FONTAGROTECH

Nitrogen nanofertilizers and a digital decision-support platform for wheat, maize and coffee

ARGENTINA, BELGIUM, COSTA RICA, ECUADOR, SPAIN, HONDURAS, PANAMA, PARAGUAY, PERU, DOMINICAN REPUBLIC



Webstory

Technological solution

Across many systems in the region, more than half the nitrogen applied never reaches the grain. The share the crop does not take up is a cost lost to whoever paid for it and, once outside the plant, becomes nitrate seeping toward the water table and nitrous oxide escaping to the air. A second difficulty is less visible: almost all the available evidence on nanofertilizers was produced in controlled trials, which leaves unanswered the question that decides adoption, namely how the technology behaves in a commercial field and whether the difference pays. The nanometric formulation addresses the first, releasing nitrogen more closely in step with crop demand and narrowing the window in which the nutrient can be lost. Trials on working farms address the second, generating evidence where soil and climate genuinely vary. The platform joins the two and returns two concrete outputs: a rate and timing recommendation for a given site, and the marginal rate of return that decision implies.

Technological description

A nitrogen nanofertilizer is a formulation in which nitrogen travels bound to nanomaterials smaller than 100 to 200 nanometers. That binding changes two things: how fast the nutrient is released, and how long it stays available in the soil. The formulation came out of Argentina's public science and technology system, is protected by patent, and carries potential for licensing and industrial production. Alongside it runs a digital platform built in Shiny, free and open source, which crosses fertilization response data, by source, rate, timing, and placement, with input, product, and carbon prices. The reference sectors are two, and quite unlike each other: rainfed field cereals, wheat and maize, and coffee growing, a perennial and intensive system.

Impacts and results

The central technological result is a nanofertilizer validated under commercial production conditions, with its technology readiness level (TRL) raised from 4 to 6. The network of multi-location trials will record yield, agronomic nitrogen use efficiency, nutrient recovery fraction, nitrate leaching, greenhouse gas emissions, and emissions intensity per tonne harvested. From that analysis the project expects agronomic recommendations for each site and production system, yield-nitrogen response curves by fertilizer source and crop, efficiency-emissions frontier charts, and a table of emissions intensity factors by site, crop, and fertilization technique. The platform will remain online free of charge, with a user manual, and will make it possible to characterize adoption profiles. The team's ex ante estimate places the potential benefit at close to a 10% reduction in the nitrogen rate and a 10% increase in yield.

+ 2
Expected TRL level increase

3
Expected scientific publications

2400
Expected beneficiaries

100
Expected scientific-technical personnel trained

1
Technological dissemination product expected

18
Expected trials or pilots implemented and validated

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