

NutriBudget, optimisation of nutrient budget in agriculture: the Mediterranean pilot

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Nutrients such as nitrogen (N) and phosphorus (P) play an essential role in agriculture but the rise of the machines and the use of mineral fertilizers in the past decades have negatively affected water, air, and soil quality, as well as its biodiversity also contributing to climate change. To address this, the European Commission's Green Deal aims to reduce nutrient losses and fertilizer use at least 50% and 20%, respectively by 2030.

With the objective of optimizing nutrient flows and reduce pollution without compromising food production in agriculture, the Horizon Europe project NutriBudget will develop and implement an integrated nutrient management platform, called Nutriplatform, as a decision-support tool for farmers, advisors, policy makers and regional authorities. The Nutriplatform will be grounded on knowledge from existing and new field-tested agronomic measures to mitigate nutrient losses from agriculture combined with cutting-edge models on nutrient budgets, data standards and indicators. Thus, a wide range of mitigation measures to shrink nutrient losses from agricultural-farming systems will be tested in 5 pilot regions (4 nutrients hotspots and 1 nutrients-deficient) distributed along 4 different climatic regions: Boreal (Finland), Atlantic (Belgium), Mediterranean (Spain), Continental + nutrient surplus (Italy), and Continental – nutrient deficient (Switzerland).

BETA Technological Center (UVIC-UCC) is the leader of the Mediterranean pilot located in Catalonia (Spain), where the main challenge is the soil and water pollution (mainly nitrates) due to excessive application of waste from pig farming. In this context, on-farm experimental work is carried out to identify and evaluate novel combinations of the most effective mitigation strategies evaluating its impacts on nutrient budgets, environmental pressures, agronomic production, and climate change mitigation potential. Specifically, 5 mitigation measures will be tested in this pilot, which are:

- Precision fertilization of bio-based fertilizers and/or mineral fertilizer through multilevel data integration: The objective is to compare the yield outcomes between homogeneous fertilization and site-specific fertilization strategies, all under conventional agricultural practices within the same experimental field. The innovation in this trial lies in the application of precise management zone maps, considering both soil data collected through an online multi-sensory platform and crop data derived from advanced and accurate satellite imagery.
- Advanced NH₃ emissions mitigation using zeolites: The objective is to study whether the use of zeolites reduces NH₃ emission in agricultural soils, which would increase N use efficiency, availability, and consequently crop yield. Also, it seems a potential climate change mitigation.
- Dual-purpose Lemna cultivation (green manure production and alternative protein): The objective is to develop a sustainable cultivation system for optimizing duckweed biomass production using liquid fraction of pig manure as a nutrient source, and to assess the potential applications of its biomass as a green manure and/or alternative protein source for animal feed supply.
- Enhanced and optimised fertilisation with upgraded pig manure products to avoid nutrient excess in soils: In the framework of the FERTIMANURE project, a field trial with winter wheat crop was designed in 2021 to test the agricultural adequacy of a tailor-made fertilizer (TMF) formulated with different bio-based fertilizers (BBFs) produced in an on-farm pilot plant from pig slurry. Now, the objective is to assess the agronomic performance of the TMF for 2 additional years to study the environmental impact and potential soil quality and crop yield improvement in a long term.
- Deep-rooted nutrient cycling with Kernza perennial cereal to mitigate nutrient losses to soils and groundwaters: The performance of Kernza and its potential to mitigate nutrient leaching (particularly nitrates) to surface water and groundwater will be evaluated in the field, in comparison to its annual counterpart (such as barley or winter wheat) under different fertilization treatments. The influence of the rhizosphere microbiome on the nutrients use efficiency of the crop will also be investigated.

The data set obtained from these mitigation measures, along with those tested in the other 4 pilots, will provide a valuable knowledge from which the Nutriplatform will be developed. Thus, NutriBudget will help agriculture to intensify sustainably by systemically optimizing nutrient flows and budgets across different agricultural production systems and regions in the EU, to limit and reduce pollution provoked by nutrient losses from agriculture without compromising food production.

Keywords: Nutrient models, mitigation measures, Zero-pollution, nutrient circularity, smart platform.

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Website: <https://www.nutribudget.eu/>