



ENTEC® fertilisers help limit expensive nitrogen losses and assist your crops to use nitrogen more efficiently.

- ENTEC helps protect against nitrogen losses for improved crop uptake.
- ENTEC gives crops access to ammonium for better growth and greater phosphorus, copper and zinc uptake.
- ENTEC reduces nitrate flushes for more consistent, quality produce.
- ENTEC gives crops a more continuous supply of nitrogen with potentially fewer applications for better workload efficiency on farm.

[www.entecfertilisers.com.au](http://www.entecfertilisers.com.au)

A wide-angle photograph of a lush green agricultural landscape. In the foreground, a red dirt road curves through the field. In the middle ground, a large-scale center pivot irrigation system is in operation, with multiple long, white water jets spraying across the green crops. The background shows rolling green hills under a bright, slightly overcast sky.

Achieve more from nitrogen fertilisers with ENTEC

Incitec Pivot Fertilisers is Australia's reliable leader in soil and plant nutrition, investing locally in agronomic solutions to help Australian farmers remain globally competitive. [www.incitecpivot.com.au](http://www.incitecpivot.com.au)



# Nitrogen in soils

A balanced supply of ammonium and nitrate nitrogen is important to optimise plant growth and deliver quality produce.

In soils, **ammonium** nitrogen ( $\text{NH}_4^+$ ) can come from fertiliser or from organic matter.

Ammonium is not mobile in soils or prone to leaching or denitrification. It must be in the root zone to be taken up by plants.

However, plants face stiff competition for ammonium in the soil from bacteria.

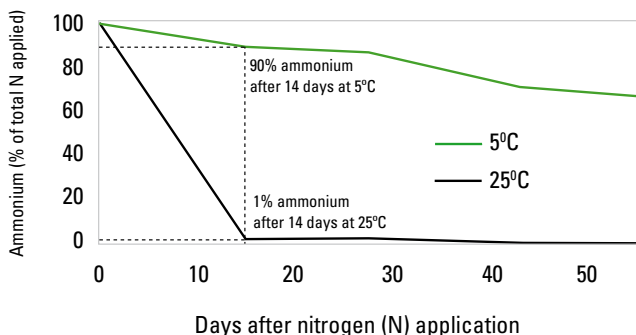
Soil bacteria convert ammonium to **nitrate** nitrogen. This can happen quite quickly, given the right soil conditions and temperature. For example, in a moist alkaline vertosol soil at 25°C, 97% of applied urea had converted to nitrate after 14 days. Source: Suter et al. (2008)^ (See diagram below)

Most of the nitrogen taken up by plants is nitrate nitrogen ( $\text{NO}_3^-$ ). Nitrate nitrogen is highly mobile in the soil and easily accessible to plants.

Any nitrate nitrogen not taken up by plants is at risk of leaching or denitrification (gaseous) losses. The gases released include nitrous oxide.

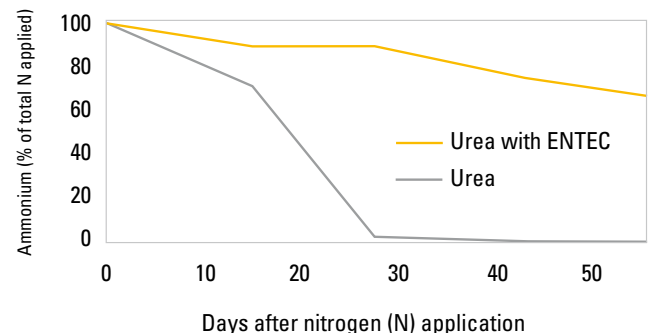


## Ammonium levels from applied urea over time at two temperatures



The conversion of ammonium to nitrate nitrogen is more rapid in warmer soils. This experiment was conducted in a moist alkaline vertosol soil (pHw 7.8) (60% water filled pore space). Source: Suter et al. (2008)^

## ENTEC stabilises nitrogen in the ammonium form



This experiment was conducted with urea in a moist alkaline vertosol soil at 15°C (pHw 7.8) (60% water filled pore space). Source: Suter et al. (2008)^

# What is ENTEC?



ENTEC stabilises applied ammonium nitrogen in the soil for a number of weeks after application.

It does this by acting on the nitrifying bacteria (Nitrosomonas) which use ammonium as their preferred energy source.

ENTEC works like a sleeping pill on the nitrifying bacteria when they attempt to use the ammonium from the nitrogen fertiliser.

As the stabilising effects of the ENTEC diminish, the ammonium converts to nitrate nitrogen in the normal way.

How long ENTEC is active in the soil is dependent on soil temperature and other soil conditions (pH must be above 4.5).

ENTEC fertilisers should be applied or incorporated into the soil.

ENTEC does not reduce Nitrosomonas populations in the soil or leave harmful residues in soils or harvested crops.

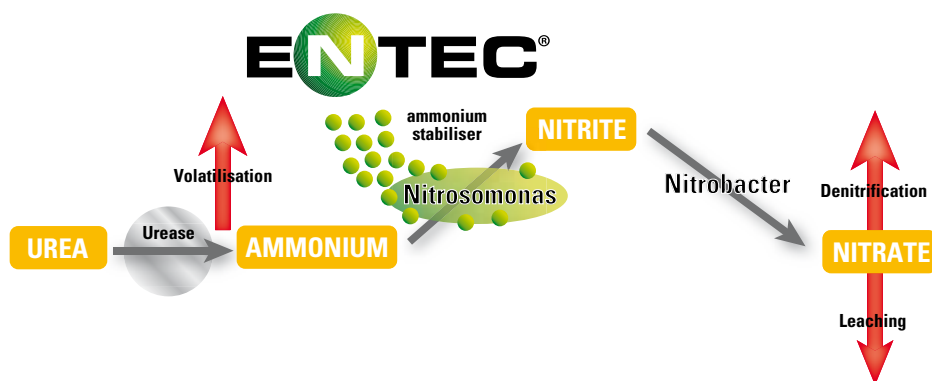
The active ingredient in ENTEC is 3,4-dimethyl pyrazole phosphate (DMPP).

## How long is ENTEC active in soil?

Average soil temperature (°C) where fertiliser is placed	Usual time for 50% of ENTEC stabilised nitrogen to be nitrified
<12	10 weeks +
12 - 18	4 - 10 weeks
19 - 30	4 weeks or less

How long ENTEC is active in the soil depends on soil temperature and other soil conditions. Source Incitec Pivot Fertilisers, 2010. [www.entecfertilisers.com.au](http://www.entecfertilisers.com.au)

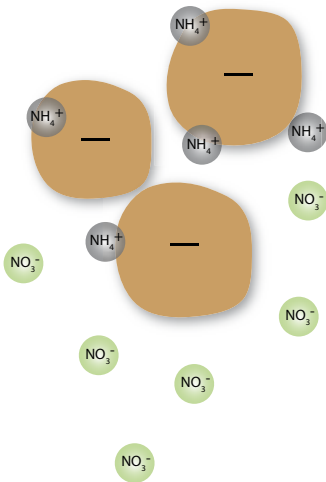
## ENTEC and the nitrogen cycle



ENTEC acts on Nitrosomonas to stabilise ammonium in the soil. ENTEC fertilisers should be applied or incorporated into the soil. ENTEC does not prevent volatilisation losses that may arise from surface applications.

# Protect against losses with ENTEC

## Nitrogen in the soil



Nitrate nitrogen ( $\text{NO}_3^-$ ) is susceptible to leaching. Ammonium nitrogen ( $\text{NH}_4^+$ ) is attracted to negatively charged soil particles.

When using standard fertilisers, the majority of the nitrogen applied may be rapidly converted to nitrate nitrogen.

This results in a large pool of nitrate nitrogen in the soil. Unless it is taken up by the crop or immobilised by soil bacteria, it will be susceptible to leaching or denitrification.

Leaching occurs when nitrate nitrogen moves down through the soil profile beyond the root zone. Leaching losses can be significant, particularly on lighter soil types.


Denitrification occurs where soil oxygen levels are limited. This typically occurs when soil moisture levels rise, excluding oxygen. It can result in the

loss of nitrogen gas and nitrous oxide to the atmosphere.

Although denitrification is generally associated with extended periods of waterlogging, normal irrigation and typical rainfall events can result in denitrification losses.

ENTECC reduces these losses by stabilising the fertiliser applied in the ammonium form, which reduces the size of the nitrate pool in the soil for a number of weeks.

During this time, your crops will still have access to any nitrate nitrogen applied with the fertiliser, mineralised soil reserves of nitrate nitrogen and ammonium nitrogen from the applied fertiliser.

 Dairy farmer Rod Madden,  
Grafton, New South Wales

**“We can go out and plant maize silage when we want to without having to worry.**

**ENTECC helps keep the nitrogen in the root zone for longer, so we’re at less risk of losing it through leaching and it means there is more nitrogen for the maize when it needs it.**

**This has made a significant difference, with yields increasing by 25%.”**



# Give crops access to ammonium with ENTEC

Plants take up the majority of their nitrogen as nitrate nitrogen for one simple reason – it is more readily available to them.

By using ENTEC fertilisers, you can give crops better access to ammonium nitrogen.

Research has shown the uptake of nitrogen in the ammonium form is superior to that of nitrate (see example below).

The uptake of ammonium requires less energy than nitrate (Ulrich 1992). Ammonium can be directly used for nitrogen absorption (Pasda et al 2001) whereas nitrate has to undergo reduction at a high energy cost to the plant prior to nitrogen uptake.

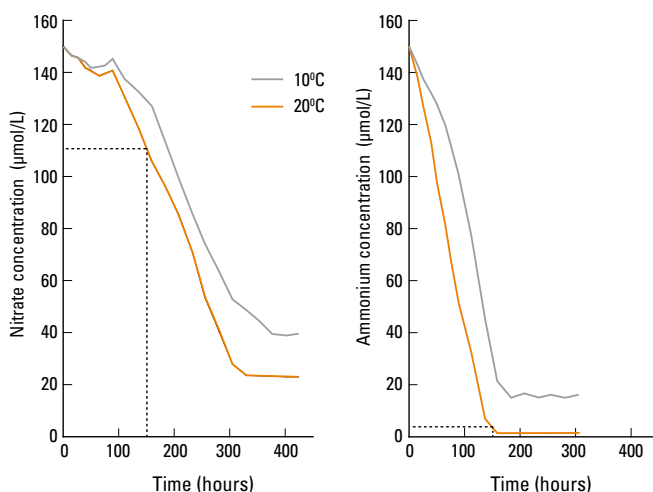
The effects of ammonium nutrition can even be visible in some plants as darker green leaves.

Ammonium nutrition also lowers the pH in the zone immediately surrounding the roots. This has been shown to improve the uptake of phosphorus, copper and zinc (Thomson et al 1993).

Your crops will also have access to any nitrate nitrogen applied with the fertiliser, as well as soil reserves of nitrate nitrogen to provide a balance of crop nutrition.

Any ammonium not directly taken up by crops will be converted to nitrate as the effects of the ENTEC treatment diminish.

## Nitrate and ammonium depletion of the nutrient solution



In this trial using pine trees, nitrogen uptake was greater and more rapid where ammonium nitrogen was given to the trees, rather than nitrate nitrogen. After 150 hours, the trees had used only 38 µmol/L of nitrate, but almost all of the available ammonium. Source: Marschner et al, 1991. Trees 5, 14-21.



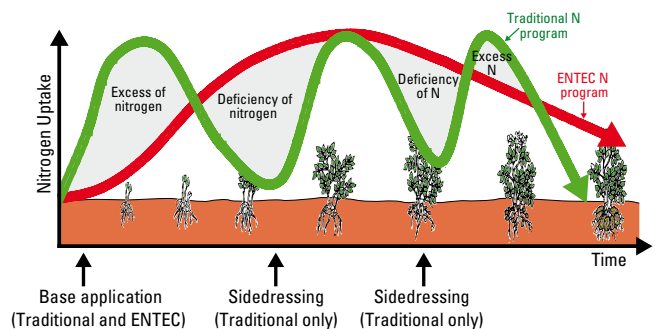
# Better manage your workload with ENTEC

ENTEC can be used to delay the availability of nitrate nitrogen for a number of weeks.

In effect, when applied as a base application, it can provide a 'topdress' or 'sidedress' nitrogen application without the need for a second pass over the paddock.


ENTEC fertilisers also offer a less labour intensive way to give crops a more continuous supply of nitrogen instead of applying small amounts of nitrogen fertiliser frequently.

## Comparing traditional and ENTEC fertiliser programs



A base application of ENTEC helps to provide a more continuous supply of nitrogen to the crop and may reduce the need for fertiliser topdressing or sidedressing. (Graph for illustrative purposes only)



 Potato grower Mark Fritz,  
Bundaberg, Queensland

**"For the crops that were planted in June we have been able to cut back on an application, which saves us in fertiliser and labour costs.**

**We are still fine tuning our fertiliser strategy, but we are already seeing the benefits in using ENTEC fertilisers as a way of insuring against nitrogen losses."**

# Reduce nitrate flushes with ENTEC

ENTEC assists in reducing the size of nitrate pools in the soil after fertiliser application, helping to minimise flushes of nitrate nitrogen.

Using ENTEC fertilisers can improve the balance of nitrogen nutrition by increasing the availability of ammonium to the crop.

High nitrate levels in fruits and vegetables is an issue of concern to some growers because it can lead to poor quality produce or even crop failure.



Vegetable grower, Glenn Abbott,  
Kalbar, Queensland

**“The plants had access to a more even uptake of nitrogen, with ENTEC helping deliver a steady release of nitrogen, rather than large hits throughout growing stages of the crop.**

**It also meant we avoided cases of Jelly Butt in the lettuce crops, where the lettuce wilts and dies.”**

## Nitrate content of harvested vegetables with and without ENTEC

Crop	Number of trials	ppm nitrate in harvested produce		
		No fertiliser	Fertiliser without ENTEC	Fertiliser with ENTEC
Lettuce	18	336	784	672
Cauliflower	9	118	145	83
Leek	8	46	101	106
Celeriac	5	228	449	393
Chinese Cabbage	4	1030	1365	1295
Cabbage	4	201	258	176
Lambs Lettuce	10	50	913	877
Radish	3	693	1480	1353
Carrot	6	15	52	27
Spinach*	5	49	1438	963

Source: European BASF trials, 1999 and 2000, mean of two nitrogen rates.  
\* Mean of early year autumn and winter spinach.

## Potential to improve your productivity with ENTEC

Because ENTEC helps reduce nitrogen losses, it may be possible to improve the productivity of your crops or reduce the amount of fertiliser applied without production losses.

Results will vary depending on your cropping system and soils.





See your accredited ENTEC adviser today to discuss how ENTEC fertilisers could improve your cropping system.

# ENTEC fertilisers

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## Consider using ENTEC

- At planting in vegetable row crops
- Pre-plant or at planting in winter cereals
- On light soils in high rainfall areas where leaching losses have the potential to be high
- In irrigated areas or paddocks prone to waterlogging where leaching or denitrification losses could be significant
- On lawns and turf to improve ammonium nutrition and grass colour
- Where high nitrate contents in produce could cause quality, shelf life or disease issues
- To potentially minimise sidedress applications
- To minimise the negative impacts of uncontrolled growth flushes and nitrate spikes
- To improve the efficiency of applied nitrogen.

	Nitrogen				Phosphorus	Potassium	Sulphur	Other
	Urea	Ammonium	Nitrate	Total				
Nitrophoska® Special with ENTEC 	-	7%	5%	12%	5.2%	14.1%	8%	1.2% magnesium, 0.02% boron
Gran-Am® with ENTEC 	-	20.2%	-	20.2%			24%	
Urea with ENTEC 	46%	-	-	46%				
MAP with ENTEC 	-	10%	-	10%	21.9%		1.5%	
EASY N® with ENTEC	21.5% (w/v)	10.5% (w/v)	10.5% (w/v)	42.5% (w/v)				

For more information, contact your ENTEC accredited Incitec Pivot Fertilisers Distributor or visit [www.entecfertilisers.com.au](http://www.entecfertilisers.com.au)

Incitec Pivot Fertilisers continues to evaluate ENTEC treated products under a range of scenarios. The duration of inhibition of nitrification (ammonium stabilisation) by DMPP (ENTECC) is likely to be significantly reduced under warm soil conditions (>18°C). ENTECC is not recommended where soil temperatures at the point of fertiliser placement are likely to exceed 30°C. Under cold soil conditions (<12°C), inhibition of nitrification may be prolonged - under these situations ENTECC treated products are not recommended where a rapid nitrogen response is desirable. Refer to the table for more detail. ENTECC is also unlikely to be effective on soil pH (1:5 water) range outside of 4.5 - 10.

Average soil temperature (°C) where fertiliser is placed	Expected duration of inhibition of nitrification (time for 50% of ENTECC stabilised nitrogen to be nitrified)
<12	10 weeks +
12 - 18	4 - 10 weeks
19 - 30	4 weeks or less

This is a guide only, which we hope you find helpful as a general tool. While Incitec Pivot Limited has taken all reasonable care in the preparation of this guide, it should not be relied on as a substitute for tailored professional advice and Incitec Pivot accepts no liability in connection with this guide. Talk to your local Incitec Pivot Fertilisers Distributor Agronomist about soil testing and arranging a specific fertiliser recommendation that best suits your needs.

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^ Chen, D. Suter, H et al. (2008) Australian Journal of Soil Research, Vol 46, pp 289 - 301. Incitec Pivot Fertilisers is a business of Incitec Pivot Limited, ABN 42 004 080 264.

