Together for sustainable Irrigation
EUROPEAN IRRIGATION ASSOCIATION

Friday 3 July 2026

14h00 – 16h00

EIA Summer Irrigation Forum : Is Hydroponics Irrigation ?

Code of Conduct

- EIA believes it is important that its activities are at all times carried out **in accordance with the applicable law, especially competition law**.
- We believe that business shall be conducted in an atmosphere of **free competition**, i.e. on the basis of price and quality.
- Our Code of Conduct shall be binding on **all members** as well as **on other participants** when taking part in activities of EIA.
- **Prohibited Topics :** Prohibited topics include sale prices, price adjustments, discounts, mark-ups, specific customers, tenders, information about production, turnover, investments, or any commercially sensitive information…

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EIA Summer Irrigation Forum

The House keeping rules

- The event is recorded and will be shared.
- Please present your full name and your organisation properly.
- Please mute your microphones while you not participating.
- Please use the chat box for questions and comments.
- If you can, turn on your camera on so we can see each other.

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EIA Summer Irrigation Forum

Draft Agenda

14:00 -14:20	**Opening** **Introduction**	**Moshi Berenstein,** EIA President
14:20 -14:30	**Welcome & introduction of New Members**	**Fleur Martin,** EIA Communication Officer
14:30 -15:00	**Invited Speaker :** "Is Hydroponics Irrigation ?"	**Dimitrios Savvas,** Director of the Laboratory of Vegetable Crops - Agricultural University of Athens
15:00 -15:30	**Innovation and Technology session** "Water-independent greening solutions for the city"	**Baptiste Laurent,** Founding President of Vertuo
15:30 - 16:00	**Open session for Q&A**	

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What is happening at EIA

From sector representation to a platform for implementation, evidence and member value

From “Europe needs irrigation” → **to “Europe needs practical solutions to deliver Water Efficiency First”**

1. Advocacy platform

- Common narrative: precision irrigation, digital water management, reuse
- Position paper, policy monitoring and Brussels engagement
- July Commission meetings: ENV/Water Resilience + AGRI implementation

2. Market intelligence

- ESCP strategic diagnostic: adoption, barriers and enablers
- Member demand: practical insight for 2027 planning
- Shift from equipment to performance, proof of value and ROI

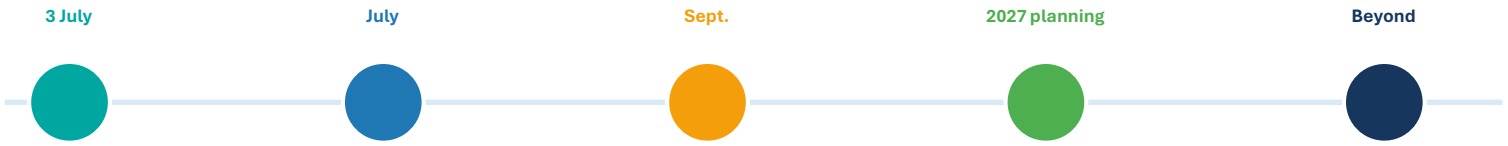
3. Strategic visibility

- European Parliament FruitCREWS roundtable on sustainable water management
- Summer Forum: hydroponics and water-independent urban greening
- September Irrigation Days: member strategy + EU policy roundtable

The association is becoming a bridge between policy, business reality and practical deployment.

Where EIA can create value next

Turning policy momentum and market change into practical support for members



Summer Forum

Explore emerging irrigation questions: hydroponics and urban water-autonomous greening

Commission dialogue

Bring the new EIA narrative to ENV/Water Resilience and AGRI Cabinets

Irrigation Days

Connect member strategy, policy roundtable and implementation dialogue in Brussels

Member business use

Translate insights into company planning: segments, ROI, channels and partnerships

Market observatory

Build a recurring source of sector intelligence and evidence-based advocacy

Narrative — Irrigation as water-resilience infrastructure, not only water consumption

Evidence — KPIs, proof of value, ROI models and measurable outcomes

Deployment — Certification (evidence based), Partnerships, funding eligibility (EIB etc.) and practical adoption on the ground

The opportunity for EIA: help members anticipate change and position the sector as a practical solution for Europe's water resilience.

EIA Summer Irrigation Forum

Welcome to the new members

- We are delighted to announce that **five new members** have joined the association since our last forum.

- The EIA now has 82 members.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MANUFACTURER
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WE AIM TO BE GLOBALLY RECOGNIZED FOR INNOVATIVE POWER
WHAT WE DO
POWER SOLUTIONS DESIGNED FOR SEA AND LAND


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TO SUPPORT CUSTOMERS IN
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HIGH-PERFORMANCE PRODUCTS FOR
MARINE, POWER GENERATION &
INDUSTRY

OFF-HIGHWAY APPLICATIONS

STATIONARY AND MOBILE

AGRICULTURE

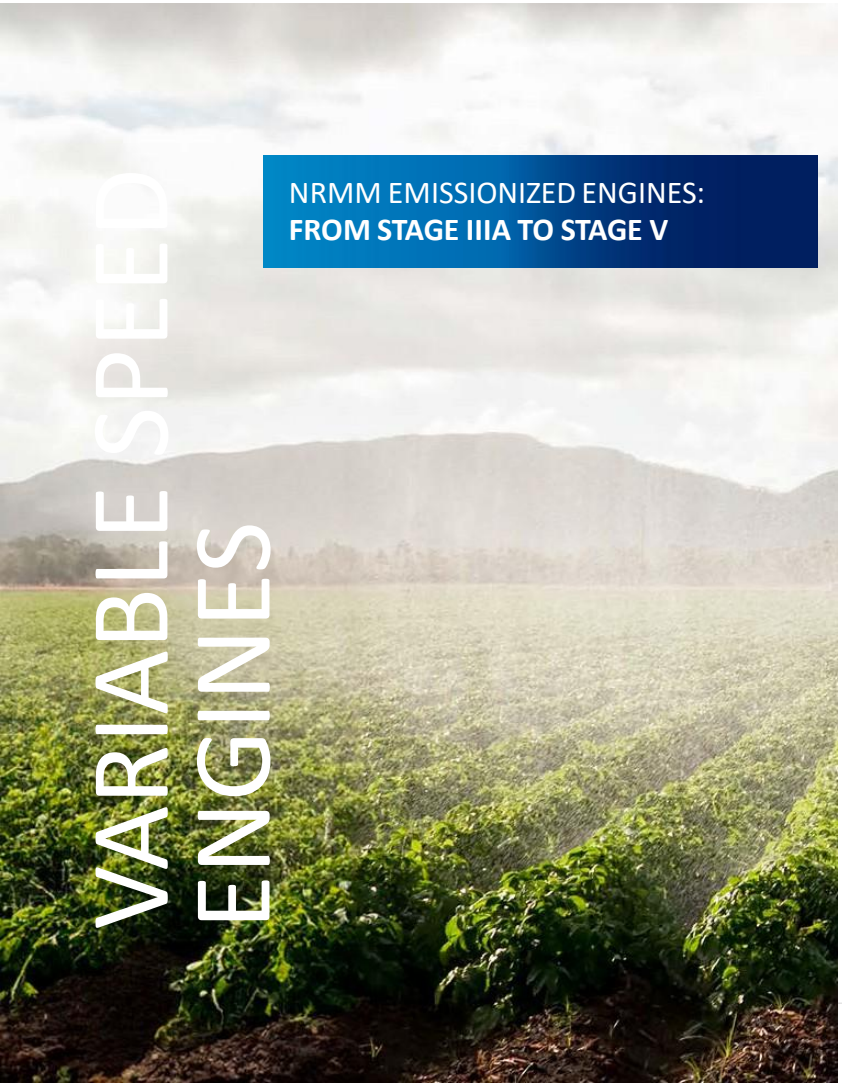
CONSTRUCTION

SPECIAL APPLICATIONS

MATERIAL HANDLING

OTHERS

- Diesel & Gas engines
- Components
- New Energy



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FROM STAGE IIIA TO STAGE V

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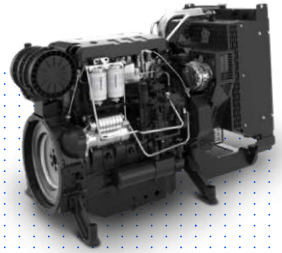
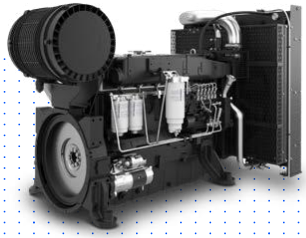
SUITABLE FOR STATIONARY AND MOBILE APPLICATIONS.

4M11



6M16



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- Mechanical fuel injection for easy servicing. High tolerance to varying fuel quality. Compact Design
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European Irrigation Association

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Toutes les solutions sont dans la nature

Irrigation

Pumping Systems

Fountains

Misting Systems

Rainwater
Harvesting & Reuse

Blue-Green
Infrastructure

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Raindancer Smart Irrigation Management

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Big Irrigation Guns


Booms


Hose Reel Irrigation


Pivot / Linear


Self-Driving
Machines

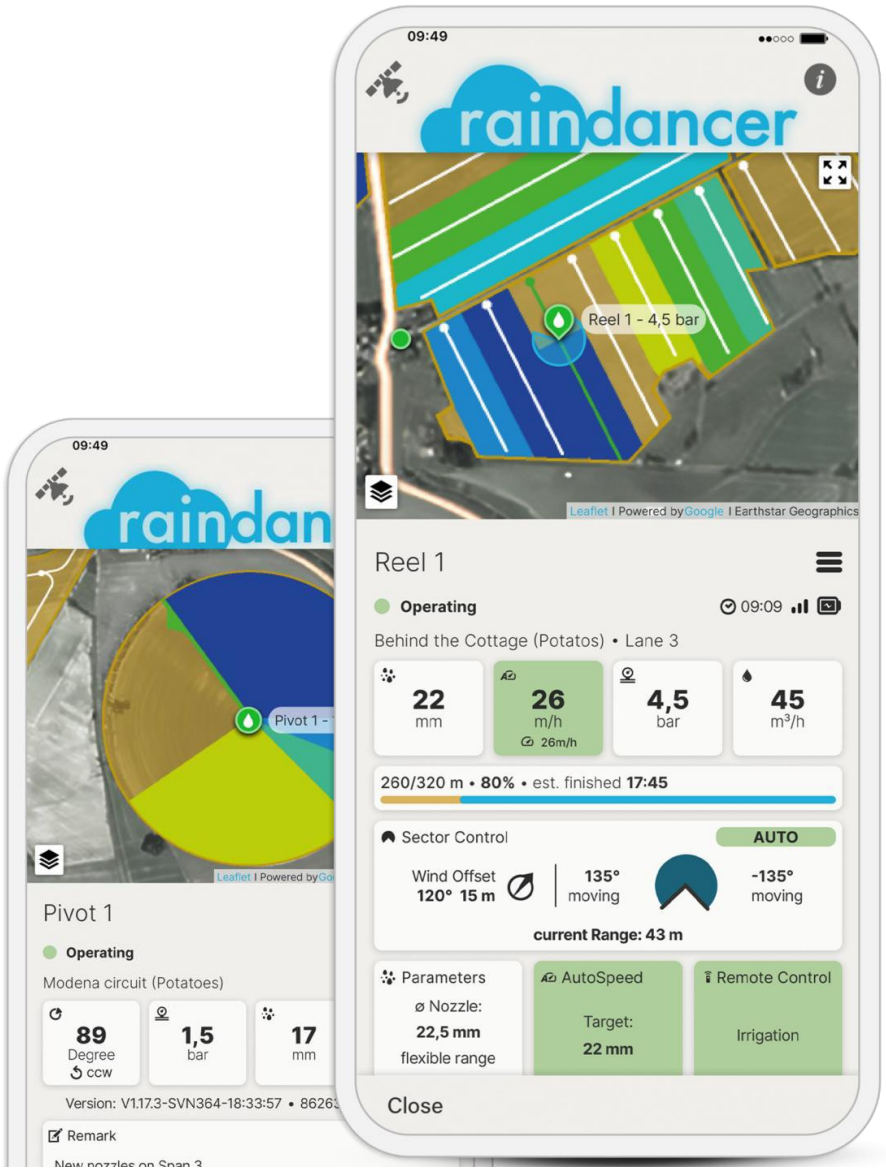
Raindancer

Helps farmers to monitor and control their irrigation via Smartphone or PC.

Using raindancer is very easy and it is available for **every irrigation machine, brand independent and retrofittable.**

What is it about?

- All Information at a Glance
- Alert on faults
- Planning
- Remote Control
- Saving Water, Energy and Time



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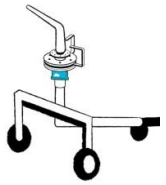
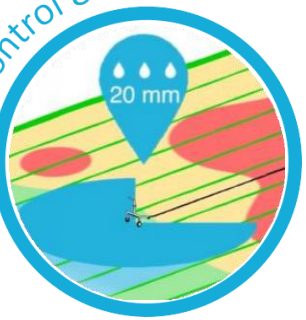
Automatic Gun Sector Control



Monitor Irrigators

Pump Control

Remote Control & VRI



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Collaboration

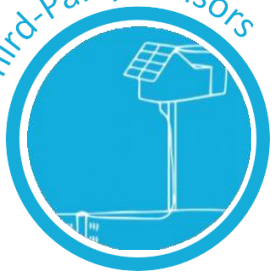
Automation

Integration

Reporting

Third-Party Data-Consumers

Third-Party Sensors



Third-Party Services

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Our Premium Members

Образец заголовка

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Our Members

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Contacts EIA

If you would like more information about joining us as a member, please email us :

communication@irrigationeurope.eu

Or Register as a Member online :

Scannez-moi !

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Recent developments in soilless/hydroponic cultivation

Dimitrios Savvas

Department of Crop Science, Laboratory of Vegetable Production, Agricultural University of Athens, Greece

Soilless Culture (SC)

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- **All methods of growing plants with their roots growing out the natural soil and fed exclusively through the supply of a complete nutrient solution**
- **The roots grow either directly in pure nutrient solution or in a porous growing media (substrates) which retains nutrient solution in part of its pores**

SC on bags filled with a growing medium

SC on troughs filled with a growing medium

NFT system

Floating hydroponics

Aeroponics

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Nutrient solution

A diluted water solution containing all essential nutrients in form of inorganic ions or soluble inorganic compounds *

*** With the exception of iron, which is contained in form of an organic chelate.**

Nutrients and their plant-available forms in nutrient solutions

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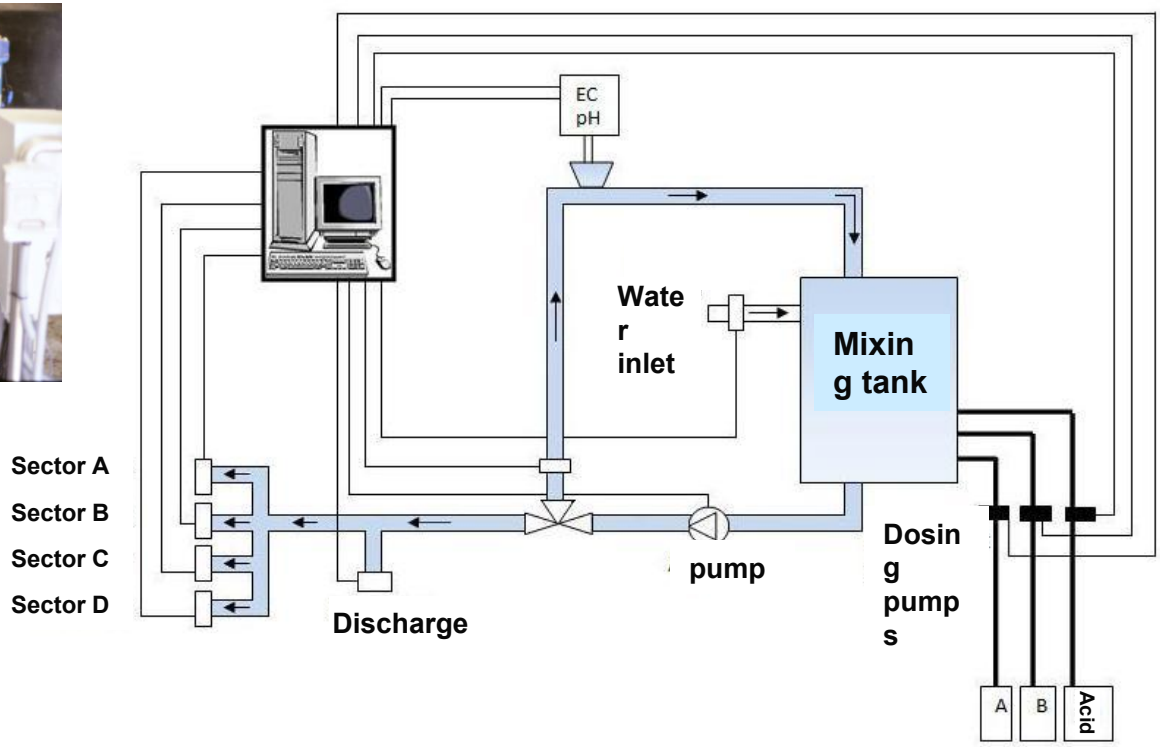
Macronutrient	**Chemical form**	**Micronutrient**	**Chemical form**
nitrogen (N)	NO_3^-, NH_4^+	Iron (Fe)	Fe^{2+}
Phosphorus (P)	$H_2PO_4^-$	Manganese (Mn)	Mn^{2+}
Sulphur (S)	SO_4^{2-}	Zinc (Zn)	Zn^{2+}
Potassium (K)	K^+	Copper (Cu)	Cu^{2+}
Calcium (Ca)	Ca^{2+}	Boron (B)	H_3BO_3
Magnesium (Mg)	Mg^{2+}	Molybdenum (Mo)	MoO_4^{2-}

Lay-out of a fertigation machine with *A/B* stock solutions injected into a mixing tank



Is hydroponics irrigation?

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Irrigation is intimately associated with nutrition in soilless culture as the nutrient solution is intended to cover the plant needs in both nutrients and water.

In some water culture systems (e.g. floating hydroponics) the roots of the plants grow directly in a nutrient solution (no regular supply, no irrigation scheduling).

In soilless cultivations on substrates as well as in NFT systems and aeroponics, plants are irrigated frequently (several times per day) but each irrigation event is short (ca. 2 – 6 minutes).

Thus, irrigation scheduling is very important, but the concepts of controlling frequency and duration of irrigation are substantially different than those applied in soil-grown crops.

Irrigation control concepts in hydroponics:

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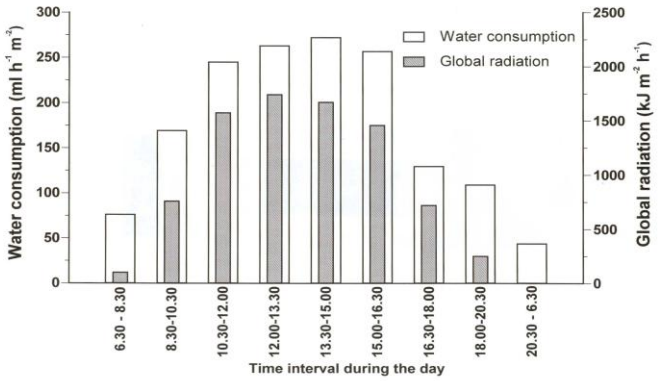
1. Irrigation frequency adjustment at pre-determined times during the day

- It is applied if there is no alternative option
- Inflexible system as it cannot adapt to differences in climatic conditions from day to day
- More frequent irrigation during the midday
- More frequent irrigation during the warm season of the year

Variations in water consumption and solar radiation during a day in a tomato crop grown hydroponically



Irrigation control concepts in hydroponics:

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2. **Irrigation based on simulation or measurement of the evapotranspiration**

Typical model to estimate the evapotranspiration (***ET_c*, mm**) in a greenhouse (Baille et al., 1994)

$$ET_c = A[1-\exp(-K * LAI)]G + B * LAI * D$$

where:

***G* is the solar radiation (MJ m^{-2}) for a particular time interval,**

***D* is the air vapour pressure deficit (kPa),**

***LAI* is the leaf area index (m^2 m^{-2}),**

***K* is a light attenuation coefficient related to the reduction of light in the canopy with LAI,**

***A* (dimensionless) and *B* (W m^{-2} kPa^{-1}) are parameters which must be calibrated for any particular crop and stage of plant development.**

Irrigation control concepts in hydroponics

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3. Irrigation based on real time monitoring of the evapotranspiration

Experimental device used to monitor the changes in the weight of the substrate due to plant water loss through transpiration.

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Management of nutrition in hydroponics

Constraints governing the establishment of a nutrient solution composition

I. Association between anions and cations

The addition of a macronutrient ion imposes addition of another ion of different charge at an 1 : 1 equivalent ratio ⇒ **The input of a macronutrient cannot be considered independently of the other macronutrients**

An example: Addition of potassium

$KNO_3 \rightarrow K^+ + NO_3^-$

$KH_2PO_4 \rightarrow K^+ + H_2PO_4^-$

$K_2SO_4 \rightarrow K^+ + SO_4^{2-}$

$KCl \rightarrow K^+ + Cl^-$

Constraints governing the establishment of a nutrient solution composition:

II. Mineral composition of water

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- **In most cases, the irrigation water contains considerable amounts of some:**
  - **macronutrients (Ca, Mg, S-SO_4^{2-}),**
  - **micronutrients (Mn^{2+}, Zn^{2+}, Cu^{2+}, B και Cl^-)**
  - **other macroelements (HCO_3^-, Na^+).**

In some cases, the concentrations of the above elements in the irrigation water may approach or even exceed their target concentrations in the nutrient solution.

The need to regularly adjust the nutrient solution composition

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- The composition of the nutrient solution supplied to the plants needs modifications during cultivation, depending on the **crop developmental stage and current climatic conditions (season of the year).**
- The calculations have to be individually performed for each grower and cropping stage, because the **mineral composition of the irrigation water** used to prepare nutrient solutions varies depending on the location of the greenhouse.
- Thus, there is a need for modern computational tools operating as decision support systems (DSS) which can provide easy and accurate calculation of nutrient solutions in each commercial enterprise whenever needed.

NUTRISENSE: A novel DSS to manage nutrient supply in soilless cropping systems

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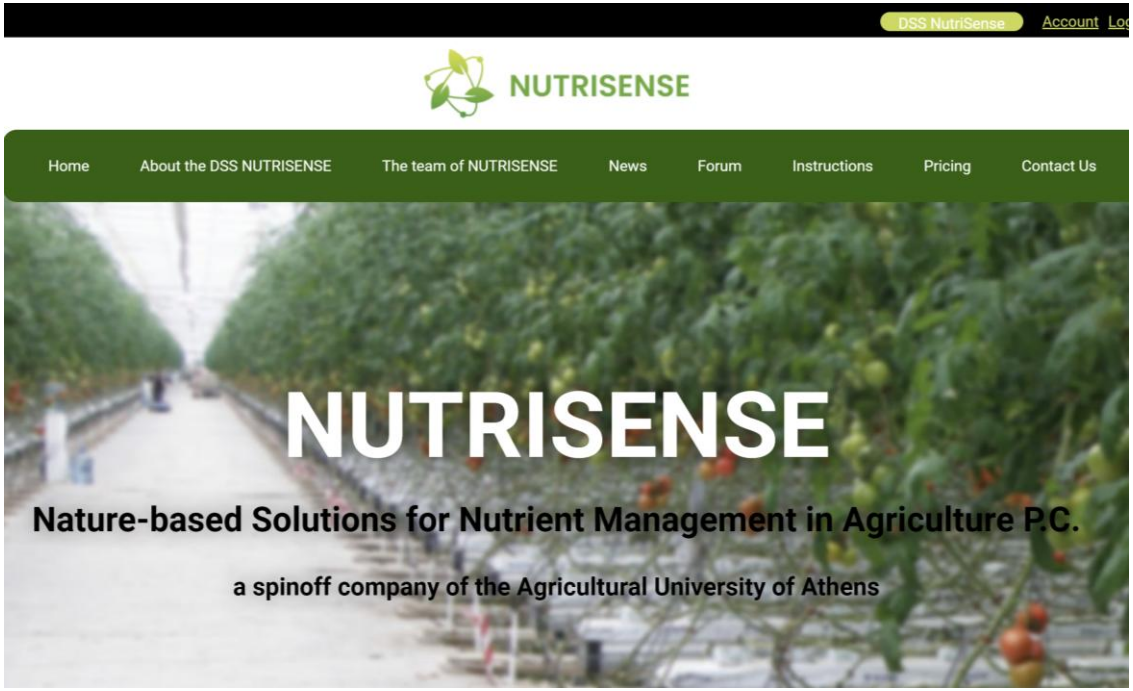
The website of NUTRISENSE: https://nutrisense.online/



econutri

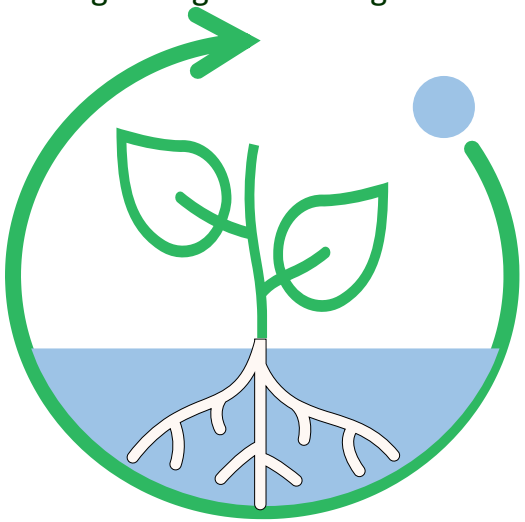
A HORIZON Europe innovation project

https://econutri-project.eu/

Objectives of ECONUTRI

Optimize, validate, and demonstrate nature-based novel solutions adapted into a holistic concept, which contribute to:

- **reduction of NO_3-N and P leaching and run-off,**
- control of N losses through ammonia volatilization, and
- mitigation of GHG emissions originating from the agricultural sector.



Closed-loop soilless culture systems

Funded by the European Union

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Recycling of nutrient solutions in closed soilless culture systems

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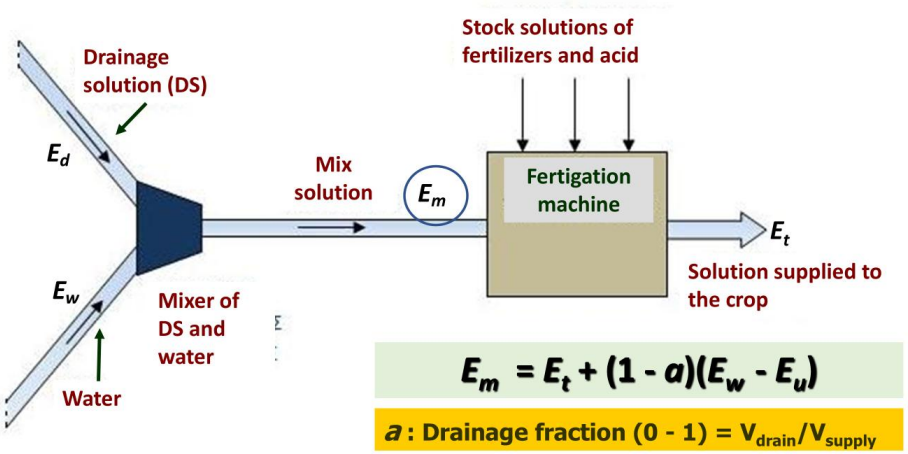
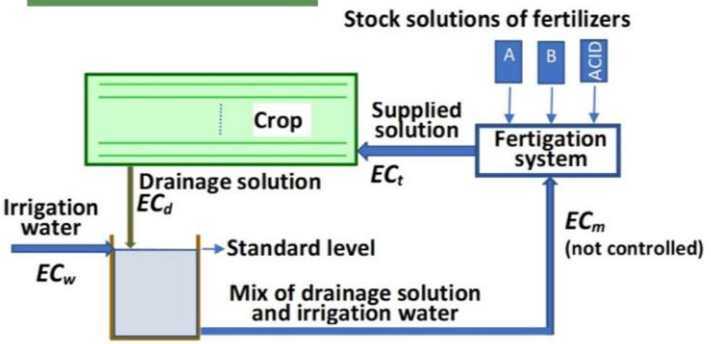
Schematic representation of the most common technology for recycling of the drainage solution in closed soilless crops grown on substrates



$$E_m = E_t + (1 - a)(E_w - E_u)$$

a : Drainage fraction (0 - 1) = V_{drain}/V_{supply}

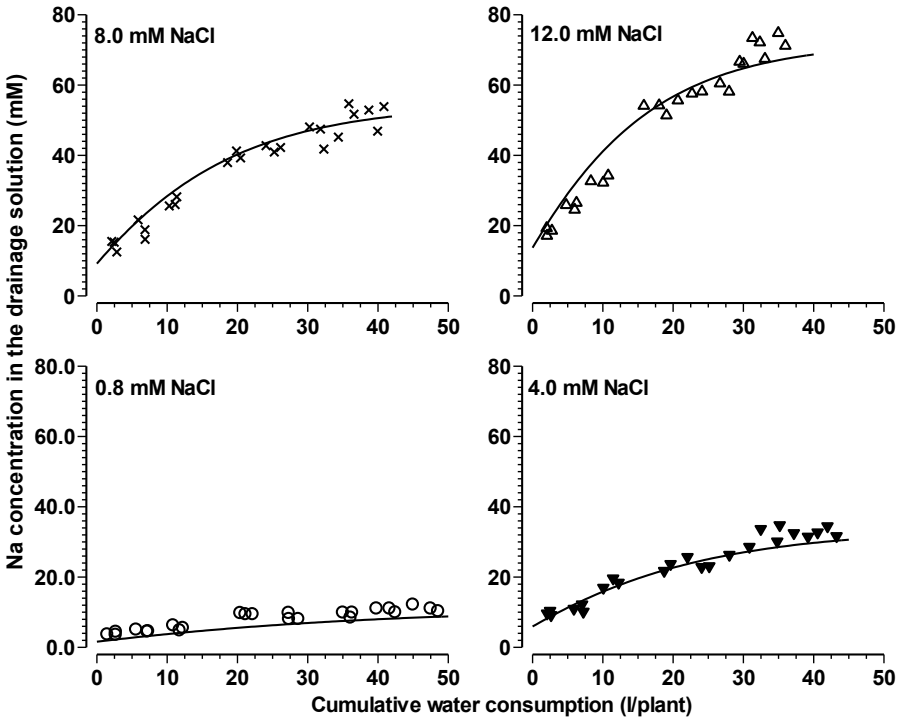
Schematic representation of the most common technology for nutrient solution recirculation in water culture systems.



Difficulties related to nutrient solution recycling

- **Recycling of the nutrient solution may result in recycling of pathogens.**
- **The composition of the nutrient solution changes as it passes through the root environment and thus the nutrient concentrations in the drainage solution are not similar with those in the solution supplied to the crop.**
- **Sodium originating from the raw water may accumulate in the root environment as there is no leaching of this non-nutrient ion.**

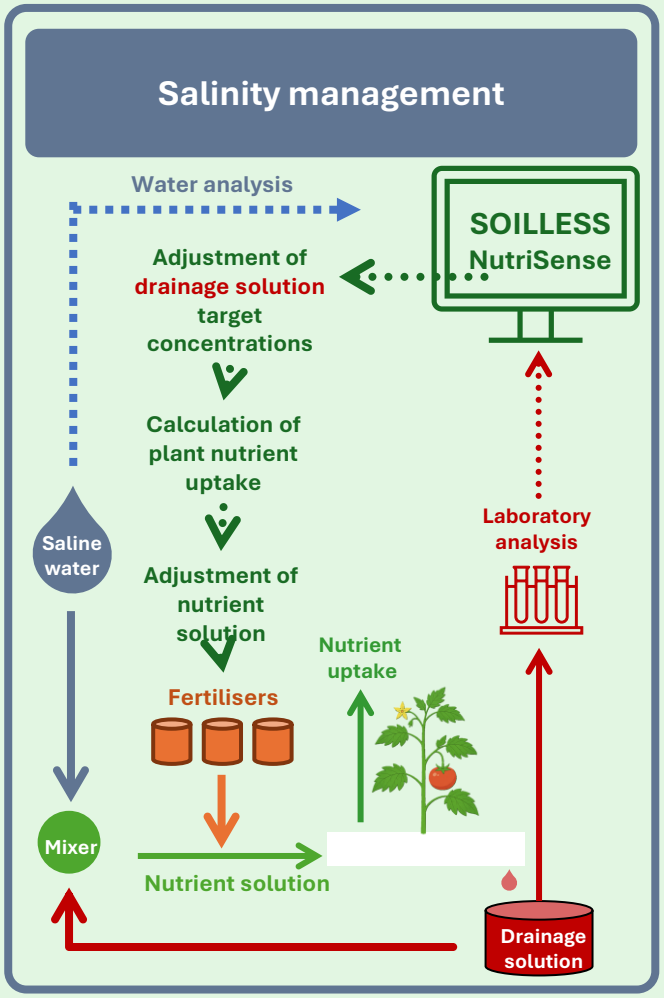
Na^+ and Cl^- accumulation in closed hydroponic systems



Evolution of sodium (Na^+) concentrations in the drainage water at four different Na^+ concentrations in the irrigation water in pepper crops grown from October to May in closed hydroponic systems.

Savvas et al. 2008, Bios. Engin.

Na^+ and Cl^- accumulation is an issue if the concentrations of these ions in the irrigation water are not low enough (Na^+<1 mM).



Salinity management algorithm **to control sodium (Na^+) accumulation** by dynamically adjusting target nutrient concentrations in the root zone

Agricultural Water Management 301 (2024) 108968

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journal homepage: www.elsevier.com/locate/agwat

Development and validation of an innovative algorithm for sodium accumulation management in closed-loop soilless culture systems

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Tomato
drainage solution
Nutrisense
water recycling
nutrient losses

ABSTRACT

In closed-loop soilless culture systems, the increase of the electrical conductivity (EC) caused by Na^+ accumulation is a major bottleneck for recycling of the nutrient solution if water sources are used which contain Na^+ at substantial concentrations. Currently, the recommended nutrient concentrations for the root zone of tomato exceed those for maximising yield, aiming to induce a moderate salinity stress to enhance fruit quality. A new strategy for Na^+ accumulation management is proposed, which gradually reduces the target concentrations of macronutrients except for P in the root zone in proportion to the accumulation of Na^+, considering a minimum safety threshold, while maintaining the mutual ratios between them constant. The algorithm developed to support this new strategy was applied via the Decision Support System NUTRISENSE (https://nutrisense.online/) in tomato grown in mineral wool in a closed-loop soilless cropping system. The new strategy was compared with the standard strategy of maintaining constant nutrient concentrations in the root zone. The results demonstrate the efficiency of the new strategy to control the EC in the root zone while ensuring a balanced nutrition of the plants. By applying this strategy, the losses of nitrate and phosphorus due to discharge of drainage solution (DS) were reduced by 25.5 % and 9.20 %, respectively, while avoiding yield losses due to salinity stress, and increasing water productivity (WP) and agronomic efficiency of nitrogen (AE_N). Nevertheless, the new strategy could not fully eliminate the need to discharge DS when raw water with a Na^+concentration of 4 mM was used to prepare nutrient solution.

Management of nutrition in closed-loop hydroponic systems: State of the art

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Current standard commercial practice in soilless greenhouses:

- **Send out a drainage solution sample to a laboratory for chemical analysis, every 1 to 4 weeks.**
- **The results are received 3 to 7 days after sample collection.**
- **Using the analytical results, the nutrient supply is readjusted.**
- **Readjustment means preparation of new stock solutions A and B**
- **However, the readjustment is based on analytical results that are not actual anymore.**

Next innovation:
Ion selective electrodes (ISE)

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- ISE are sensors for in-situ measurement of nutrient concentrations in the recycled drainage solution (DS)

- To properly utilise the obtained measurements, a suitable controlling system operating as a Decision Support System is needed to automatically adjust the fertiliser injection rates.

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Experiment with Tomato crop

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Treatments:

1. Closed-loop system with standard management
2. Closed-loop system: new strategy application

Daily drainage sampling
Manual measurement & data entrance

ISE sensors

NUTRISENSE DSS

Results (LAQUAtwin ISEs)

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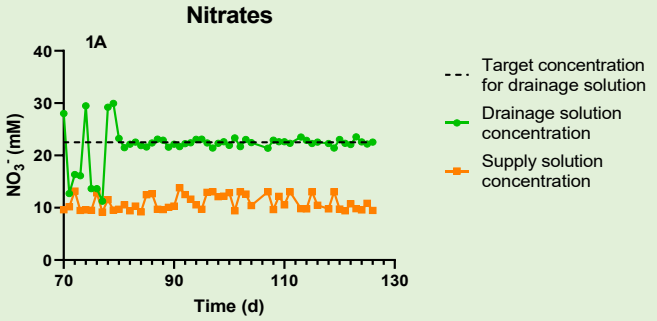
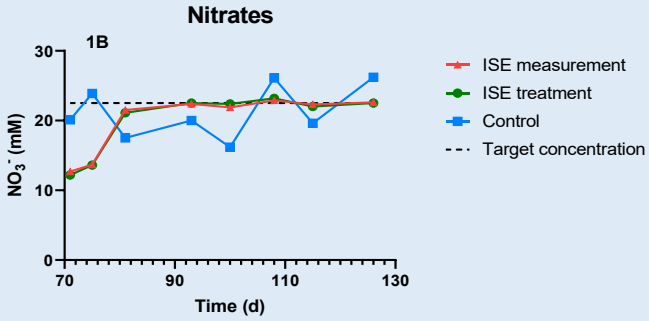
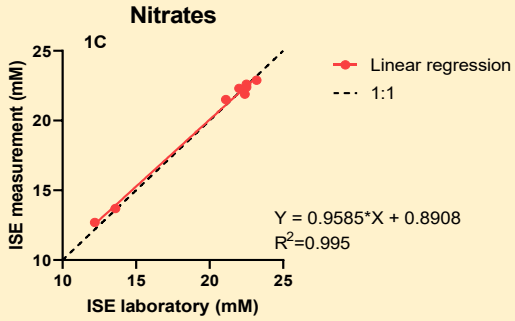
Daily concentrations in the drainage and supply solution in the ISE treatment



Concentrations in the drainage solution in both treatments using ISE or laboratory analysis



Linear regression between the results obtained from ISE and from laboratory analysis



Giannothanasis, E., Cedeño, J., Ntatsi, G., Thompson, R.B., Savvas, D., 2025. Precision nutrient management in a closed-loop soilless tomato crop using ion selective electrodes and a novel Decision Support System. Journal of Environment Management 387, 125792. https://doi.org/10.1016/j.jenvman.2025.125792.

Integration of **ion-selective electrodes** (ISEs) enables daily monitoring of drainage solution and automatic adjustment of nutrient supply

Journal of Environmental Management 387 (2025) 125792

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Journal of Environmental Management

journal homepage: www.elsevier.com/locate/jenvman

Research article

Developing and validating a modelling approach linked with ion selective electrodes to control pollution of water resources from greenhouse crops

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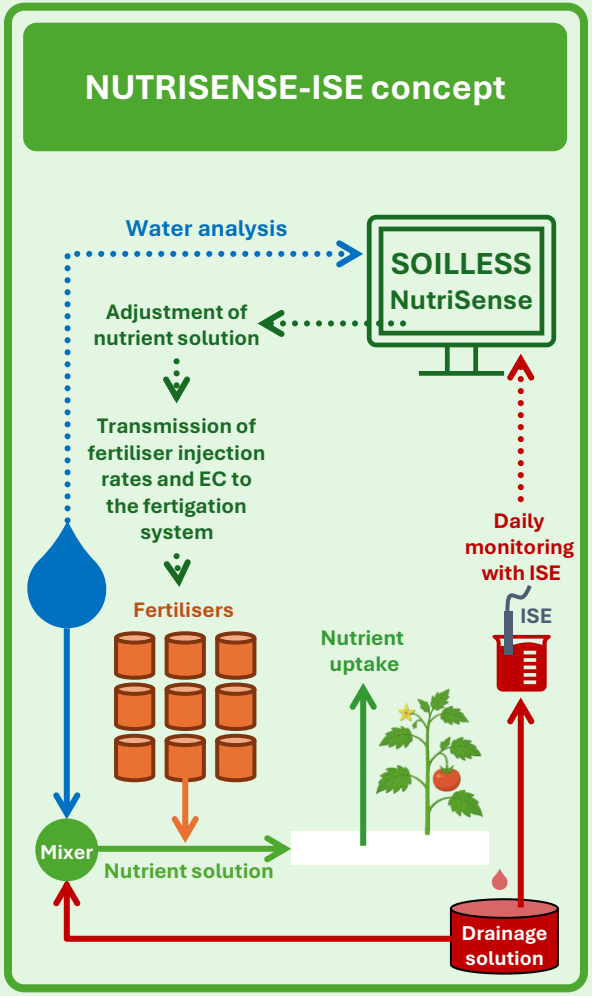
ARTICLE INFO

Keywords:
Drainage solution
Hydroponics
Precision agriculture
Nitrate pollution
Nutrient sensing
Nutrient recycling
Nutrisense

ABSTRACT

The recycling of drainage solution (DS) in greenhouses by applying closed-loop soilless cropping systems (CLS) eliminates pollution of aquifers by nitrogen and phosphorus emissions. However, the variable nutrient composition of the DS poses a significant challenge to its recycling in CLS. To addresses this challenge, a strategy was developed, based on daily monitoring of macronutrient concentrations in the DS using ion-selective electrodes (ISE) coupled with a modelling approach applied through a decision support system (DSS). The ISE measurements were input data for the DSS to calculate appropriate rates of different single-fertiliser concentrated solutions for automatic injection into a mixture of DS and raw water. The fertiliser injection rates were transmitted online to a fertigation system equipped with nine different single-fertiliser concentrated solutions and were applied automatically in real time. The objective was to maintain the root-zone nutrient concentrations within an optimal range. To test this technology and to validate the modelling approach applied through this DSS, tomato was grown in a CLS with daily measurement of NO_3^-, K^+, Ca^{2+}, and Na^+ concentrations in the DS using ISEs. The accuracy of the ISEs was confirmed by comparing their measurements with those from standard laboratory procedures in the same samples. The model approach successfully maintained the target nutrient concentrations in the root zone and increased fruit yield by 7.6 % and the agronomic efficiency of nitrogen by 23 %. The proposed technology is expected to encourage the adoption of CLS by growers thus minimising environmental impacts from greenhouse crops.



Management of Na^+ accumulation using **ion-selective electrodes** (ISEs)

Smart Agricultural Technology 12 (2025) 101366

Contents lists available at ScienceDirect

Smart Agricultural Technology

journal homepage: www.journals.elsevier.com/smart-agricultural-technology

Sodium accumulation management in a closed-loop soilless cropping system using ion selective electrodes and a novel Decision Support System

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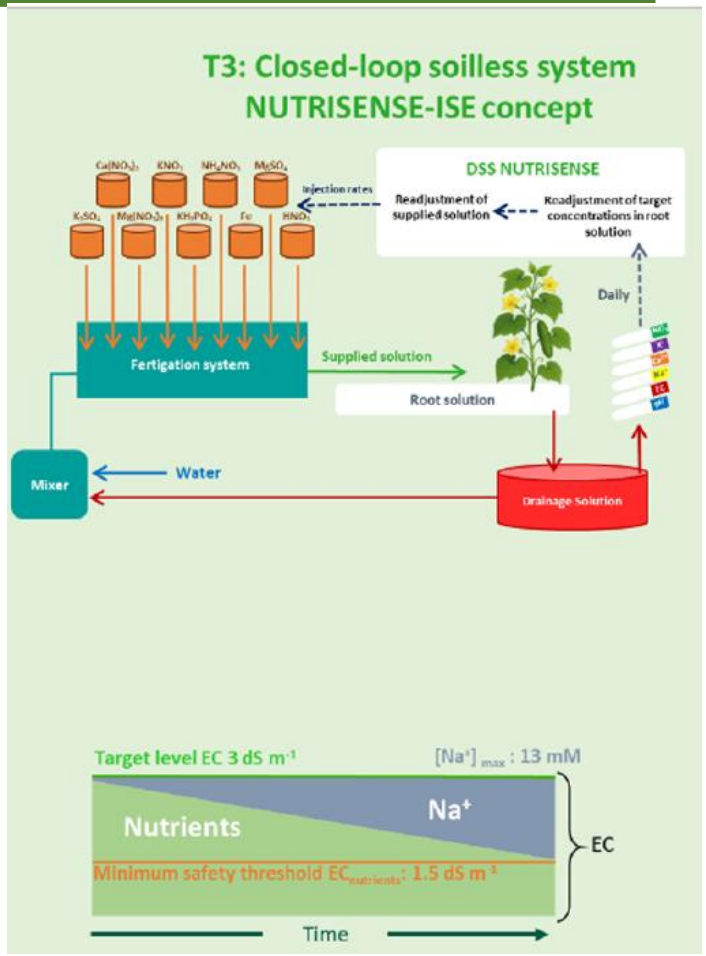
ARTICLE INFO

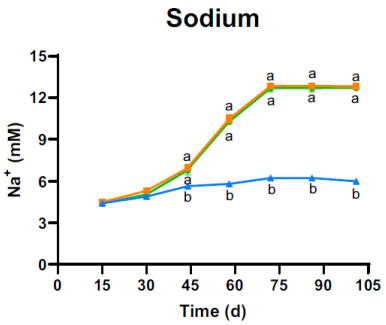
Keywords:
Hydroponics
Ion sensing
Drainage solution
Precision nutrition
Nutrient recycling
Nutrisense

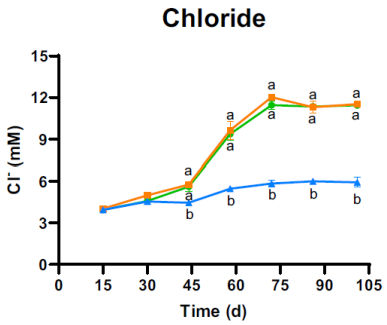
ABSTRACT

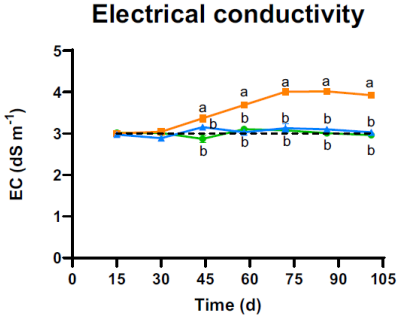
Sodium accumulation is the major obstacle for recycling drainage solution (DS) in closed-loop soilless culture systems (CLS). To address this problem, a novel technology combining ion-selective electrodes (ISE) with a decision support system (DSS) was tested in a cucumber crop grown in a CLS using raw water with a sub-optimal Na^+ concentration (2.5 mM). The K^+, Ca^{2+}, NO_3^- and Na^+ concentrations in the DS were measured daily using ISEs and the results were entered into the DSS, which calculated actual injection rates of concentrated fertiliser solutions and transmitted these on-line to a multi-tank fertigation system for automatic implementation. The DSS followed a strategy aiming at gradual reduction of the target nutrient concentrations in the root solution to safe minimum thresholds, while maintaining target mutual ratios, to compensate for Na^+ accumulation. Three treatments were compared: an open system, a CLS with standard nutrient management, and a CLS with daily automatic readjustment of the nutrient supply by the DSS based on ISE-measured K^+, Ca^{2+}, NO_3^- and Na^+ concentrations in the DS. The use of ISEs in combination with the DSS maintained the target EC in the root zone, thus preventing exposure of the crop to excessive salinity. Furthermore, in the ISE-DSS treatment, yield and plant nutrient status were similar to those in the open soilless system. In the ISE-DSS treatment, the water productivity increased by 46 % and 15 % and the agronomic efficiency of nitrogen by 64 % and 73 %, compared to the open system and to the CLS with standard nutrient management, respectively. This study showed that smart digital technologies supported by ISEs can successfully mitigate salinity damage due to Na^+accumulation in CLS.

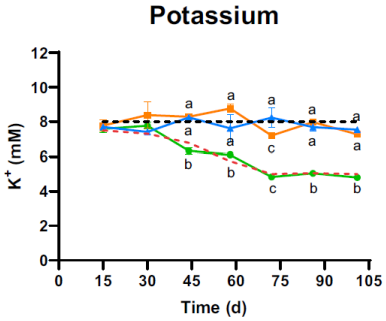


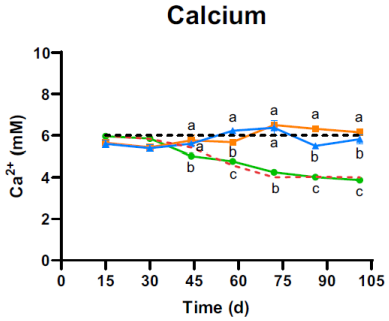
Management of Na^+ accumulation using **ion-selective electrodes** (ISEs)

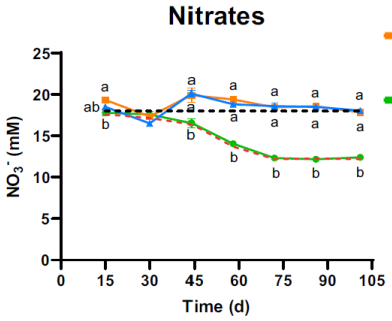












Na^+ in the irrigation water: 2.5 mmol/L

T1 Open system

T2 Standard closed system

T3 Closed system with Na^+ salinity compensation using the ISE-NUTRISENSE system

Standard target EC and concentrations (under non-salinity conditions)

Target macronutrient concentrations readjusted daily to compensate for Na^+ and Cl^- accumulation

<u>Advanced Approach</u>: Automatic measurements with ISEs and online transmission of the measurements to the DSS

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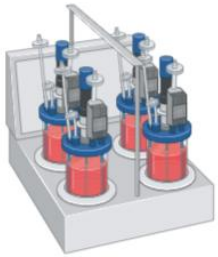
Aptisens ISEs working online

Daily measurement of 7 macronutrient concentrations plus EC and pH in the drainage solution (DS) and real-time transmission to the NUTRISENSE DSS

NUTRISENSE DSS

Cloud Service

Injection rates of concentrated solutions of 8 fertilisers



Fertigation system

Cations: Na^+, K^+, Ca^{2+}, Mg^{2+}

Anions: NO_3^-, Cl^-, $H_2PO_4^-$

AI-driven fertigation in closed-loop hydroponic systems (CLS)

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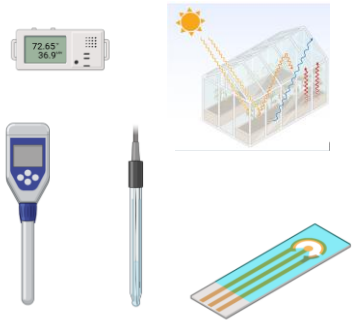
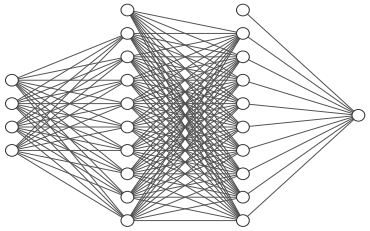


Sensor data

Sensor Data

Real-Time Data storing

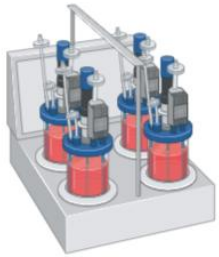
Sensor Data



NeuroPlant: AI data Processing and Decision-making System

Drainage Solution Composition (EC-pH-[ions])

Irrigation Plan



Multi-tank Fertigation system

Fertilization Plan

NUTRISENSE DSS

Supply High Quality Nutrient Solution

Currently an experiment with cucumber grown in a CLS supported by:

- ISEs,
- the NUTRISENSE DSS, and
- a multi-tank fertigation system

has been just terminated aiming at:

- optimising the algorithms for the re-adjustment of the nutrient supply and
- developing a PINN using machine learning and AI to minimise the errors of the ISE measurements

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A follow up experiment is designed to validate:

- the algorithms for NS readjustment and
- The PINN to minimise errors in the ISE measurements

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Thank you for your attention!!