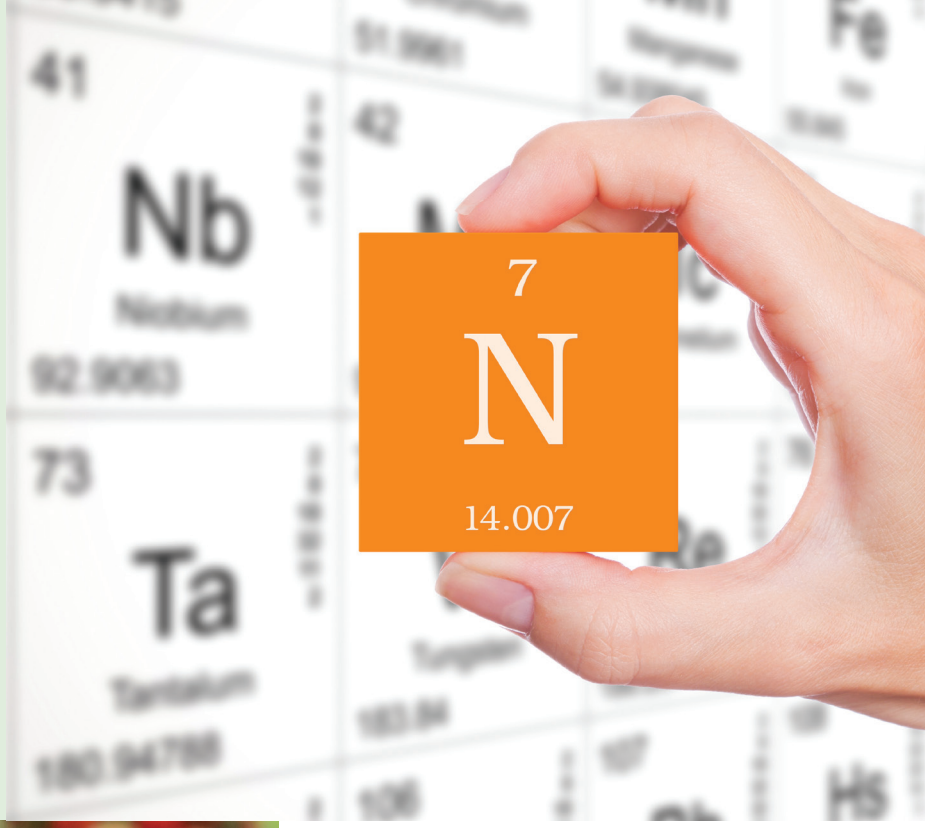
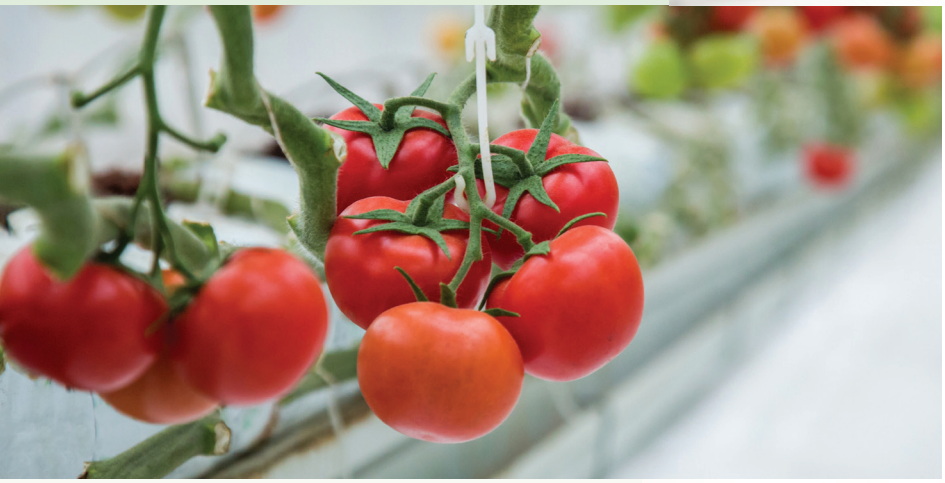
# Manipulating growth habit with PiNT

While many plants usually take up most of their nitrogen in the form of nitrate, experiments conducted using hydroponic systems, where the form of nitrogen available can be more easily controlled, have shown some interesting results. Plants supplied with a mixture of nitrate and ammonium often have increased growth and yield. In an independent scientific trial on tomato, switching from all nitrate to 75% nitrate and 25% ammonium gave thicker stems, more root dry matter and surface area, leading to an increase in yield. PiNT can be used to exploit this plant response by gradually providing ammonium in irrigation systems, which tend to be predominantly nitrate.



In maize, a mixed nitrogen source elevated yield due to increased partitioning to grain. This correlated with an increase in endogenous cytokinins and so this was thought to be the underlying mechanism. Furthermore, applying nitrate with a foliar cytokinin application gave similar yield to a mixed nitrogen source. Studies have also shown better root growth, with increased branching, after the addition of ammonium compared to nitrate alone.

Foliar applications of PiNT have been shown to stimulate root development, reduce internode lengths and increase yields (see relevant product sheets). When PiNT is applied at low volumes, it often only provides a small proportion of the plants total nitrogen needs, however can result in interesting physiological changes. This is likely due to nitrogen signalling, whereby plants perceive nitrogen and alter endogenous hormone levels. This can regulate nutrient up-take, for example, through altered root architecture. Therefore, while PiNT can be an efficient nitrogen source, lower rates of application can also provide agronomic benefits.

PiNT™

Find more information on our PiNT technology at:
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