MAR2PROTECT

Innovation Factsheet

FERT-ROOT: Integrated soil conditioning and nutrient retention system

Problem Solved

Subsoil compaction restricts root penetration and suppresses rhizosphere microbial activity, reducing nutrient uptake efficiency in vineyards, orchards, and row crops. As a result, excess fertilizer leaches beyond the root zone, becoming a major source of diffuse groundwater nitrogen and phosphorus pollution while increasing production costs through over-fertilization.

FERT-ROOT addresses this challenge by combining cold plasma nanobubble water conditioning, nutrient sequestration, and biological soil stimulation. The integrated system improves soil structure, enhances nutrient availability, stimulates beneficial microbial activity, increases fertilizer uptake efficiency, and reduces nutrient losses to groundwater.

How It Works

FERT-ROOT integrates two complementary technologies delivered through existing irrigation systems:

HumeFlo™ Water Treatment System

- → Cold plasma photocatalytic oxidation generates H_2O_2/O_3 nanobubbles.
- → Oxidizes dissolved minerals, metals and chlorides.
- → MacroPlex™ sequestering agent prevents calcium and magnesium from binding phosphate into unavailable precipitates. Improves soil physical and chemical conditions.

Soil Bio-Stimulants

- → AminoFix-3000™ provides slow-release carbon and nutrients for microorganisms.
- → Nitro-15™ delivers organic nitrogen through protein hydrolysates.
- → Enhances microbial activity, nutrient transformation, and root development.

Together these components improve nutrient uptake, reduce fertilizer leaching, and support healthier root systems while retrofitting directly onto existing drip or micro-irrigation infrastructure.

Unique Value Proposition

An integrated soil conditioning and nutrient retention solution that combines nanobubble water treatment, nutrient sequestration, and biological soil stimulation to improve fertilizer uptake, reduce nitrogen and phosphorus leaching to groundwater, alleviate soil compaction, and enhance root development. Proven in commercial vineyards, FERT-ROOT helps farmers improve nutrient-use efficiency and maintain crop productivity while supporting sustainable groundwater protection.

Result Identification

Technology Short Name

FERT-ROOT.

Full Name

FERT-ROOT: Integrated soil conditioning and nutrient retention system.

Lead Partner

Stellenbosch University (SU), South Africa.

Work Package / Task Related Deliverables

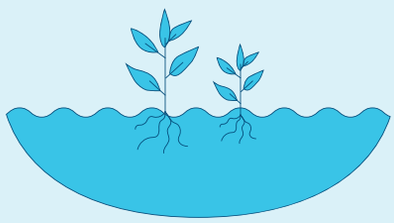
WP2, Task 2.4: Mitigation of agricultural N/P leaching to GW through FERT-ROOT (TEC6). Related deliverables: D2.3, D2.4, D2.5, D2.6, D5.4.

Current TRL

TRL 8. Commercially available technology.

KER Type

Product → Technology.



- **Efficiency:** improves nutrient availability, root development, microbial activity, and fertilizer uptake efficiency.
- **Cost:** reduces fertilizer losses and dependence on costly mechanical remediation measures such as soil ripping.
- **Safety:** non-invasive technology installed directly in irrigation systems with no specialized operators required.
- **Sustainability:** reduces nitrogen and phosphorus leaching into groundwater, supporting sustainable agricultural production and groundwater protection.
- **Competitive advantage:** combines physical/chemical water treatment and biological soil stimulation in a single integrated solution, addressing several causes of nutrient loss simultaneously.

Target Markets & Users

Segment	Description	Role
Farmers	Irrigated vineyards, orchards and fruit, vegetable, cereal and row-crop producers	Primary user; buyer
Water utilities, drinking water/water suppliers	MAR operators and water utilities benefiting from reduced agricultural nutrient leaching into groundwater	Secondary user; beneficiary
Government and international organisations	Catchment-management agencies and groundwater authorities responsible for water-resource protection	Regulator; policy maker
Industrials (SMEs and large companies)	Irrigation-equipment suppliers and agricultural-input distributors supporting commercial deployment	Distributor; commercial partner

Exploitation Route & Business Model Outline

Exploitation route	Commercial deployment through irrigation-system integration and distribution networks; currently commercialized in South Africa
Revenue model	Sale of HumeFlo equipment and recurring supply of MacroPlex™, AminoFix-3000™, and Nitro-15™ consumables
IP strategy	Proprietary commercial technology marketed by Humefert Manufacturing (Pty) Ltd
Next steps	Expand validation to additional crops, soils and regions; strengthen distribution channels and support registration processes in target countries

Contact **Ludwig Brocker** (ludwig@humefert.com), for co-development opportunities, pilot testing, and technical integration discussions. For project coordination matters, please reach out to **NOVA**, coordinator of the MAR2PROTECT project. Collaboration, exploitation, and technology transfer opportunities are supported by **FEUGA**, the project's Technology Transfer Entity.

Discover all the technologies!

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