Urea

Urea is the most commonly used form of nitrogenous fertiliser. It is 46% nitrogen with a chemical formula $CO(NH_2)_2$. In cannot be used by plants in this form.

Urea must be transformed into nitrate before it can be taken up by plants. This change is driven by chemical and biological processes.

The first change that happens is hydrolysis, where urea is broken down into ammonium and carbon dioxide by soil enzymes (ureases). This takes between 1 day and 1 week depending on the soil moisture and temperature. As this happens the soil around the urea particle turns alkaline (pH>7) which causes ammonium to hydrolyse into ammonia gas. This is volatilisation. The ammonia is lost to the atmosphere.

Urease inhibitors provide temporary protection of up to 1 week for minimizing volatilisation in surface broadcast urea. SustaiN Green is a urea product that contains both urea and a urease inhibitor.

FAR funded research on the benefits of SustaiN are reported in Maize Arable Update 61

Ammonium is less mobile and less favourable to plants than nitrate. In aerobic soil conditions, nitrifying bacteria transform some of the ammonium into nitrate and the remainder is immobilised in soil organic matter. This is a store of nitrogen, which later becomes available to the plant through mineralisation processes.

Different microbial processes occur in water-logged soils, anaerobic micro-organisms denitrify ammonium into the nitrogen gases which are lost to the atmosphere. Nitrification inhibitors work by restricting the microbial processes. The most common nitrification inhibitor is DCD (dicyandiamide). It is available in two proprietary products Eco-N and DCn