WHO WE ARE

CICYTEX (Center for Scientific and Technological Research of Extremadura) is a public-sector research institution of the Regional Government of Extremadura, Spain, dedicated to applied research, technological development and innovation in the agri-food and environmental sectors. Its work is strongly oriented towards supporting sustainable agricultural management under real farming conditions.

CICYTEX has more than 20 years of experience in irrigation and fertilisation research in irrigated Mediterranean agriculture, with strong expertise in soil–plant interactions, crop nutrition, soil and water management, agronomic monitoring and field-based decision support. The group works on horticultural crops, particularly processing tomato, broccoli and cauliflower, under both experimental and commercial farming conditions, in close collaboration with cooperatives, irrigation communities and private farms.

Within this framework, CICYTEX designs and implements soil and plant monitoring campaigns aimed at generating reliable and operational information for agricultural management. Its work includes soil physical and chemical characterisation, crop nutritional assessment, spatial variability analysis, and the integration of laboratory data, field measurements, plant and soil sensors, diagnostic tools and satellite imagery. The group also applies proximal soil sensing using the DUALEM-1S sensor to measure apparent soil electrical conductivity (ECa), supporting the identification of within-field spatial variability and the design of targeted soil sampling strategies to improve irrigation and fertilisation management.

CICYTEX also has experience in translating monitoring results into operational recommendations through decision-support tools such as VegSyst-DSS for irrigation and nitrogen fertilisation management in horticultural crops, and IrriDesK, a digital twin for automatic precision irrigation. A relevant part of its activity is conducted in nitrate vulnerable areas such as the Vegas Bajas del Guadiana, where reliable soil and nitrogen-related information is essential to support sustainable and environmentally sound management.

OUR TOPIC OF INTERESTS IN Horizon Europe

- HORIZON-MISS-2026-05-SOIL-01: Monitoring soil health in practice: equipping stakeholders to sample, analyse, and interpret soil health indicators.

- HORIZON-MISS-2026-05-SOIL-04: Leveraging long-term field experiments and other datasets to develop AI-ready decision support systems for sustainable soil management.

OUR priority interest in research collaboration in the selected topic

For **HORIZON-MISS-2026-05-SOIL-01**, CICYTEX can contribute through its expertise in robust field sampling, soil and plant monitoring under real farming conditions, spatial variability assessment, interpretation of soil-related indicators, and practical agronomic decision support. Its work is well aligned with the topic scope, which calls for improved sampling and analysis protocols, better interpretation of soil data and uncertainties, and stronger integration of direct sampling, proximal sensing and remote sensing. In particular, the use of the DUALEM-1S sensor to map apparent soil electrical conductivity (ECa) supports stratified and representative soil sampling, improves the interpretation of soil variability, and contributes to more reliable soil health assessment in heterogeneous agricultural systems.

CICYTEX can also contribute to the expected outcomes of SOIL-01 by improving the reliability and accessibility of soil health data, helping land managers and advisors understand the limitations and uncertainties of soil datasets and indicators, fostering multi-actor collaboration, and supporting the development of practical protocols and best practices for soil sampling and monitoring. Its established collaboration networks with cooperatives, irrigation communities, private farms and advisors provide a strong basis for stakeholder engagement, participatory validation and knowledge exchange.

For **HORIZON-MISS-2026-05-SOIL-04**, CICYTEX can contribute through its experience in integrating field experiments, in situ monitoring, laboratory analyses, agronomic observations, sensor-based measurements and spatial information into structured datasets suitable for agronomic interpretation and decision support. This is highly relevant to the development and validation of AI-ready and user-oriented decision support systems for sustainable soil management. CICYTEX can particularly support the field validation of AI-based recommendations, ensuring that resulting tools are robust, understandable, actionable and adapted to real end-user needs in Mediterranean irrigated agriculture.

Overall, CICYTEX's priority interest lies in contributing to projects that connect soil monitoring, data integration, uncertainty analysis and decision support with practical agricultural management, especially in irrigated systems where soil variability, water availability and nutrient management are critical for both productivity and environmental sustainability.

WHAT WE OFFER (expertise, publications, infrastructures and skills offered)

CICYTEX offers strong applied expertise in soil, water and nutrient management in irrigated Mediterranean agriculture, supported by more than 20 years of experience in irrigation and fertilisation research. The group works on horticultural crops and fruit trees under both experimental and commercial farming conditions, providing solid capacity to generate and validate results under real agricultural scenarios.

CICYTEX offers expertise in soil and plant monitoring, sampling design, spatial variability assessment, soil physical and chemical characterisation, crop nutritional assessment, and field validation. Its analytical work includes soil nitrate and ammonium determination, soil electrical conductivity, soil texture, soil organic matter assessment, and irrigation water quality analysis, including electrical conductivity (EC), pH and phosphate determination using Hanna instruments. These analyses are complemented by plant-based diagnostic tests, including nitrate determination in sap using the LAQUAtwin sensor and the assessment of foliar nitrogen, phosphorus and potassium concentrations, allowing a more accurate interpretation of soil–plant interactions and crop nutritional status.

The group also uses field-based sensing and diagnostic tools, including proximal soil sensing with the DUALEM-1S sensor to measure apparent soil electrical conductivity (ECa), supporting the delineation of spatial variability and the design of targeted soil sampling campaigns for improved irrigation and fertilisation management. In addition, CICYTEX uses plant such as Dualex, Apogee and SPAD, together with soil sensors and satellite imagery, to improve the monitoring of crop nutritional and water status under real farming conditions.

CICYTEX also applies the combined use of Hyprop and WP4C systems to determine field capacity, permanent wilting point and soil water retention curves, supporting detailed characterisation of soil hydraulic properties relevant to water management and soil health assessment. The group also provides experience in the use of decision-support tools for agricultural management, including VegSyst-DSS for nitrogen fertilisation management in horticultural crops, and IrriDesK, a digital twin for automatic precision irrigation. These tools support the translation of monitoring results into practical recommendations for farmers, advisors and water managers. This expertise is also supported by applied R&D projects such as "Evaluation of VegSyst-DSS as a decision support tool for irrigation and fertilisation management in open-field horticultural systems."

In addition, CICYTEX contributes with experimental and demonstration plots, field monitoring equipment, analytical capacity for soil, water and plant assessment, and established collaboration networks with cooperatives, irrigation communities and private farms. The group also offers skills in multi-source data integration, knowledge transfer, and the development of practical protocols and best practices for sustainable irrigation and fertilisation management, particularly in nitrate vulnerable zones such as the Vegas Bajas del Guadiana.

– **HORIZON-MISS-2026-05-SOIL-01: Monitoring soil health in practice: equipping stakeholders to sample, analyse, and interpret soil health indicators.**

Coordination and Support Actions

Expected outcomes	How CICYTEX could contribute to each expected outcome?
Enhanced reliability and accessibility of soil health data by and for laboratories, land managers, advisors and policymakers.	CICYTEX contributes to the enhanced reliability and accessibility of soil health data by and for laboratories, land managers, advisors and policymakers through robust sampling design, field validation and integrated soil–plant monitoring under real farming conditions. The group applies harmonised methodologies combining laboratory analyses (soil nitrate and ammonium, soil electrical conductivity, texture, organic matter), irrigation water quality assessment (EC, pH, phosphates), and plant diagnostics (sap nitrate using LAQUAtwin, foliar NPK). In addition, the integration of proximal sensing (e.g. ECa mapping using the DUALEM-1S sensor), in situ measurements and satellite data supports a better characterisation of spatial variability and reduces uncertainty. Data accessibility is enhanced through decision-support tools and user-oriented approaches that translate complex datasets into actionable information for farmers, advisors and policymakers.
Improved understanding by land managers, other relevant practitioners and policymakers of the conditions, limitations and	CICYTEX contributes to the improved understanding by land managers, other relevant practitioners and policymakers of the conditions, limitations and uncertainties of soil data and outputs

uncertainties of soil data and outputs and tools (e.g. datasets, indicators, descriptors, methodologies, pedo-transfer functions)	and tools by linking soil measurements with plant-based indicators and agronomic responses under heterogeneous field conditions. Its experience in irrigated Mediterranean systems allows the evaluation of uncertainties associated with sampling strategies, soil indicators and monitoring tools. By integrating soil, plant and environmental data, the group can identify the applicability limits of datasets, indicators and pedo-transfer functions, improving their interpretation and supporting more reliable decision-making in real agricultural contexts.
Increased collaboration and interaction among stakeholders, including end-users, around soil heath data issues	CICYTEX contributes to increased collaboration and interaction among stakeholders, including end-users, around soil health data issues through its strong collaboration networks with cooperatives, irrigation communities, private farms and advisors. The group can actively support the multi-actor approach through co-creation processes, on-farm trials, demonstration activities and participatory validation of soil monitoring methods. This facilitates effective knowledge exchange between researchers and practitioners and ensures that tools, protocols and recommendations are aligned with user needs and readily applicable in practice.
Support the development of standards, norms and reference frameworks as well as national and international guidelines of soil sampling and monitoring and promote best practices.	CICYTEX contributes to the development of standards, norms and reference frameworks as well as national and international guidelines of soil sampling and monitoring, and to the promotion of best practices through its experience in harmonised soil sampling and monitoring protocols adapted to irrigated

	agricultural systems. Its expertise in sampling design, nutrient monitoring and spatial variability assessment supports the generation of evidence-based guidelines to improve data quality and representativeness. The group can also contribute to best practices by integrating laboratory analyses, proximal sensing (e.g. ECa mapping), plant diagnostics and field observations into operational protocols. Its experience in nitrate vulnerable zones provides a relevant framework for developing standardised approaches aligned with environmental regulations and sustainable soil management.

– **HORIZON-MISS-2026-05-SOIL-04: Leveraging long-term field experiments and other datasets to develop AI-ready decision support systems for sustainable soil management**

Innovation Actions

Expected outcomes	How CICYTEX could contribute to each expected outcome?
Enhanced adoption of impactful sustainable soil management solutions and strategies supported by AI-powered decision support systems by land managers	CICYTEX contributes to the enhanced adoption of impactful sustainable soil management solutions and strategies supported by AI-powered decision support systems by land managers by linking AI-powered tools with real farming conditions, operational agronomic management and end-user needs. The group has extensive experience in irrigation, fertilisation and soil–plant monitoring in irrigated Mediterranean agriculture, which is highly relevant for testing and validating practical recommendations derived from AI-supported tools. Through its collaboration with farmers, cooperatives, irrigation communities and advisors, CICYTEX can support the co-development, demonstration and validation of user-oriented solutions, helping ensure that AI-based decision support systems are understandable, actionable and trusted by land managers. Its experience with VegSyst-DSS and IrriDesK further strengthens its capacity to translate complex datasets into practical management recommendations.

harmonised, standard, robust, interoperable and accessible methods, protocols and logical architecture for long-term field experiments (LTEs) data collection and integration (including with other datasets) are in place	CICYTEX contributes to harmonised, standard, robust, interoperable and accessible methods, protocols and logical architecture for long-term field experiments (LTEs) data collection and integration through its expertise in field monitoring, sampling design, soil and plant assessment, and multi-source data integration.The group has experience in combining laboratory analyses, proximal sensing, plant diagnostics, agronomic observations and satellite information into structured datasets suitable for agronomic interpretation and decision support. Its capabilities include soil nitrate and ammonium determination, soil electrical conductivity, soil texture, soil organic matter assessment, irrigation water quality analysis, plant diagnostic tests, and the use of sensing tools such as DUALEM-1S, Dualex, Apogee and SPAD. These capacities support the generation of robust and standardised datasets that can complement long-term field experiments and facilitate interoperability with broader soil health databases and AI-ready infrastructures.
Scientists, policymakers, and land managers gain enhanced access to comprehensive, high-quality soil data, enabling better research, informed decision-making, and effective land management practices	CICYTEX contributes to ensuring that scientists, policymakers and land managers gain enhanced access to comprehensive, high-quality soil data, enabling better research, informed decision-making, and effective land management practices through the generation, integration and practical use of structured soil, plant and environmental datasets. CICYTEX can support this outcome

	by generating and organising high-quality, field-validated datasets and by facilitating their practical accessibility for different user groups. The group integrates laboratory data, agronomic observations, satellite information and continuous in situ monitoring into structured internal databases and dashboards, supporting traceability, interpretation and operational use. A relevant part of this infrastructure relies on low-cost plant, soil and environmental sensors connected through LoRaWAN communication technology, enabling continuous data acquisition under real field conditions without dependence on proprietary systems. These data can be visualised through open-access platforms, thereby improving accessibility for farmers, advisors and other stakeholders. Its experience in nitrate vulnerable zones such as the Vegas Bajas del Guadiana provides a particularly relevant framework for producing and validating decision-relevant soil and nutrient data with direct usefulness for sustainable land and water management.

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