

ENPOWER MORE THAN JUST A NITROGEN ADVANTAGE

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Improving nitrogen (N) management on-farm using an ammonium stabiliser like eNpower® has benefits beyond just reducing the potential for N losses.

Ammonium stabilisers can effectively manage the N loss pathways – leaching, denitrification and runoff. Reducing losses equates to more N being available to the crop. This is precisely what agronomists and farmers strive to achieve – more of what is applied available to grow better crops with more yield (Figure 1).

However, eNpower as an Enhanced Efficiency Fertiliser (EEF) provides more than just a N advantage. Ammonium stabilisers are lauded for their ability to improve nitrogen use efficiency. eNpower works by keeping more N in the ammonium form for longer than usual. This stabilisation time frame can last weeks and even up to three months. There is more to eNpower than just N.

This is how it works. Hydrogen ions are the direct measure of acidity. Whilst a root is taking up ammonium across a root membrane and into the root, at the same time it releases a hydrogen ion to the outside of the root membrane and into the rhizosphere. One positively charged ion in, one positively charged ion out to balance the electrical charge across the root membrane. As hydrogen ion concentration is the direct measure of acidity, the more ammonium uptake that occurs, the more hydrogen ions that are released into the rhizosphere. Consequently, PAN results in rhizosphere acidification. This process is only a very localised acidification and provides benefits to nutrient availability. Importantly, the acidification occurs in the rhizosphere only and not the soil profile.

What is the rhizosphere?

The rhizosphere is a zone in soil that surrounds a plant's entire root system. It is very narrow band being approximately 1 to 1.5mm across. The rhizosphere is a 'hot spot' of biological and chemical activity – primarily driven by the many and varied root system exudates and their interactions (Lines-Kelly, 2005).

What would a rhizosphere look like? Imagine a plant in your hand, intact with its complete root system – primary, secondary, tap and down to root hairs. Then you dunk it into a tin of thick paint and remove it. That 'thick paint' layer and volume now encompassing all the roots represents the rhizosphere when the plant is growing in the soil. This is the zone of PAN influence.

The rhizosphere (around the roots) is where the localised acidification process will occur. Changing soil pH changes the availability of nutrients, even if it is only occurring in such a small and very defined area. This is a natural process, but with eNpower and ammonium stabilisation, the process lasts for much longer. Refer to Image 1 for an image of an acidified rhizosphere.

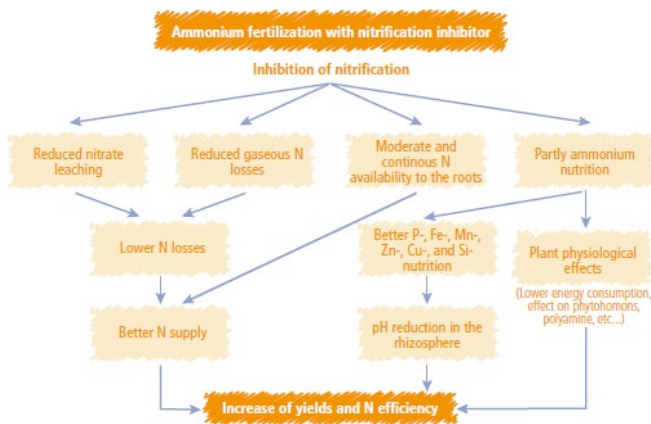


Figure 1: Ammonium fertilisation with nitrification inhibitor – reduced losses, improved nitrogen use efficiency and improved nutrient availability. Source: Trenkel, 2010.

Ammonium stabilisation with eNpower and localised pH

How can one simple thing provide so many advantages? Reduced leaching, denitrification and runoff is just the beginning of an extensive list. Let's consider just one other advantage to having more ammonium in soil for longer.

If N is available to crops in the ammonium (NH₄⁺) form, it promotes the release of hydrogen (H⁺) ions into the rhizosphere (i.e. around each individual root) in a crop's root system. Hydrogen ions directly influence pH (the consequence of this is discussed below). This process lasts for the duration of ammonium stabilisation that eNpower provides. More ammonium available to crops for an extended period is ammonium stabilisation. Greater access to ammonium leads to the multifaceted process referred to as Partial Ammonium Nutrition (PAN).

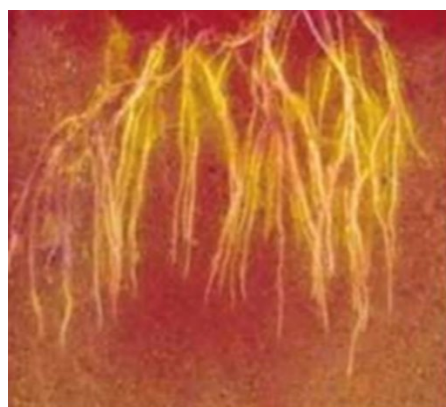


Image 1: Root induced rhizosphere acidification due to ammonium fertilisation. The 'yellow' colour indicates the localised areas where soil pH is lower relative to the soil profile pH in 'red/orange'. (Source: Marschner & Romheld, 1983).

Soil pH and nutrient availability

Soil pH directly influences nutrient availability. Crops have optimum pH ranges that favour their growth. This optimum range will vary with crop species, but generally, a range between 6.0 and 7.5 pH will suit most situations. Refer to Figure 2.

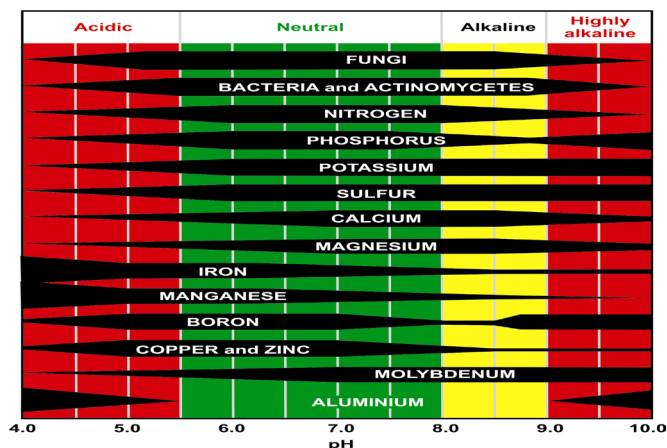


Figure 2: The influence on soil pH and nutrient availability. For each nutrient the broader the black band the greater, and the narrower the lesser, the nutrient is available for any given pH.

Source: Agronomy In Practice (IPF).

This short-term rhizosphere pH change makes some nutrients more plant-available. It will vary depending on the starting profile soil pH and the extent of the rhizosphere pH change. Nutrients that have been documented to benefit from increased plant availability and uptake (Trenkel 2010; Dotaniya & Meena 2013). They include:

- Phosphorus (P)
- Iron (Fe)
- Zinc (Zn)
- Copper (Cu)
- Silicon (Si)
- Calcium (Ca) and Magnesium (Mg) in alkaline soils.

This influence lasts for the duration of ammonium stabilisation and then the rhizosphere pH will revert to the starting profile pH. This increased phosphorus and trace element availability can provide benefits especially in annual crops where the requirement for trace element supply favours earlier growth stages. There are the same advantages for perennial crop also.

In horticulture, ammonium stabilisers on granule fertilisers are commonly used for pre-planting or planting application in annual crops. This will dictate where the advantages of rhizosphere acidification can be achieved with this fertiliser use option.

For a liquid fertiliser option, eNpower + Easy N provides the flexibility and convenience of using N through fertigation but now with the advantage of eNpower. This fertiliser option gives the greater scope to use eNpower throughout more of a crop's growth cycle and also provides greater use opportunities, and rhizosphere acidification options, in fertigated crops including perennial horticulture.

eNpower + Easy N is designed as a soil applied fertiliser. Do not use eNpower + Easy N for foliar applications in any crops.

Summary

The advantages of eNpower use are much broader than just benefiting the availability of a single nutrient such as nitrogen. eNpower and rhizosphere acidification can improve the availability and plant uptake of multiple nutrients.

Consider eNpower treated fertiliser in your next nutrient program.

Further Information

For more information, please feel free to contact me

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Or discuss the eNpower advantages with your local IPF supplier.

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