Reducing N Fertilization without Yield Penalties in Maize with a Commercially Available Seed Dressing

Summary for Policymakers

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THE BACKGROUND

Conventional management of agricultural production has often depleted soil quality and decreased soil health. Depleted soils can further reduce the provision of essential ecosystem services for crop production and local environments, impacting yields and water use efficiency. The combination of intensive tillage and high nitrogen (N) fertilization also increases the mineralisation of soil organic carbon (SOC), a process that releases CO_2 emissions and exacerbates the contribution of agricultural soils to Greenhouse Gas concentrations (GHGs) in the atmosphere[1]. Finding solutions that work within farmer economics to maintain crop production while mitigating environmental and climate impacts is an essential step toward a more sustainable world.

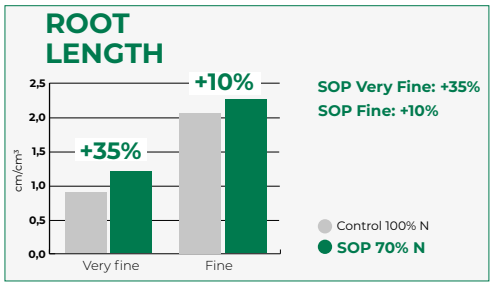
THE STUDY

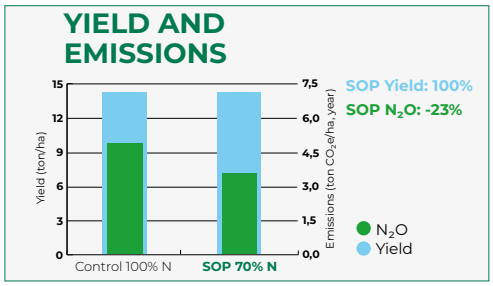
The study (https://doi.org/10.3390/agronomy11030407) was designed to evaluate the possibility to reduce synthetic N fertilization in the cultivation of corn (Zea mays L.). The trial was conducted at CERZOO research center (Piacenza, Northern Italy), under real world field conditions using existing agricultural soil, in 200 m^2 plots, randomized to minimize the influence of any potential soil differences upon the final results.

Three levels of fertilization were tested: 230 kg (100%), 160 kg (-30%) and 0 kg of synthetic N were applied in different plots after a common fertilization with 50 kg of equivalent efficient N from cattle slurry, with SOP COCUS MAIZE + and without (Control). The roots were measured at anthesis and the crop cycle N_2O emissions were measured for the entire crop cycle year (April 2019 - April 2020).

THE RESULTS

A comparison analysis was conducted for root structure, crop yield, and soil N_2O emissions between the Control plots using fertilization at 100% synthetic N and the SOP COCUS MAIZE+ plots using -30% less synthetic N. Field data demonstrated a significant increase for the SOP treated plants in the very fine root hairs and the fine root length, both of which improve the efficiency of water uptake and plant nutrient cycling. Yield remained stable for both plots, Control and SOP (approximately 14 tons of grain per hectare), while N_2O emissions decreased by -23% per unit of production in the SOP treated plots.





SOP AND THE UN SUSTAINABLE DEVELOPMENT GOALS (SDGs)

The possibility to reduce synthetic N fertilization while maintaining crop yields would represent a step forward toward both environmental sustainability, human health, and overall food security under increasing risks from climate change. The crucial link between the UN Sustainable Development Goals (SDGs) and agricultural production is based upon the efficient use of nitrogen in cereal production systems [2]. The European Commission (EU) has also recognised this crucial link, and has set ambitious goals for reducing synthetic fertilizer usage by -20% at the field level by 2030 [3]. The primary reasons for these regulatory guidelines are the significant impacts upon the environment and human health from the inefficient use synthetic fertilization in agricultural production [4]. Most imporantly, it is generally known that the excess use of synthtetic N fertilization does not necessarily lead to increased crop yields, but can instead lead to high N losses in surface- and groundwater bodies causing negative water quality impacts, in addition to increased atmospheric GHGs emissions via N_2O cycling [5].

SOP products demonstrate the ability to improve the environmental footprint of agricultural operations and to reduce the risks associated with climate change for staple crop production. By establishing a commercial and scientific basis for maintaining current crop production levels with reduced need for synthetic fertilization, SOP products support the UN SDG framework for a more sustainable world and can be recognized by producers and their supply chains for SDG6 (Water Quality), SDG11 (Sustainable Cities), SDG12 (Responsible Production), SDG13 (Climate Action), and SDG15 (Life on land). The SOP COCUS Maize+ application has been certified according to ISO standards and the ISO warrants the recognition of alignment with the UN SDG goals with this SOP application in commercial use.

THE RESEARCH TEAM

Prof. Dr. Vincenzo Tabaglio and Dr. Andrea Fiorini work in the department of Sustainable Crop Production (DI.PRO.VE.S.) at Università Cattolica del Sacro Cuore, located in Piacenza, Italy. Their work focuses on the study of new practices and innovative technologies for crop production intended for animal feedstock and food production, with a view toward sustainability within the food industry. Dr. Marcello Chiodini, PhD, a researcher at the University of Milan and an SOP collaborator, and Lorenzo Poggianella, from the University of California, Davis, assisted with the crop trial design and the analysis of the data sets.

THE SOP PRODUCT

SOP COCUS MAIZE+ is a seed dressing based on natural materials and is produced by SOP - Save Our Planet. The SOP technical process creates crop applications that work with the microbial communities present in the soil and the rhizosphere in order to improve plant-microbial interaction. The goal of the SOP COCUS Line is to improve water use efficiency, plant nutrient availability, and nutrient uptake in corn production for increased plant resilience and improved farmer economics. This application has been commercialized since 2005 and is used by farmers in several EU countries.

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