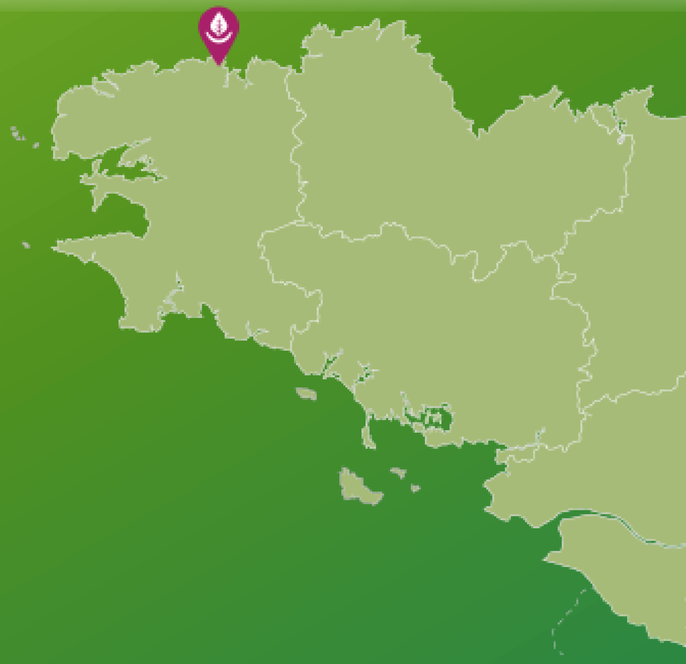
Biostimulants World Congress



Biostimulant evaluation: from *in vitro* tests to fruit quality evaluation

Vegenov

#BiostimulantsWorldCongress

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Biostimulant evaluation: from in vitro tests to fruit quality evaluation

Vegenov (French applied research centre) has been involved in 3 projects aiming to identify, evaluate, and characterise biostimulant products , from in vitro tests to fruit quality evaluation.

2021
Screenalg Project
***Arabidopsis in vitro* trials**

2020
Vespa project
Lettuce fast screening under abiotic stress

2018
Saphir Project
Tomato yield and quality evaluation

SCREENALG (2021 – 2024)

Development of methodologies and tools for microalgae biomass and extracts screening

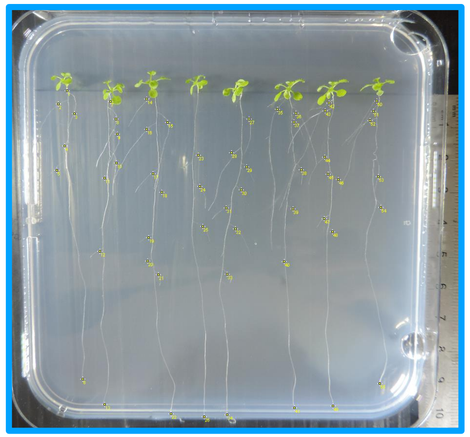
This project aimed to evaluate 28 different microalgae extracts for their ability to relieve drought stress using *in vitro Arabidopsis thaliana* tests. Based on biomass production improvement and root architecture modification,.

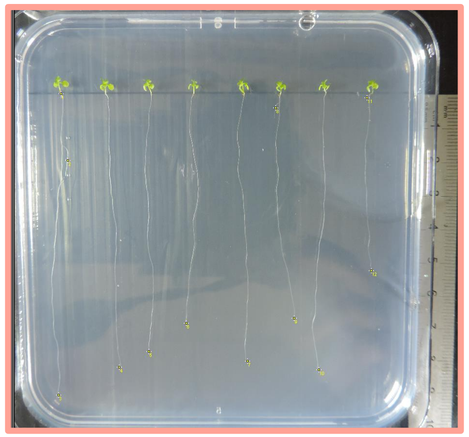
Acutodesmus sp. grown with or without CO_2. 28samples extracted using hydroalcoholic, acid and alkaline media, enzymes or ultrasound

Extracts chemical profiles using untargeted chemical analytical method combining UHPLC (Ultra High Performance Liquid Chromatography) and IMS-Q-TOF (Ion Mobility Spectrometry – Quadrupole – Time Of Flight)

In vitro protocol development to assess extracts under drought stress (mannitol, PEG,…). Determination of *Arabidopsis thaliana* roots profiles via imageJ® : main root length, number of roots ramification.

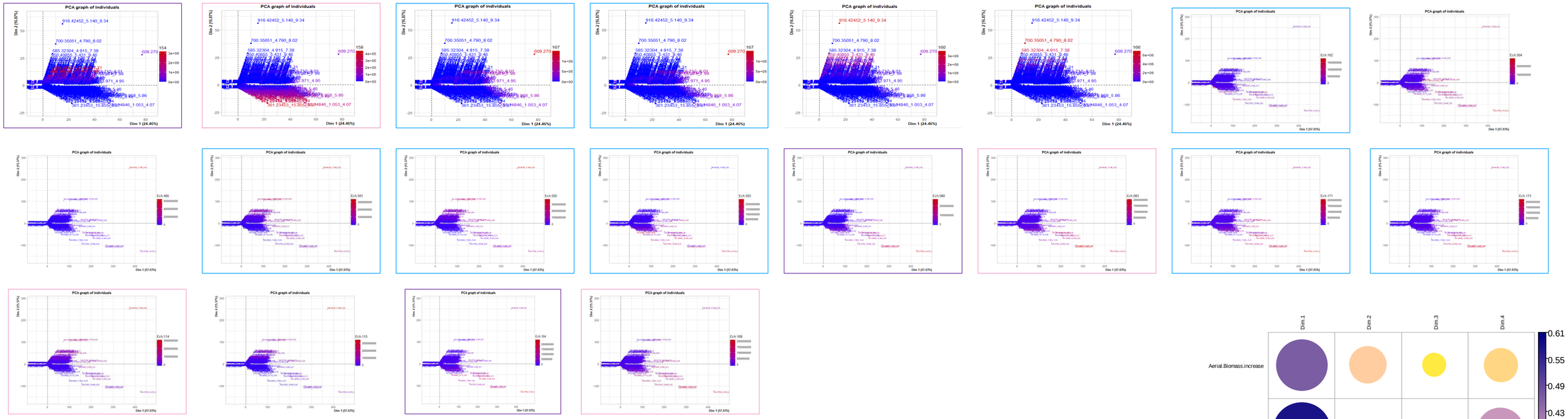
21 days

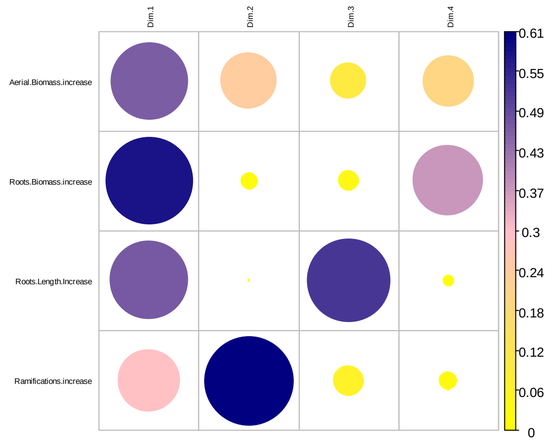




SCREENALG (2021 – 2024)

Development of methodologies and tools for microalgae biomass and extracts screening





84 765 POS markers identified via UHPLC / MS → selection / treatment of 30 main markers x 5 first ACP dimensions → 150 markers as goal

28 extracts evaluation x 2 doses
Assessment of roots length and ramifications

Correlation between the 150 markers and extracts efficiency under drought stress → identification of main molecules using a database (Chemspider®)

VESPA (2020 – 2022)

Valorisation of agricultural effluents as a support for biomass production

Extracts were based on microalgae and photosynthetic bacteria consortia cultivated on drainage water collected in farmers greenhouses. Vegenov evaluated the ability of the consortia to allow an optimal growth of lettuce under nutritive, thermal or drought stresses.

Selection of microalgae (CEA) and bacteria ((Adequabio) that enable greenhouses run off treatment → selection of three samples: bacteria, microalgae and consortium.

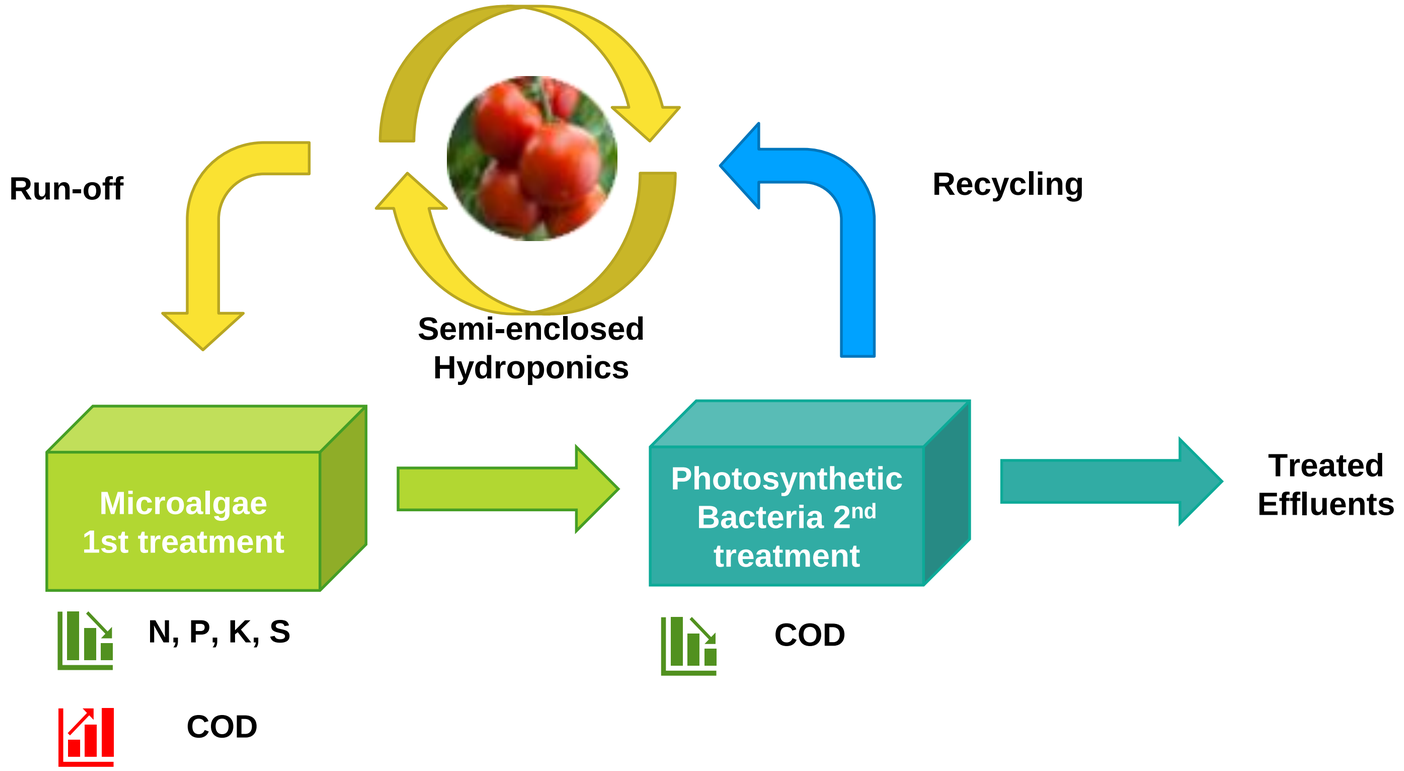
Social implementation: surveys and interviews

Protocol development to assess extracts on lettuce under abiotic stress: thermal, nutritive and drought
Two application mode: roots and foliar
Two concentrations

1 month

VESPA (2020 – 2022)

Valorisation of agricultural effluents as a support for biomass production



CTIFL 100L prototype installation : Tomato hydroponics. Issues with nitrogen content decrease.

Microalgae and Bacteria inoculated in two separated tanks.

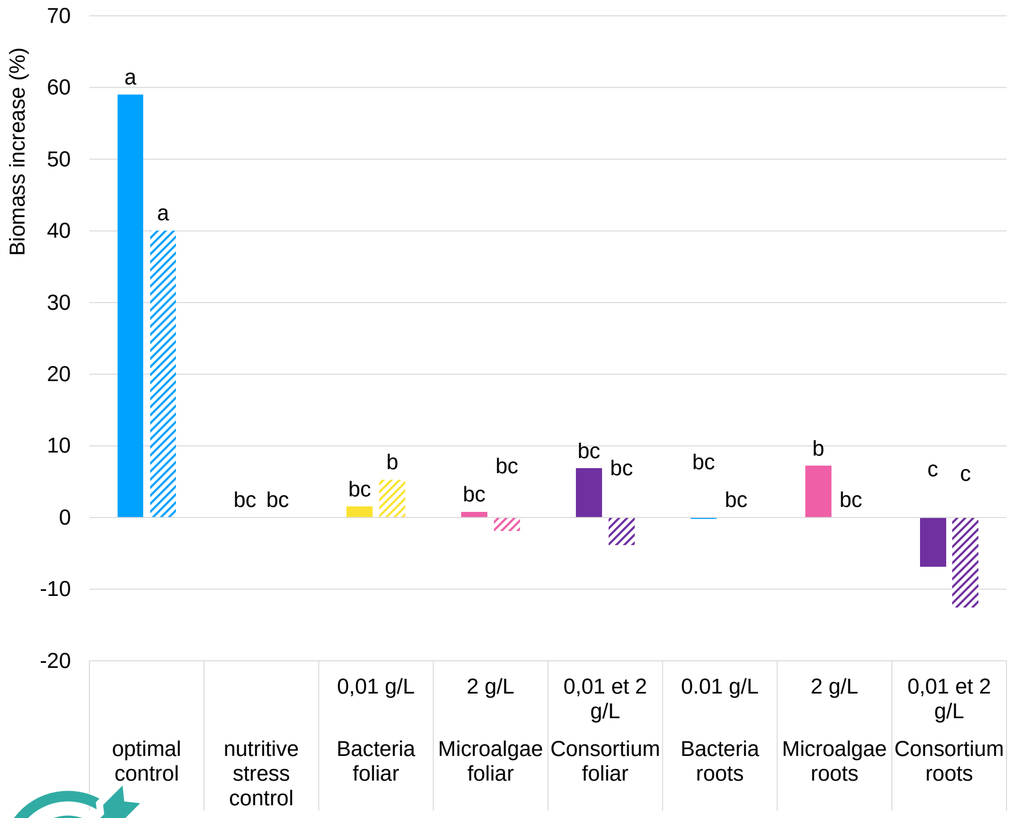
Social implementation
2 types of growers:

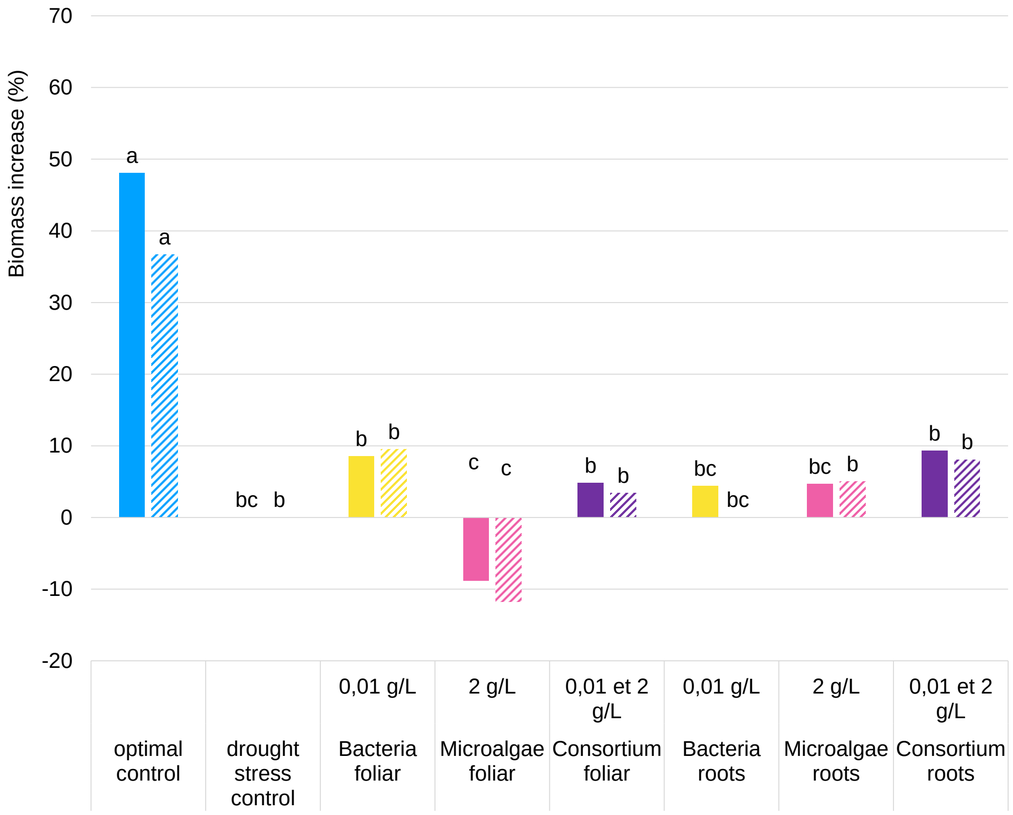
- “high-tech” characterised by high equipment's investment, well aware of technical progress, interested in decreasing their need in heating and water.

- “low-tech” characterised by few equipment, interested in decreasing their need in fertilizer and water.

VESPA (2020 – 2022)

Valorisation of agricultural effluents as a support for biomass production





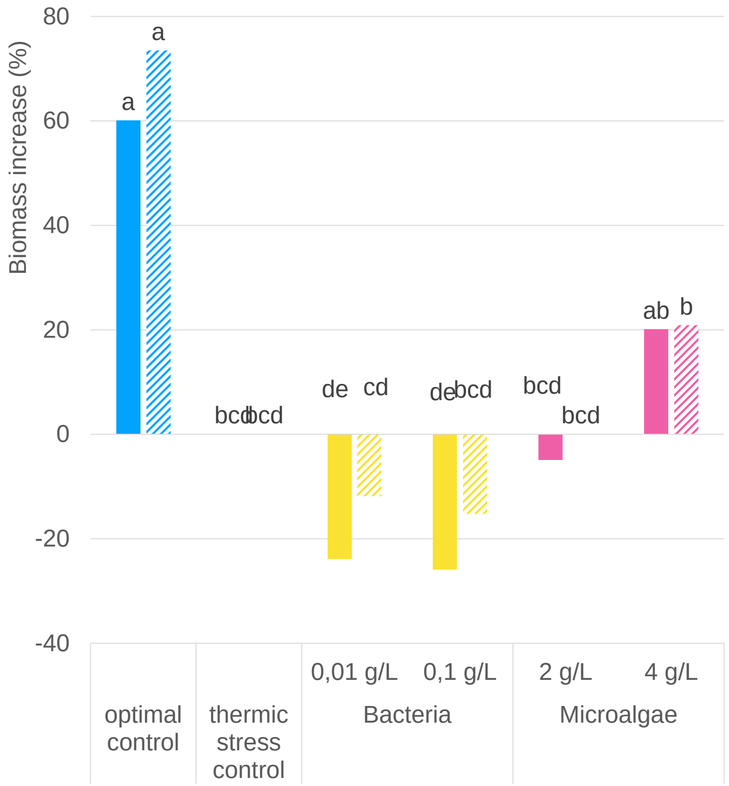
No statistical effect on nutrient deficiency. Efficiency against drought stress. Impact of application mode on the efficiency:

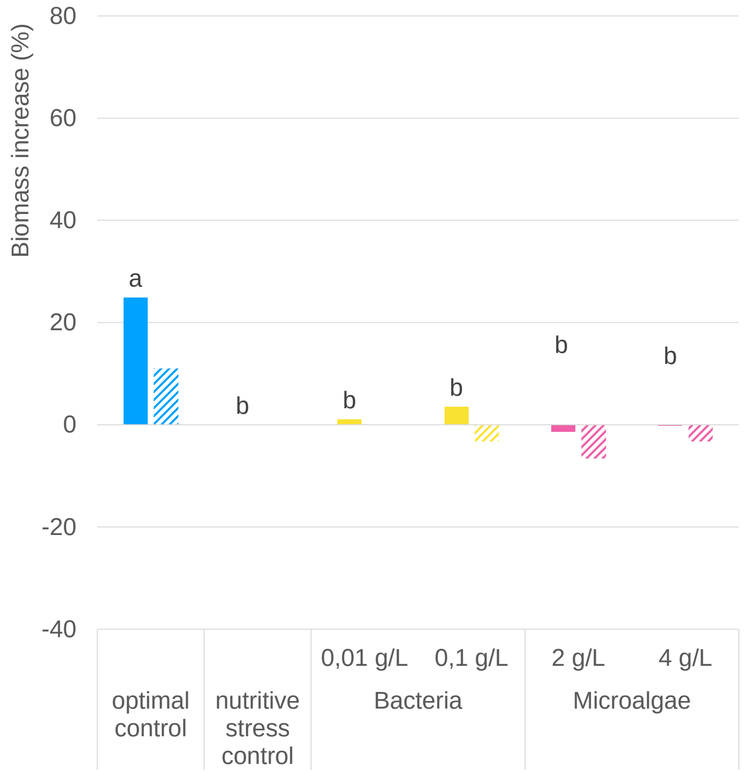
Microalgae at roots level (top soil application)

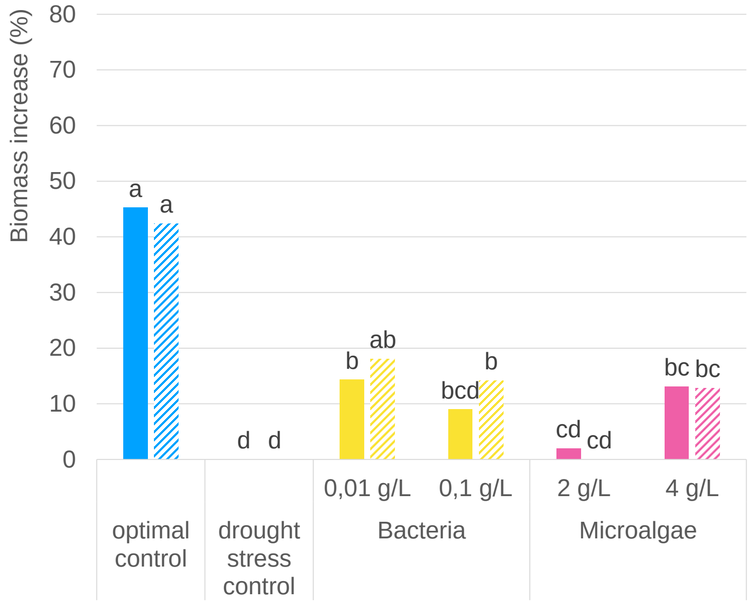
Bacteria at foliar level

VESPA (2020 – 2022)

Valorisation of agricultural effluents as a support for biomass production







This project enabled the characterisation of two interesting consortia, inducing:

Biomass improvement of lettuce under thermal stress after application of microalgae at root level,

Positive impact of bacteria on plantlets drought stress tolerance.

SAPHIR (2018-2022)

Agriculture alternative solutions based on innovative and renewable hydrolysed proteins

Evaluated extracts were based on animals breeding by and co-products. This project aimed to identify new biostimulants, able to maintain or improve fruit quality under stress conditions.

11 by and co-products (Cooperl) were treated (Gaïago) and analysed (amino acid profiles)

3 prototypes were assessed for biostimulant potential → one with an impact on height and biomass

1 product showed a biostimulant impact on lettuce trial and was assessed on tomato trial under abiotic stress. To evaluate the product potential different stress intensities were applied: from 25% to 75%.

→ qPFD® (INRAe) and proline content were assessed in the first trial

→ Protocol was developed to assess fruits yield and quality on dwarf tomato.

Drought stress: tomato → qPFD® and proline content

Nutritive stress: dwarf tomato → fruits yield and quality

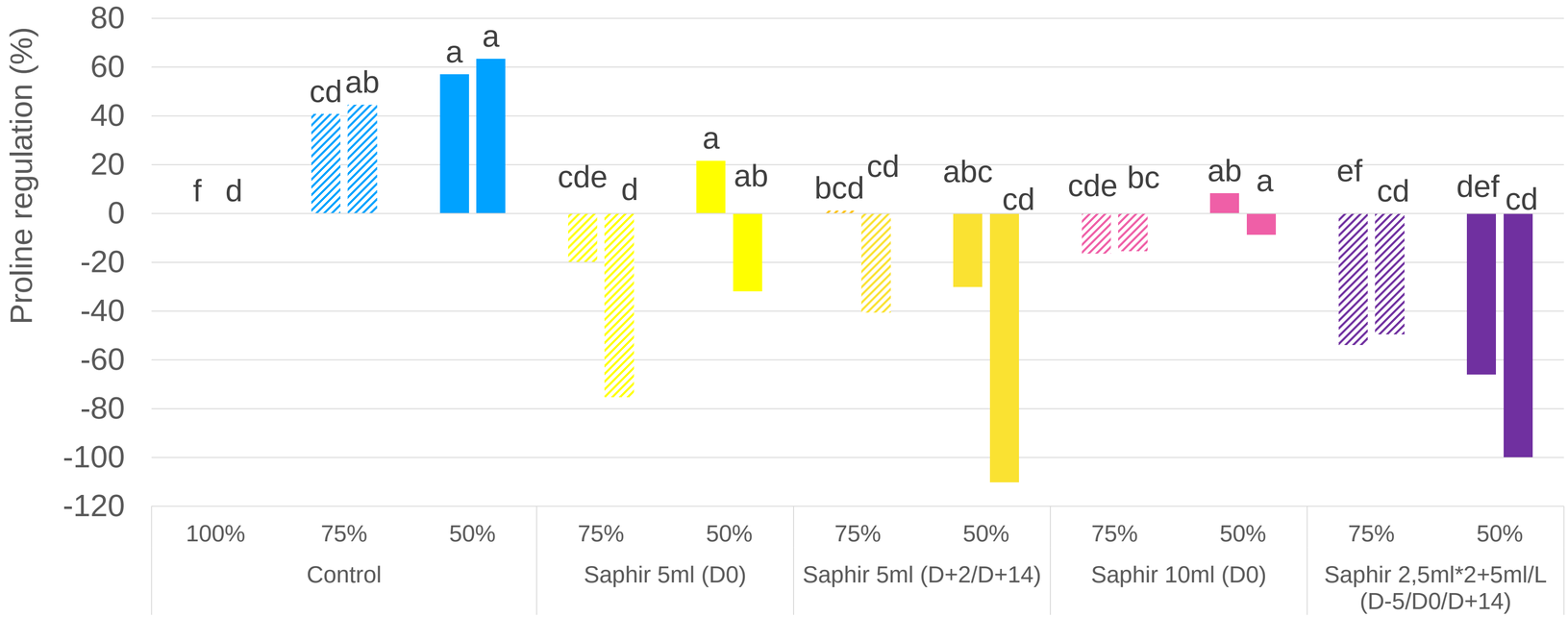
3-4 months

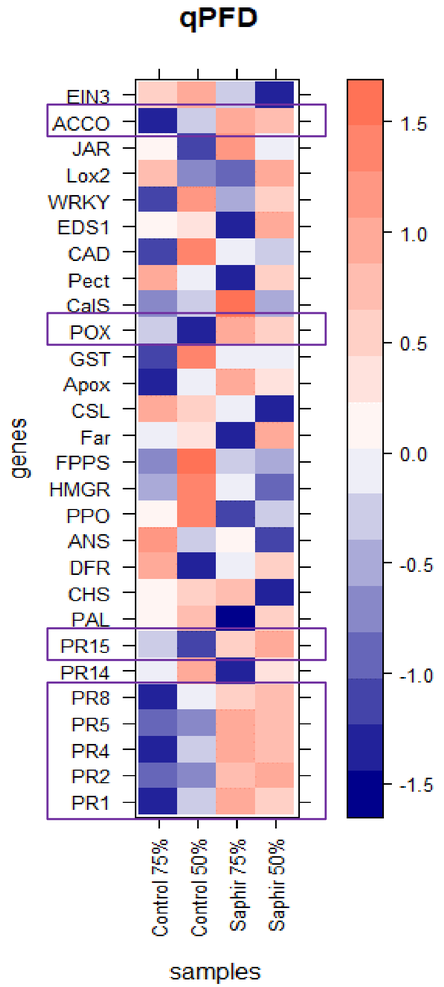
SAPHIR (2018-2022)

Agriculture alternative solutions based on innovative and renewable hydrolysed proteins

Upregulation of proline content strongly correlated with drought intensity.

Downregulation of the amino-acid after Saphir product application. Impact of application number and time.

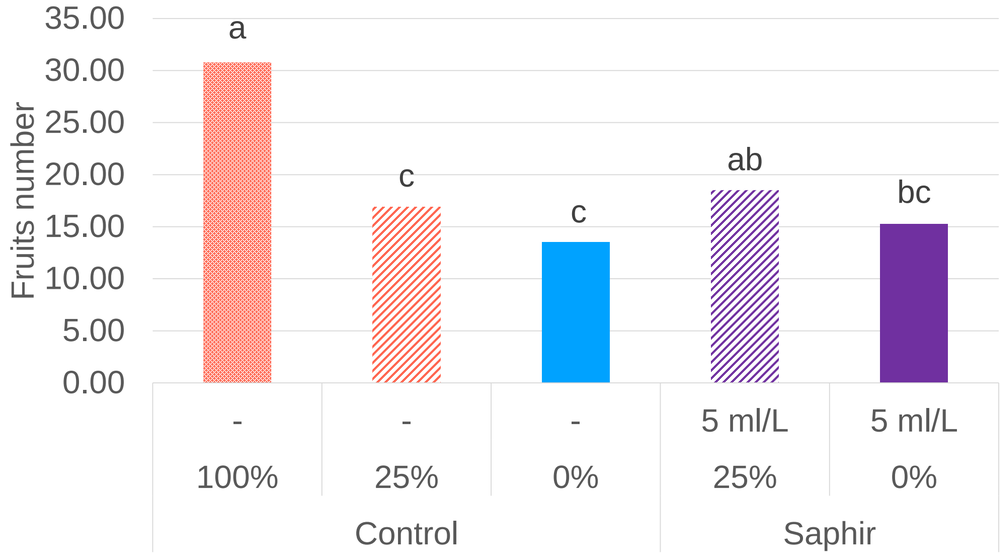


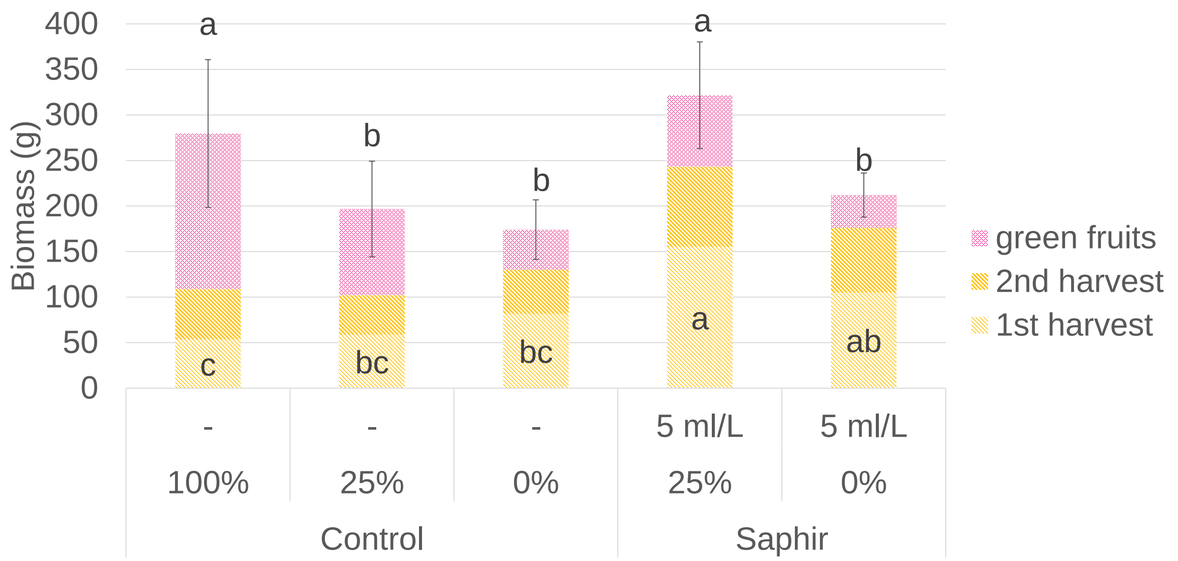


Upregulation of PR1, PR2, PR5 allowing plants drought tolerance (Liu *et al.*, 2013). Overexpression of POX and ACCO genes responding to oxidative stress and ethylene pathway.

SAPHIR (2018-2022)

Agriculture alternative solutions based on innovative and renewable hydrolysed proteins





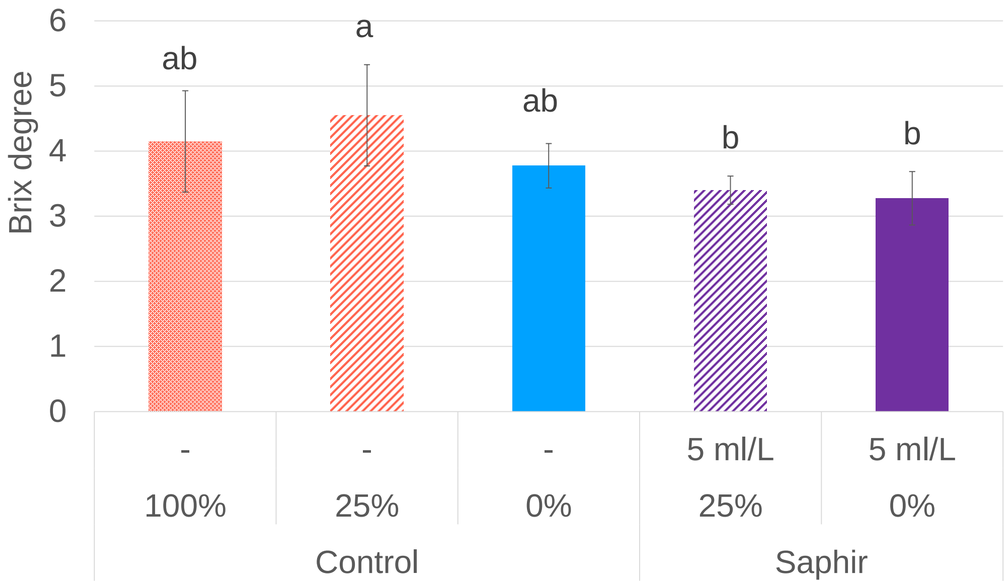
Negative impact of nutritive stress on fruits number and biomass

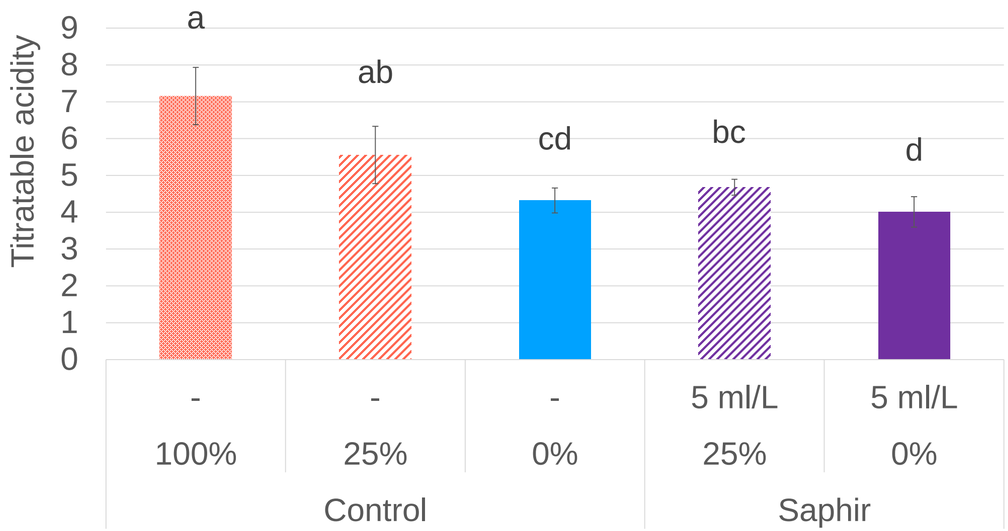
Positive impact of nutritive stress on harvest earliness

Positive impact of Saphir biostimulant on harvest earliness and quantity

SAPHIR (2018-2022)

Agriculture alternative solutions based on innovative and renewable hydrolysed proteins





Negative impact of nutritive stress on fruits acidity

Positive impact of Saphir biostimulant on harvest earliness and quantity negatively correlated with Brix degree and titratable acidity

Conclusion

Products

Microalgae extracts

Microalgae

Bacteria

Animals coproducts

Species

Arabidopsis thaliana

Lactuca sativa

Solanum lycopersicum L.

Abiotic stress

Drought stress

Nutritive stress

Thermal stress

Screenalg Efficiency

+28 % Aerial Biomass

+47 % Roots Biomass

+46% Roots Length

+60% Roots Ramifications

Vespa Efficiency

Application mode and doses

Products efficiency = stress dependent

+20 % Aerial Biomass

+21 % Roots Biomass

Saphir Efficiency

Applications number and doses

Genes overexpression

-110 % proline content

2 weeks harvest earliness

+13 % fruits number

+63 % yield

Biostimulants World Congress

Plant Quality and Health

Céline BATY-JULIEN

Klervi CRENN

Emilie HASCOËT

William MAUGUEN

Antoine MENIL

Mathilde MERRER

Claudie MONOT

Marie-Catherine MUZELLEC

Florian PODEUR

Pierre QUEAU

Thibaut TREMOUILLAT

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