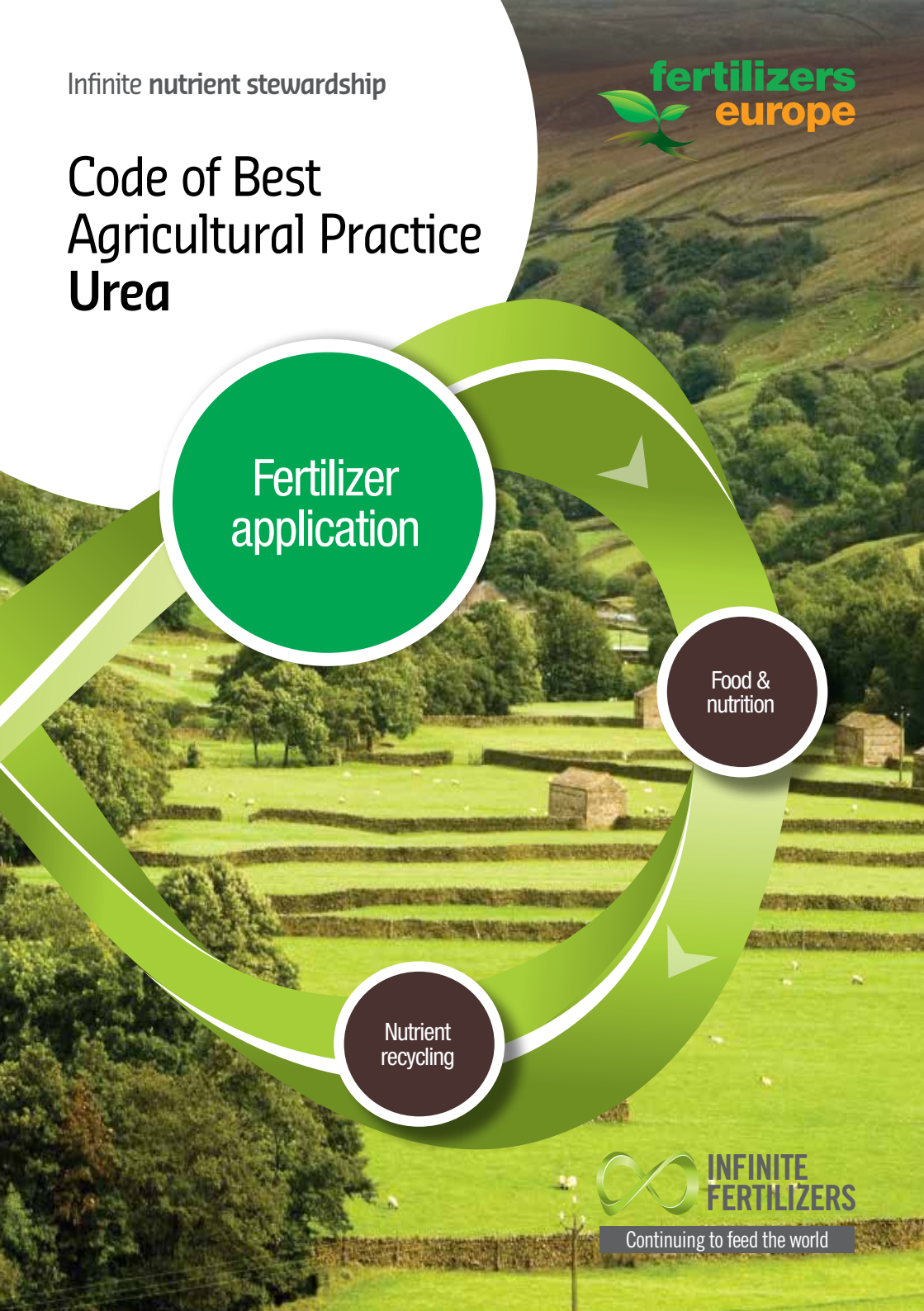
Infinite **nutrient stewardship**

fertilizers europe

Code of Best Agricultural Practice **Urea**



INFINITE FERTILIZERS

Continuing to feed the world

For healthy growth, plants depend upon various nutrients, of which nitrogen is needed in the largest quantity. With nitrogenous fertilizers, farmers and growers supply nitrogen to the plants in order to achieve optimum crop yield and sustainable agricultural production.

These guidelines focus on the use of the mineral nitrogenous fertilizer urea. They are designed to provide general recommendations for its effective use on agricultural crops under European conditions.

Best Agricultural Practice

CROPS REQUIRE AN ADEQUATE SUPPLY OF NUTRIENTS IF SATISFACTORY YIELDS AND HIGH QUALITY ARE TO BE MAINTAINED. PLANT GROWTH AND THE SUBSEQUENT HARVEST TAKE NUTRIENTS FROM THE SOIL'S RESERVES, WHICH MUST BE REPLENISHED IF HEALTHY PLANTS ARE TO BE GROWN THE FOLLOWING SEASON.

Nitrogenous fertilizers are a very important source of replenishment. They come in an easily quantifiable mineral form and can be applied with precision. Their rate of application should be based on good agricultural practice, a concept described in the Fertilizers Europe "Code of Best Agricultural Practice - Nitrogen". The code provides a basis for efficient fertilizer use and includes the following principal elements:

➤ Nutrient budget

The nitrogen requirement of a specific crop in relation to the local climate and growth conditions, as well as yield expectation, is considered. This is then related to the crop-available nitrogen measured in the soil (analysis of mineral nitrogen) in order to subsequently determine the appropriate amount of fertilizer.

➤ Fertilizer plan

The farmer's own recycled material (manures, slurries, etc.) is evaluated according to its nutrient content. This is done for each nutrient in order to select the appropriate type and quantity of fertilizer. The fertilizer is then applied at the correct rate, at the optimum time, in single or split dressings, and using the appropriate application technique. Weather conditions and crop growth are also taken into consideration.

➤ Limitation of nutrient losses

- For water protection, fertilizer practice must respect local, regional and European legislation (e.g. the requirements of the EU's Nitrate Directive 91/676/EEC).
- Fertilizer practice for water protection contributes to the mitigation of emissions to the air (ammonia and nitrous oxide). It is efficiently complemented by the more specific measures recommended by the UN ECE[1] and by the European Commission in its "Air quality package" published at the end of 2013.

Specifics of urea

UREA IS MANUFACTURED BY COMBINING CARBON DIOXIDE WITH AMMONIA. WITH 46% NITROGEN, IT HAS THE HIGHEST NUTRIENT CONCENTRATION AMONG COMMERCIALLY AVAILABLE SOLID NITROGEN FERTILIZERS.

In the soil, hydrolysis converts urea to ammonium (NH_4^+) and carbon dioxide in a series of enzyme reactions. The ammonium ions are adsorbed by the soil (i.e. become attached to the negatively charged soil particles) and the nitrogen becomes available to the plant either in its ammonium form or, after further transformation by bacteria, as nitrate, which is more easily taken up by plants.

This breakdown of urea to release ammonium ions normally occurs within a week. The consequent nitrification, converting the released ammonium ions into nitrate, can take a few days to a few weeks.

The most favourable conditions for the efficient adsorption of ammonium ions are:

- When urea fertilizer is incorporated or well washed into the soil;
- When the soil has a high adsorption capacity;
- When the soil is sufficiently moist;
- When the soil has a low pH;
- At low temperatures.

Unfavourable conditions include:

- Persistent drought;
- High temperatures and strong winds;
- Soil that has a high pH.

These conditions may lead to important losses of gaseous ammonia (NH_3) and greenhouse gases to the atmosphere after the application of urea fertilizer.

Guidelines

IN ADDITION TO THE NORMAL MEASURES TO PROTECT WATER QUALITY, COMPLEMENTARY MEASURES ARE NECESSARY FOR UREA IN RELATION TO AIR QUALITY.

The following guidelines are based on scientific evidence and agronomic experience with urea fertilizer use based on EU and UNECE research[1]:

- Urea should be incorporated into the soil during a tillage operation, whenever possible. The efficiency in reducing NH_3 emissions is between 50% and 80%[1];
- Urea can be incorporated into the soil using closed-slot injection, one of the most efficient incorporation techniques that can ensure a reduction of ammonia emissions of up to 90%[1].

The above techniques can be used for the first nitrogen application (base dressing) made on bare soils.

For application of urea on a developing crop (top dressing), other techniques can be used, such as:

- A slow release fertilizer where, for example, urea is polymer coated. The efficiency in reducing NH_3 emissions is limited to up to 30%[1];
- A urease inhibitor applied simultaneously with urea (mixed or as a coating) can provide a 70% efficiency in reducing NH_3 emissions with solid urea, but is limited to 40% with liquid urea-ammonium nitrate[1].

Weather and soil conditions have an important influence on ammonia emissions from urea. Particular attention should be paid to choosing the best application period depending on these conditions:

- Urea should preferably be spread before significant rainfall, or should be washed into the soil through irrigation;
- Urea should be incorporated in the soil within a few hours in high temperature conditions, and when the soil is dry;
- Urea should not be used soon after liming;
- Urea should not be spread on top of slurry, crop residues and manure application or on anything that will impede the quick adsorption of ammonium ions by the soil.

[1] *United Nation Economic Commission for Europe: 1999 Protocol to the 1979 Convention on LRTAP to Abate Acidification, Eutrophication and Ground-level Ozone – Guidance document*

European Commission: Air Quality Package 18/12/2013 – COM (2013) 920 - ANNEXES to the Proposal for a NEC DIRECTIVE on the reduction of national emissions of certain atmospheric pollutants

Sound nutrient management with nitrogen fertilizers

Farmers only benefit from nutrients that are taken up by the plant and not from nutrients lost to the environment. So, for both economic and environmental reasons, it is in the farmer's and society's best interests to use nitrogen as efficiently as possible. This is the basis of sound nutrient management.

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Fertilizers Europe represents the majority of fertilizer producers in Europe and is recognized as the dedicated industry source of information on mineral fertilizers. The association communicates with a wide variety of institutions, legislators, stakeholders and members of the public who seek information on fertilizer technology and topics relating to today's agricultural, environmental and economic challenges. The Fertilizers Europe website provides information on subjects of relevance to all those interested in fertilizers contribution to global food security.

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