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Forms of Nitrogen ... Is there a difference? - Page 1 of 2

FORMS OF NITROGEN . . . IS THERE A DIFFERENCE?

There are three forms of nitrogen that we know can be used by a plant. Following are the types in order of use:

- Nitrate (NO₃)
- Ammonium (NH₄)
- Amine (NH₂)

Most nitrogen that is applied to the soil will change to nitrate. After soil application:

1. Urea (NH₂) $\xrightarrow{\text{Urase Enzyme}}$ NH₄⁺
2. Ammonium (NH₄⁺) $\xrightarrow{\text{Nitro Bacter, Nitro Somonas}}$ NO₃⁻

The first reaction is an enzyme reaction. It is very fast ... 24 hours to 36 hours.

The second reaction is bacterial. The temperatures must be above 55° F.

Loss:

The NH₄⁺ forms can volatilize into the air.

The NO₃⁻ forms can leach or (on flooded soil) change into NO₂ and volatilize into the air.

Plant Use:

The NH₄⁺ form will be absorbed by the roots and generally be changed to NH₂ (amine) in the root. For this to happen, roots must have carbohydrates. The more NH₄ that roots absorb, more carbohydrates are used for conversion to amines.

If carbohydrates are limited, the NH₄⁺ will be toxic to the plant. This is why more plants have more problems with NH₄⁺ toxicity.



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The NO_3^- form of nitrogen is also taken up by the roots, but this form of nitrogen normally moves to the leaves before it is converted to amine. Therefore, it uses carbohydrates in the leaves rather than roots.

Since there are more carbohydrates in the leaves than the roots, NO_3^- is normally not toxic.

The NH_2 form is already amine. It does not use up any carbohydrates to be converted to amine. Therefore, foliar application of urea would use very little carbohydrates from the plant.

Energy Use for Protein:

NO_3^- uses the most energy
 NH_4^+ uses less energy
 NH_2 uses no energy

If plants are too high in nitrate when seed is filling, they will use too much carbohydrates and rob the seed. Also, it will produce a tremendous drain on the plant's energy. A little nitrate is good. A lot of nitrate can be bad.

The use of large quantities of ammonium can cause calcium deficiencies. This is a problem in horticultural production. It is suggested that soluble calcium always be used if plants receive most of their nitrogen from ammonium or urea (which quickly changes to ammonium).

The ideal form of nitrogen would be amine with calcium. It would have a low energy use and less harm associated with nitrates. Such a source of nitrogen is Nitro Plus.