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Nanotechnology for soil moisture management in agricultural lands of the Andean Region

BOLIVIA,ECUADOR

Webstory

Technological solution

The project strategy is based on the development and application of nanoclays and organic hydrogels as innovative technologies to address soil degradation and drought in Andean agriculture. Nanoclays enhance water retention and availability in the soil due to their high surface area and expansion capacity. Organic hydrogels, produced from cellulose derived from agricultural residues, represent a biodegradable, sustainable, and low-cost alternative. Both materials increase water absorption and storage, reduce moisture losses, and improve the physical, biological, and microbial properties of the soil. Following laboratory validation, these technologies are being evaluated under field conditions to assess their effects on soil moisture retention and agricultural productivity in drought-affected Andean regions.

Technological description

Within the framework of the project "Nanotechnology for Moisture Management in Agricultural Soils of the Andean Region", nanoclays and organic hydrogels were developed as innovative technologies to enhance water retention in drought-affected soils. The nanoclays were obtained from clay-based materials processed through grinding and sieving to achieve reduced particle sizes, thereby increasing their surface area and moisture absorption capacity. The organic hydrogels were produced from cellulose extracted from agricultural residues and subsequently chemically modified to improve their water storage capacity. Both technologies contribute to prolonged soil moisture retention, reduced water losses, and improved resilience and productivity of crops in the Andean region.

Impacts and results

Different nanoclays and organic hydrogels were evaluated for their water absorption and retention capacity. The nanoclays were obtained from clay deposits in Ecuador and processed by grinding and sieving, while the hydrogels were produced from organic residues. Water retention varied according to nanoclay type and concentration. Among the hydrogels, those derived from borojó and sugarcane showed the highest performance, with absorption capacities exceeding 200%. During the 2025–2026 cropping season, both technologies improved quinoa and wheat productivity, with optimal application dose of 1,000 kg/ha of nanoclay and 100 kg/ha of hydrogel. Effects were less evident in potato and could not be assessed in maize due to hail damage. Additionally, 2,000 technical factsheets were produced, 330 farmers were trained, and a Virtual Learning Community was established to support technology dissemination and adoption.

+ 1000

Two 2 nanoclays developed at laboratory level with the capacity to absorb more than 200% of moisture

+ 1000

Two organic hydrogels developed at the laboratory level with a moisture absorption capacity of more than 200% humidity

500

Nanoclays and an organic hydrogel, identified in a greenhouse, capable of improving soil absorption by more than 20%.

1500

A nanoclay and a hydrogel evaluated in the field improve the productivity of at least 2 crops

200 300

Six training workshops were conducted, reaching more than 300 farmers.

200 50

More than 30 members registered on the digital innovation platform to promote the dissemination of project knowledge.

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