# Enhancing sustainable food systems in Europe

How nitrogen use efficiency and scientific tools can contribute to the European Green Deal



# Enhancing a productive, resilient and sustainable EU agriculture

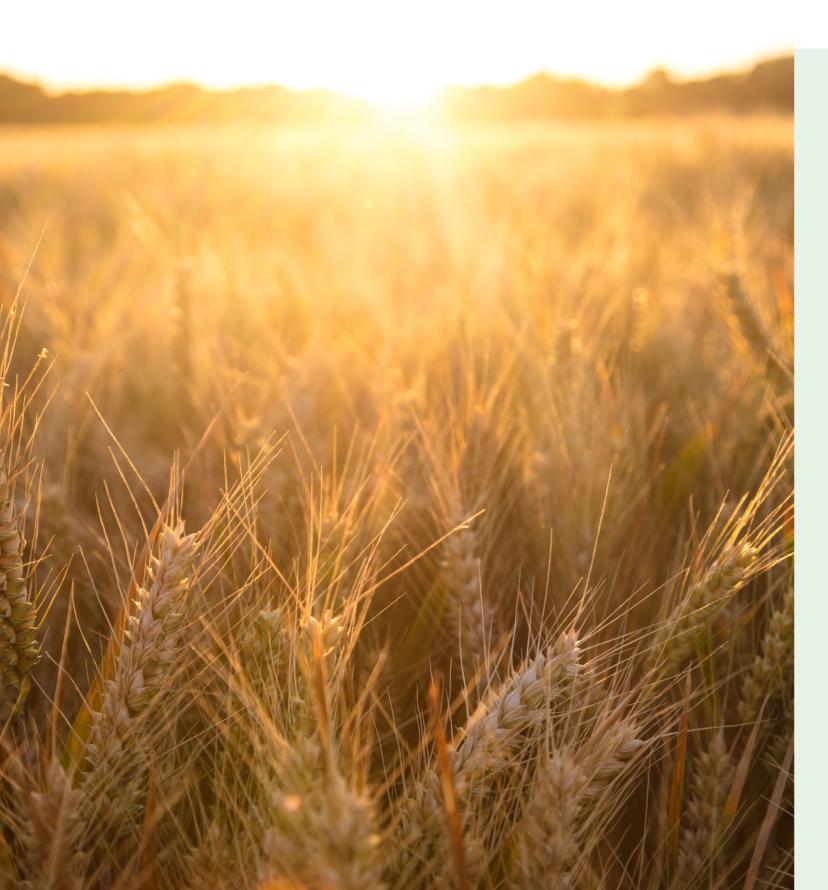
In the "Farm to Fork" and "Biodiversity" strategies published in May 2020, the European Commission put forward its ambition for European agriculture by 2030.

In relation to plant nutrients, the ambition is to reduce nutrient losses to the environment from both organic and mineral fertilizers by at least 50%, while ensuring no deterioration in soil fertility. This is expected to result in 20% reduction in fertilizer use.

This ambition can only be achieved via collective efforts throughout the whole value chain and a combination of different tools. Key among them is the focus on **nitrogen use efficiency (NUE)**, which not only gives guidance for better farming practices, but also comprises different tools in relation to sustainable fertilizer use.

While accepting the challenge of reducing nutrient losses to the environment, Fertilizers Europe calls for using NUE indicator as a metric to assess the progress of reaching the nutrient losses reduction target.

The European fertilizer sector is committed to work hand-in hand with farmers to advance a productive, resilient and sustainable EU agriculture.



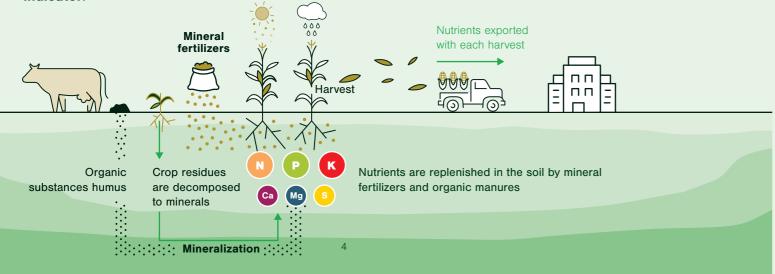
# Nitrogen Use Efficiency Indicator a vehicle for advancing sustainable agriculture in Europe

Crop growth requires sunlight, carbon dioxide  $(CO_2)$ , water and **a balanced supply of the primary nutrients** (nitrogen, phosphorus and potassium) as well as secondary and micronutrients. These nutrients are essential for a plant's basic metabolic functions.

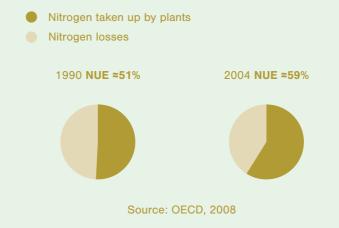
The water and nutrients are primarily absorbed from the soil via the plant's root system to allow the plant to develop to its full potential and provide maximum nutritional value. When the plant is harvested, the nutrients it has absorbed are removed from the soil. **Unless the nutrients are replenished, most of the soil fertility deteriorates with every harvest**. Natural processes that break down crop residues provide some of the required nutrients. The remainder needs to be provided by both **organic sources (such as manure) and mineral fertilizers**.

**Nitrogen** is a particularly important nutrient, a main factor for crop yield and quality, but at the same time nitrogen losses to the environment affect air and water quality and have an impact on biodiversity.

A scientifically sound way to **assess the effectiveness of the nutrient applied** is to measure the harvested amount of nutrient in relation to the amount of nutrient applied. Scientists united in the EU Nitrogen Expert Panel have developed a way to measure this for nitrogen and have defined the **Nitrogen Use Efficiency indicator**.

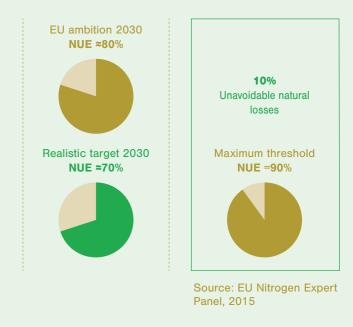


The Nitrogen Use Efficiency indicator provides information on resource use efficiency, the economy of food production and the pressure on the environment. It can therefore be used to improve farming practices.



Nitrogen Use Efficiency in European Agriculture

While good nitrogen management can reduce losses to the environment, in practice some nitrogen losses are inevitable. The EU Nitrogen Expert Panel has established a maximum threshold at <90% NUE to account for natural nitrogen losses while avoiding the deterioration of the soil's fertility.



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Nitrogen

Nitrogen

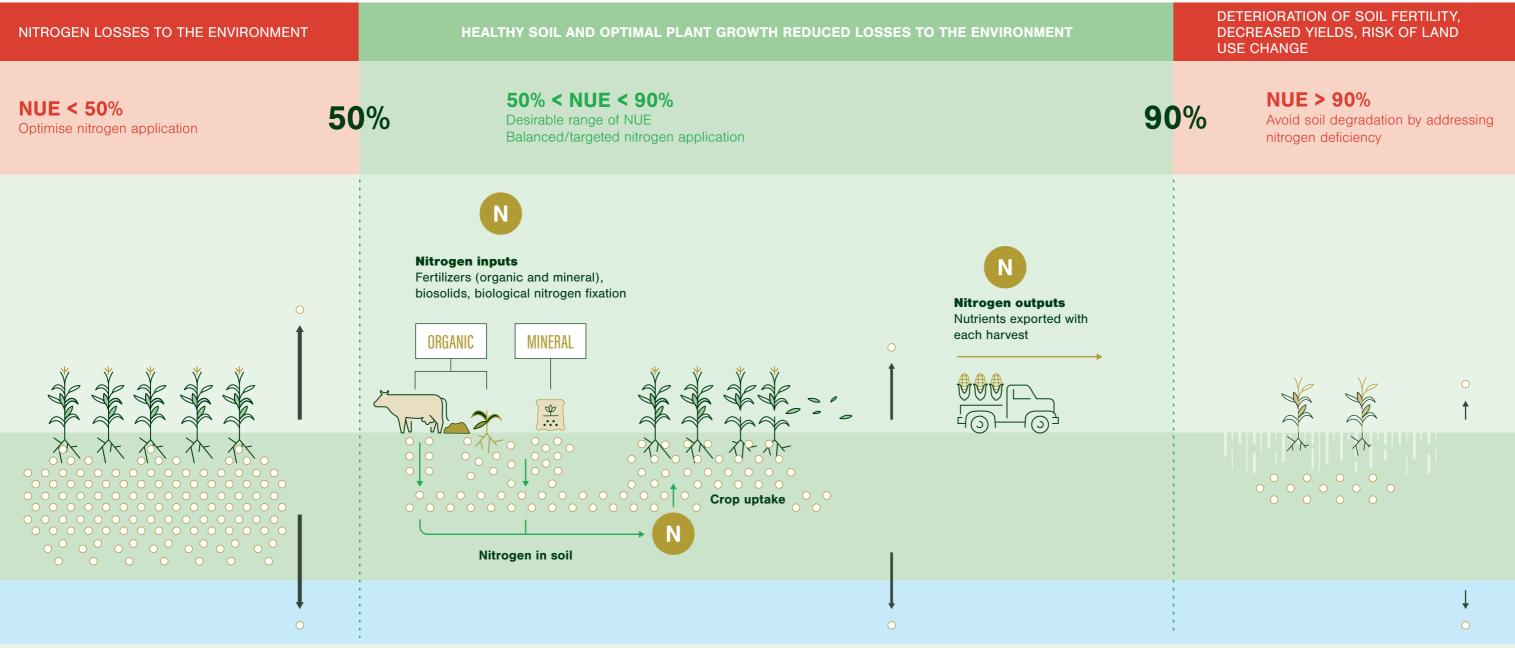
**Risk level** 

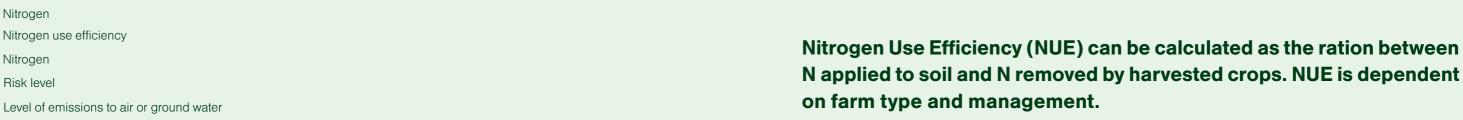
**NUE** Nitrogen use efficiency

### Nitrogen flows and **Nitrogen Use Efficiency Indicator**

### The Nitrogen Use Efficiency indicator offers ready-to-use solutions to assess the efficiency of nitrogen use in food production, allowing to minimise environmental impacts and achieve better crop yields.

The indicator can be broken down to three simplified production scenarios:

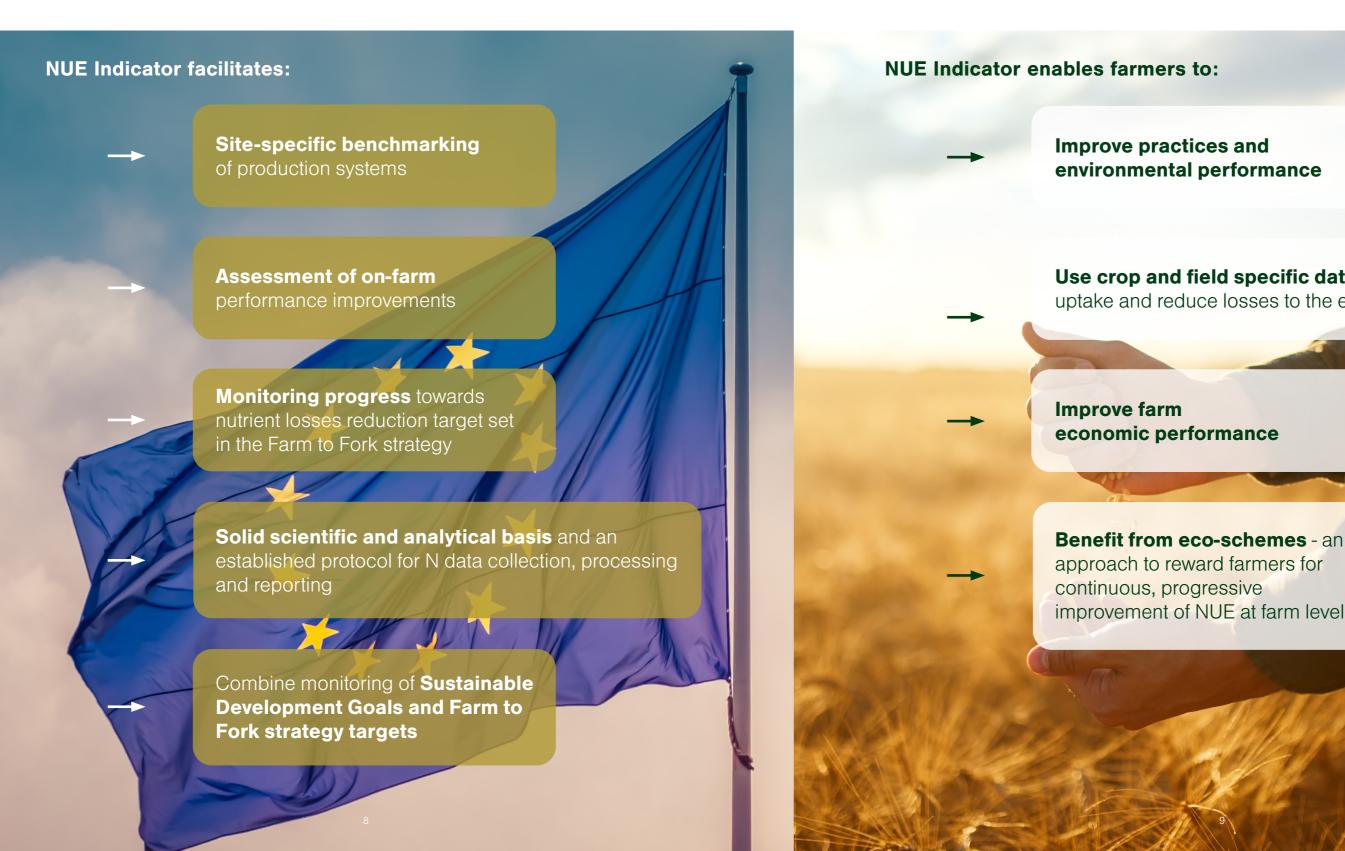




# **Benefits for policy makers**

supporting policy development and monitoring progress

# **Benefits for farmers** guiding on-farm decision making to optimise performance



### Use crop and field specific data to improve nitrogen uptake and reduce losses to the environment

improvement of NUE at farm level

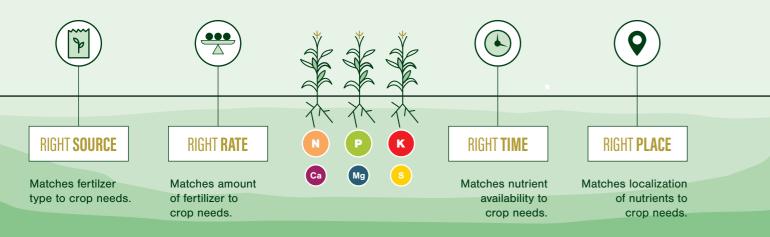
# Solutions to improve Nitrogen Use Efficiency Balanced Plant Nutrition

The optimum use efficiency of all nutrients and specifically the best possible Nitrogen Use Efficiency (NUE) can only be achieved with a **balanced plant nutrition**. The idea of a balanced plant nutrition is based on Liebig's law - a principle of agricultural sciences which states that **plant growth** is dictated by the **scarcest mineral nutrient**.

A good **crop feeding strategy** at farm level can be achieved with a balanced supply of the main nutrients needed. Balanced nutrition is essential to help crops reach high yields and quality, moving towards a crop's maximum genetic potential. The challenge for farmers and growers is that the rate and the ratio at which each nutrient is needed by a plant changes over its growth cycle. The objective of balanced fertilization is, therefore, to ensure that the plant has **access to an adequate supply of each nutrient at every growth stage** in order to avoid any over or under-supply and to optimise plant yield.

Different fertilizers have different agronomic and environmental impact, therefore, the use of the right source of fertilizer is essential. The supply of directly available forms of nutrients for specific and high demanding nutrient uptake periods, enhances NUE and minimises environmental losses.

#### **NUTRIENT STEWARDSHIP APPROACH**

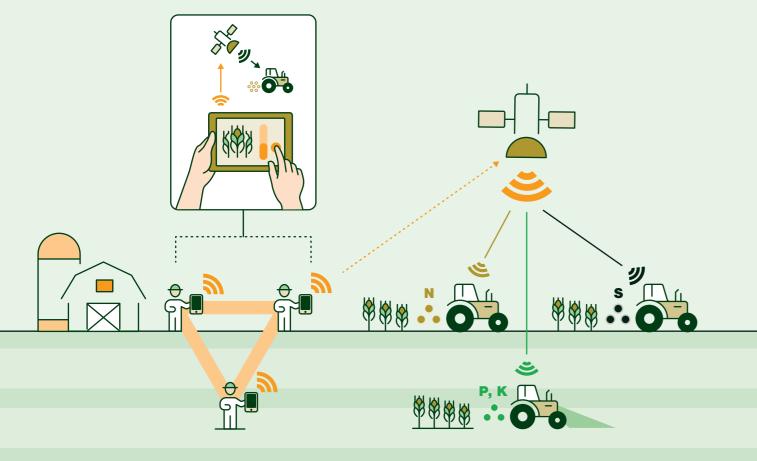




# **Precision Farming**

The fertilizer industry continuously develops practical tools that help farmers assess plant nutrient needs. The tools range from simple portable devices such as hand-held metering devices and GSM-based mobile applications, all the way to farm machinery equipped with satellite-produced biomass field maps. **Such precision farming tools enable an improved nutrient management through variable rate application, and thus, enhance nitrogen use efficiency.** 

Precision farming provides huge potential of putting agricultural practices on a new level, ensuring high productivity and improved NUE. The combination of long-established knowledge and expertise with modern technology enhances best agricultural practices.





# Enhanced efficiency fertilizers

#### **INHIBITORS**

Inhibitors are compounds that are added to nitrogen-based fertilizers to reduce nitrogen losses to the atmosphere or the groundwater after application of the fertilizer. In the soil, inhibitors delay either breakdown of urea-N (UI) or ammonium-N (NI), and thus reduce nitrogen losses. The reduction of N-losses substantially contributes to a higher nutrient use efficiency (NUE). Due to the reduction of ammonia losses (see figure below), the application of NI and UI has shown to improve NUE thereby either enhancing crop yields or achieving current yield levels with less nitrogen fertilizer.

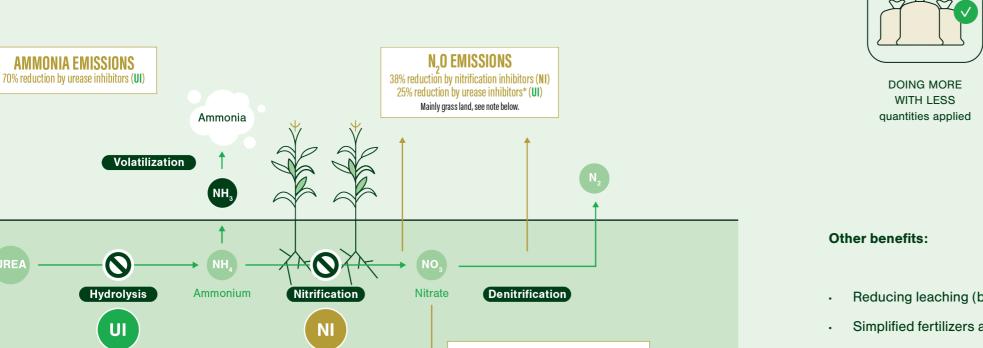
#### CONTROLLED RELEASE FERTILIZERS AND SLOW RELEASE FERTILIZERS

Controlled Release Fertilizers and Slow Release Fertilizers use physical and/or chemical mechanisms to gradually release nutrients over time so that nutrient availability is matched with plant nutrient requirement over their growth cycle.

PRECISE RELEASE

TO PLANT DEMAND

#### **Environmental and economic benefits**



LEACHING

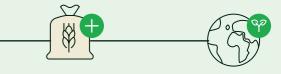
18% reduction by nitrification inhibitors (NI)

\*NOTE: 25% N<sub>2</sub>O emission reduction by urease inhibitors has been shown in a study from Cowan et al (2020) based on Irish and UK arable soils and grass land. 73% of the data comes from grass land, where inhibitors have the biggest effect.

- Reducing leaching (by rates at up to 55%)
- Simplified fertilizers application
- Optimising use of fertilizer (nitrogen, phosphate and potassium) •
- •

HIGHLY EFFICIENT

NUTRIENT USE



MINIMAL LOSSES TO THE ENVIRONMENT

Supporting farmers and growers in achieving currrent and future nutrients loss reduction target (50% reduction), as defined under Common Agricultural Policy (CAP) and Commission's Farm to Fork Strategy.

# **EU** legislation

### FARM TO FORK AND BIODIVERSITY STRATEGIES

50% REDUCTION OF NUTRIENT LOSSES RESULTING

### CIRCULAR ECONOMY ACTION PLAN & ENVISONED INTEGRATED NUTRIENT MANAGEMENT PLAN

ENSURING MORE SUSTAINABLE APPLICATION OF NUTRIENTS

CAP

INCLUDING REQUIREMENTS FOR IMPLEMENTING

## **Enablers**

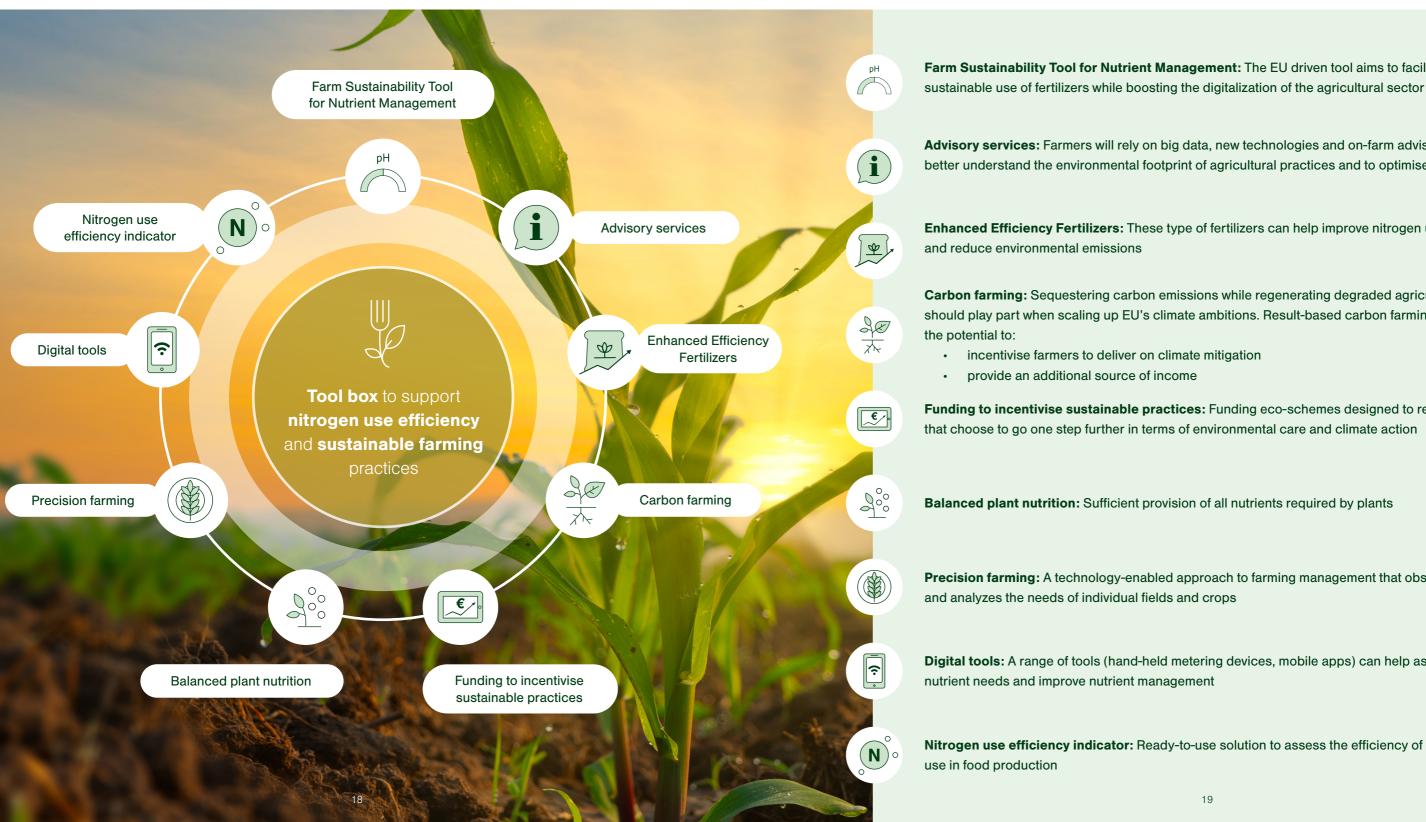
NITROGEN USE EFFICIENCY INDICATOR PRECISION FARMING INTEGRATED NUTRIENT MANAGEMENT PLAN FARM ADVISORY SERVICES ECO-SCHEMES DIGITAL TOOLS ENHANCED EFFICIENCY FERTILIZERS

# Ambition

### ACHIEVING ENVIRONMENTALLY AND ECONOMICALLY SUSTAINABLE EU AGRICULTURE

# **EU Green Deal** Resilient and sustainable EU agricultural sector

Meeting the ambition of the EU Green Deal to improve environmental and economic sustainability of EU with farmers.



# agriculture can only be achieved in a close cooperation

Farm Sustainability Tool for Nutrient Management: The EU driven tool aims to facilitate a

Advisory services: Farmers will rely on big data, new technologies and on-farm advisory services to better understand the environmental footprint of agricultural practices and to optimise production

Enhanced Efficiency Fertilizers: These type of fertilizers can help improve nitrogen use efficiency

Carbon farming: Sequestering carbon emissions while regenerating degraded agricultural land should play part when scaling up EU's climate ambitions. Result-based carbon farming schemes have

Funding to incentivise sustainable practices: Funding eco-schemes designed to reward farmers

Precision farming: A technology-enabled approach to farming management that observes, measures,

Digital tools: A range of tools (hand-held metering devices, mobile apps) can help assess plant

Nitrogen use efficiency indicator: Ready-to-use solution to assess the efficiency of nitrogen

### Fertilizers Europe

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