INSTITUTO INTERAMERICANO DE COOPERACIÓN PARA LA AGRICULTURA, SEDE CENTRAL

Nanofertilizers: more nitrogen in the plant, less in the environment

In many farming systems across the region, less than half the nitrogen applied reaches the crop. Argentina and Costa Rica are taking a fertilization technology to the field to close that gap.





+2
Expected TRL level increase

3
Expected scientific publications

2400
Expected benificiaries

100
Expected scientific-technical personnel trained

1
Technological dissemination product expected

18
Expected trials or pilots implemented and validated

Trials on working farms, across two countries and three crops

Initiative

The project brings Argentina and Costa Rica together to validate nitrogen nanofertilizers where the decision is actually made: in the commercial field, not only in the controlled trials where the evidence has so far been concentrated. The network covers wheat and maize in rainfed field systems and coffee in a perennial one, at sites capturing contrasts in soil and climate, over two growing seasons. Treatments are defined in workshops with producers, advisors, researchers and cooperatives, so that the rates, timings and placements tested reflect decisions producers actually make.

Nitrogen released at the pace the crop demands

Tech solution

A nitrogen nanofertilizer is a formulation in which the nutrient is bound to nanomaterials smaller than 100 to 200 nanometres, changing how quickly it is released and how long it stays available in the soil. The aim is to synchronize nitrogen supply with crop demand: when the two align, less is lost to leaching and a greater share ends up in the plant. In the trials, these formulations are compared against conventional urea, enhanced efficiency fertilizers and an unfertilized control, measuring yield, agronomic nitrogen use efficiency, recovery fraction, nitrate leaching and emissions. The results feed an open digital platform that returns site-specific management recommendations and estimates the economic return under different price scenarios.

MORE INFO

Impacts and Results

The project expects to validate the nitrogen nanofertilizer and advance it from technology readiness level 4 to 6, drawing on a network of multi-location trials run over two growing seasons on working farms in Argentina and Costa Rica. Validation will measure yield, agronomic nitrogen use efficiency, nutrient recovery fraction, nitrate leaching and emissions intensity per tonne harvested. The analysis should produce agronomic recommendations by site and production system, yield-nitrogen response curves, and efficiency-emissions frontier charts. A free decision-support platform will be brought online and more than 200 scientists, technicians and producers will be trained. 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.

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