The advantages of using nitrification inhibitors- in nitrogen fertilization winter cereal

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The most efficient application of nitrogenous fertilizer is an issue, which arises year after year. Nitrogen demand varies with crop type and its potential yield.

Soil residual nitrogen from previous growing seasons must be considered when deciding about the rate of nitrogenous fertilizer to apply.

Usually, the recommended rate of elemental nitrogen (N) for wheat following a cereal crop ranges from 90 to-100 Kg nitrogen (N) per hectare; for wheat after a leguminous crop from 70 to 80 Kg nitrogen (N) per hectare; for wheat after irrigated and fertilized crops or fields fertilized with manure or compost, 50 to 60 Kg (N) per hectare.

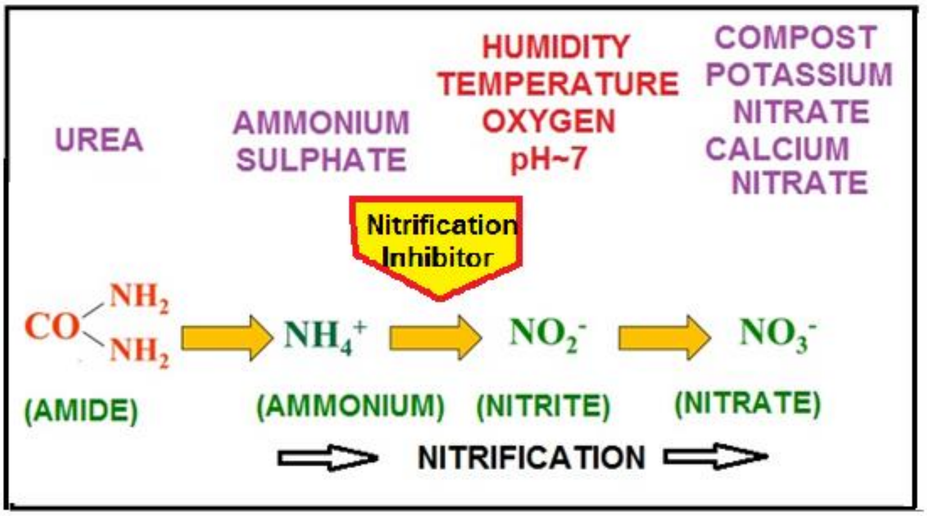
A variety of fertilizer application methods are available to the farmer to supply the required amount of nitrogen.

According to one method, the total amount of required nitrogen is applied prior to planting the crop. Solid Urea is spread, or a Urea solution or Urea is sprayed and then to get it into the soil to a depth of about 20 cm, by tilling or with a disk, cultivator or plough

This rate of nitrogen will be sufficient to feed the crop during the entire growing season when rainfall is moderate. However, additional fertilization during the crop's growth is generally required to supplement nitrogen when heavy rains leach the nitrogen down, below the rooting depth of the crop. Furthermore, a lack of aeration in the soil can occur due to continuous rainy days and the resulting denitrification process, during which nitrates in the ground are transformed into volatile nitrogenous compounds due to anaerobic conditions and bacterial activity.

It is possible to reduce this loss of nitrogen by the application of nitrification inhibitors, thereby saving on supplementary nitrogen fertilization during the crop's growth.

A description of the nitrogen cycle in the soil, starting at the moment nitrogen is applied, can help in understanding how a nitrification inhibitor works. This cycle is outlined in the diagram below.



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Pre-plant nitrogen applied as urea or ammonium sulfate does not undergo any process until wetted by rain or when irrigation is applied to germinate the crop.

Once the soil is wet, solid urea fertilizer dissolves and a urease enzyme present in the soil turns urea into ammonium within 24 hours.

Ammonium ions (NH_4^+) (originating both from urea and ammonium sulfate) adsorption immediately to the clay minerals in the soil (moderate, light, and heavy soils). The adsorpted ammonium to the clay is almost immobile in the ground even when heavy sprinkler irrigation rates are applied.

Soil residing bacteria Nitrosomonas oxidize the ammonium ions in the soil into nitrite (NO_2^-) and later bacteria Nitrobacter into nitrate (NO_3^-). The rate of this microbial process depends on soil temperature: at 30 ^{0}C, it takes a few days, but it gets slower at the lower winter temperatures, possibly taking more than a month.

During this process, the charge on the nitrogen ion changes from positive (in ammonium) to negative (in nitrate), thus making nitrogen very mobile in the soil. Precipitation or irrigation leached the nitrate down to the wetting front, deep in the ground, below the rooting depth of the crop .

The role played by rain in the efficiency of nitrogenous fertilizer must be considered in order to understand the impact of the nitrification inhibitor.

The season's first rains in October or early November (in a Mediterranean climate), after the nitrogen fertilizer has been applied into the soil, but before the seeds have been sown and soil, temperatures are still high, facilitate the nitrification process, which converts ammonium into nitrate. Later rains drive the nitrate deep into the ground so that during germination most of this nitrogen is already unavailable to the crop's roots.

The addition of a nitrification inhibitor delays this bacterial activity, leaving ammonium adsorpted to the soil for a longer time in the upper soil layer where it is available to the roots of germinating seeds. Later in winter, soil temperatures drop, and the nitrification process naturally slows down, leaving most of the fertilizer's nitrogen in the upper soil layer where root activity is maximal.

The nitrification inhibitor maintains nitrate at a low concentration and further reduces potential losses of nitrogen due to denitrification when rainy periods are continuous.

When a nitrification inhibitor is added to the pre-plant nitrogen fertilizer (as outlined above), the application of nitrogen fertilizer at the 5-6 leaves stage, which frequently is required to offset the loss of nitrogen after nitrates are ~~washed~~ leached down or when denitrification processes prevail, may be saved.

Gat fertilizers are introducing the use of nitrification inhibitors mixed with its nitrogen fertilizers in order to delay microbial nitrification in the soil thus slowing down the transformation of ammonium into nitrate.

The inhibitor is soluble and mobile; therefore, it is most suitable for combining with Urea or with liquid fertilizers containing Urea .It neither acts as a poison nor kills off the bacteria, but hinders their activity, thereby postponing nitrification for a period of 25-55 days, depending on prevailing temperatures .

The material is available pre-mixed with a liquid fertilizer, ready for use. The type of nitrogen fertilizer and its concentration in the solution determines the required concentration of the inhibitor.

Expert agronomists at Gat Fertilizers are available for guidance and assistance in planning an optimal fertilization program, in accordance with the crop's demands and the site's conditions.

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