XLIII SICA Congress

The Contribution of the Agricultural Chemistry to Healthy and Resilient Agroecosystems and to the One Health Vision

Programme & Abstracts

Padua, Italy

23-25 June 2025

https://SICA2025.azuleon.org

P.30

Evaluation of the effectiveness and ecotoxicity of new molecules used as urea-based smart fertilizers

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World population is increasing by almost 33% since 2019 and agricultural production will need to increase without compromising environment and food quality. In this scenario, the development of efficient, prompt and sustainable fertilization practice could be a valid support for crop productivity. The synthetic urea-based fertilizers are wide used, but the fertilization can determine environmental impacts, as nitrate contamination of groundwater and GHGs and ammonia emission. The use of "smart" fertilizers, by controlled N release, is an option to enhance N use efficiency, and decrease environmental pollution.
The purpose of CONTROL FERT project is to provide a sustainable approach to nutrient management, as required by Integrated Nutrient Management Action Plan of EU, developing, and testing new urea formulations, single and/or multilayer urea grains modified with the addition of urease and/or nitrification organic inhibitors. Preliminary test at laboratory conditions to verify N release, nitrification and urease inhibition in soil and ecotoxicity of smart fertilizers were performed.
Two different soils during 14 days of incubation of prototypes were analyzed. In the laboratory experiment, fertilization rate was in accordance with the N dose used in open field. Unfertilized soil, with conventional urea and with already marketable smart urea (NBPT) was considered as controls. The urea-based smart fertilizers showed inhibition trend of nitrification and urease activity during 14 days of incubation in soil. The chemical composition and the structure of smart fertilizers affected their efficiency.
Ecotoxicological tests were performed to verify the absence of environmental hazard of smart urea prototypes in the soil.
The preliminary validation has allowed to test smart fertilizers prototypes in real farming conditions, giving reliable results and producing prototypes characterized by high TRL.