







A biostimulant based on seaweed and yeast extracts mitigates water stress effects on different crops

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INTRODUCTION

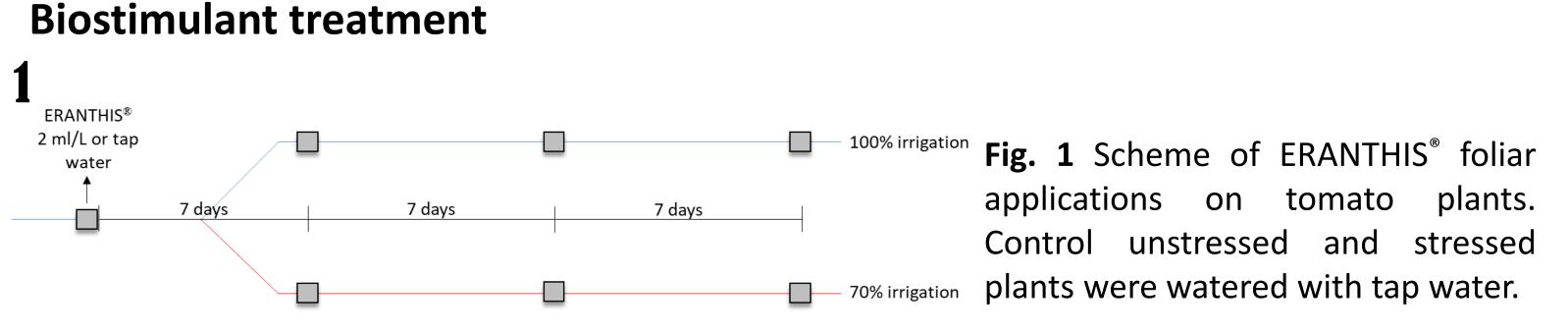
Water stress is one of the most problematic stressors worldwide. Climate change is increasing the lack of water, especially because of the global warming and frequent droughts (1). Water-shortage phenomena slow down plant development and are responsible for yield and product quality losses (1). The need to find a way to counteract water stress is the focus of many studies. Biostimulants could represent a quick and effective approach to increase tolerance in plants, thanks to the synergy effect of different bioactive components (1).

AIM OF THE WORK

The aim of this research was to study the effect of ERANTHIS[®], a biostimulant based on brown seaweeds (Ascophyllum nodosum and Laminaria digitata) and yeast extracts. This product was preliminary tested on different crops and then we decided to focus on tomato (*Solanum lycopersicum* Mill.), a crop highly susceptible to drought. Plants were grown in greenhouse under optimal and water stress conditions and the stress mitigation effect of ERANTHIS[®] was investigated by evaluating physiological (stem water potential) and biochemical (ROS scavenger enzymes, hydrogen peroxide, proline, abscisic acid) parameters.

MATERIALS AND METHODS

3



Stem water potential measurement

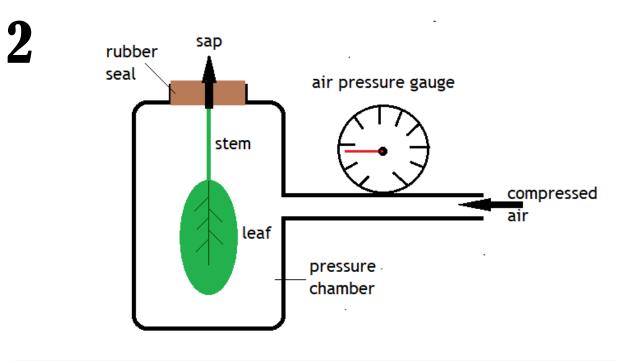


Fig. 2 Stem water potential (ψ_{stem}) was measured using a Scholander-type pressure chamber (Soil Moisture Equipment Corp., Santa Barbara, CA, USA). One leaf for plant was placed in a humidified plastic bag covered with aluminium foil to stop transpiration. After 30 min leaves were cut and allowed to equilibrate in dark conditions before the measurement.

Biochemical parameters

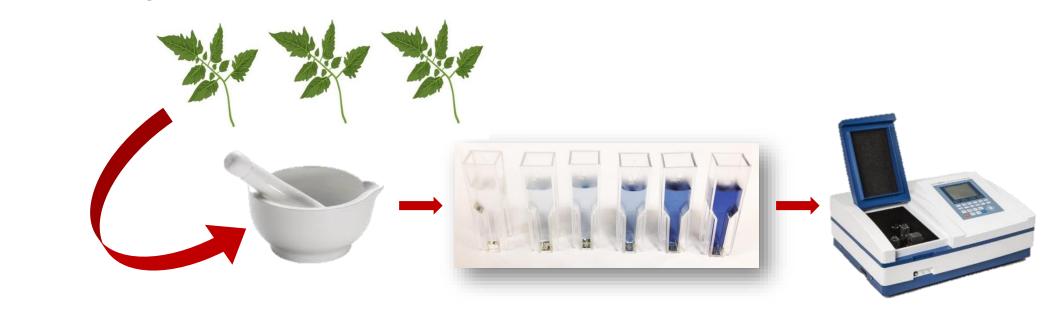


Fig. 3 ROS scavenger enzyme (Superoxide Dismutase, SOD, EC 1.15.1.1, Peroxidase, POX, EC 1.11.1.7, Glutathione-S-Transferase, GST, EC 2.5.1.18) activities, Hydrogen Peroxide (H₂O₂) and Proline evaluated spectrophotometrically. content were <u>Photosynthethic pigments</u> were extracted using 96% ethanol and quantified spectrophotometrically

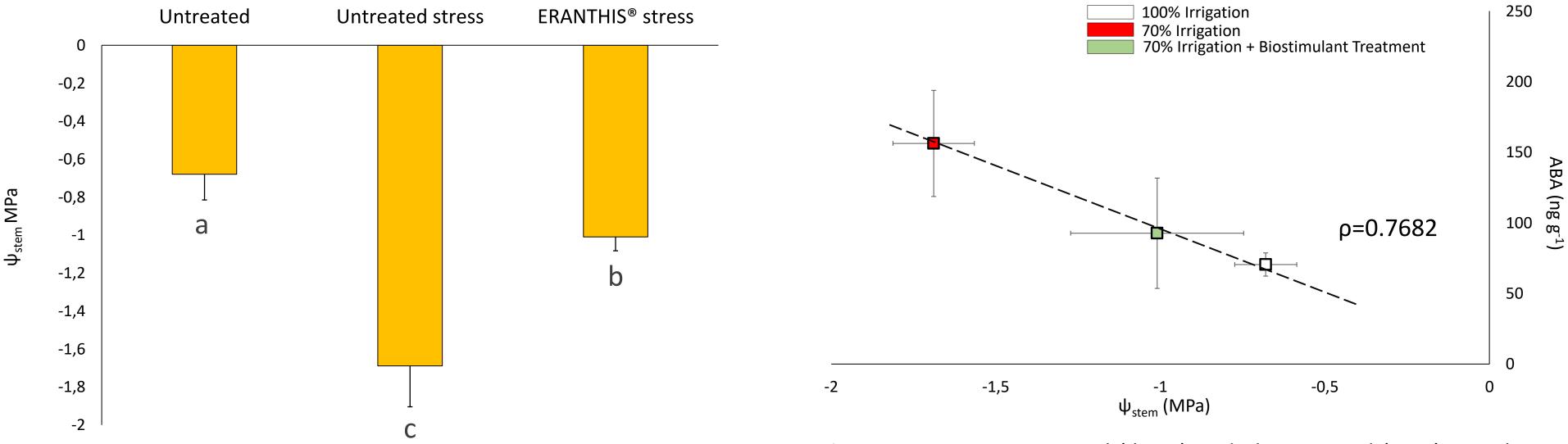
<u>Abscisic Acid</u> (ABA) was extracted using a mix of 80% (v/v) methanol, acidified with 1% (v/v) acetic acid and analyzed by UHPLC-MS/MS. For experimental details see Campobenedetto et (2).



Stem water potential and ψ /ABA correlation

Stem water potential (ψ_{stem}) is one of the most important parameters to evaluate plant water status. In Fig. 4 is reported how, in presence of stress, ψ_{stem} is strongly decreased in comparison to well irrigated control plants (-148%). Differently, stressed plants treated with ERANTHIS[®] showed values statistically less reduced (-49%).

At the same time, **Fig. 5** shows the interaction between ψ_{stem} and ABA. Abscisic Acid is an hormone involved in plant water stress response and its rising content is correlated to more negative ψ_{stem} values. It is interesting to note that the highest stress level was observed in the untreated/stressed plants (red square), whereas ERANTHIS[®]-treated/stressed plants showed less ABA content in leaves and a higher stem water potential values (green square). These results lead to hypothesize a stress mitigation effect exerted by this biostimulant.



Indeed,

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scavenger

7).

compared

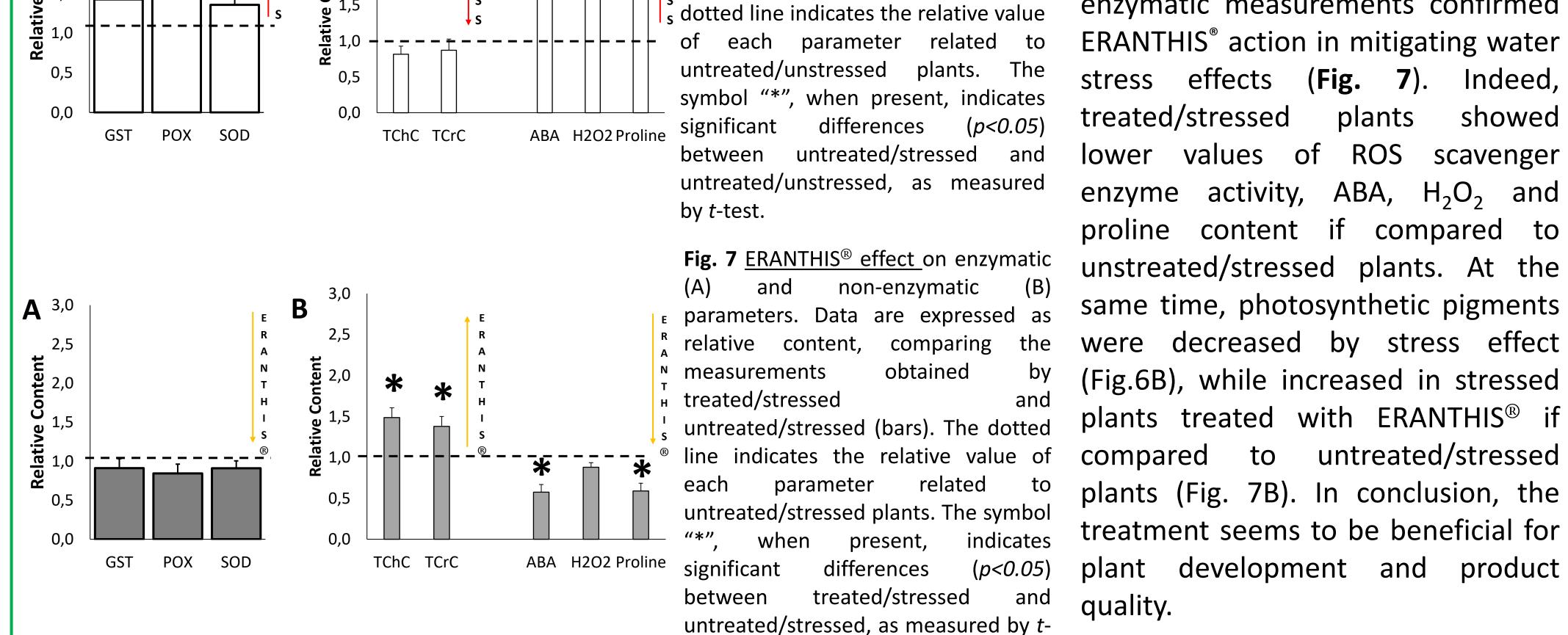
plants

ROS

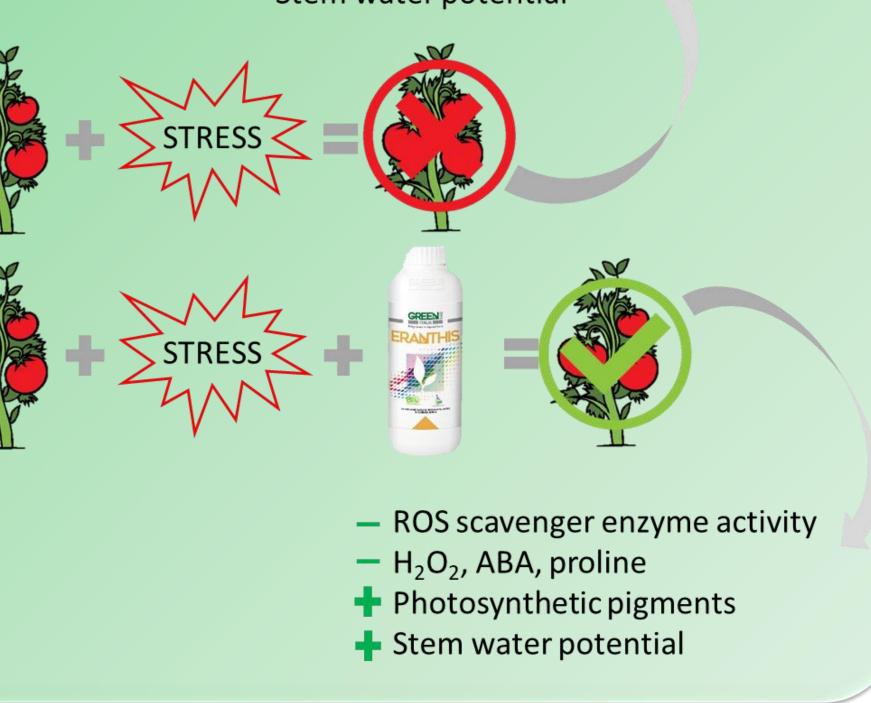
water potential of untreated/unstressed, Fig. Stem untreated/stressed and treated/stressed plants. Bars with different letters indicate significant different values at *p*<0.05 as measured by one-way ANOVA followed by Tukey's HSD post hoc test

Fig. 5 Stem water potential (ψ_{stem}) and abscisic acid (ABA) correlation The white shapes represent untreated plants with 100% full water supply, the red ones untreated/stressed plants and the green ones treated/stressed plants. The dotted lines show the correlation between ABA content and ψ_{stem} The ρ coefficient was calculated dividing the covariance of the two variables by the product of their standard deviations.

Biochemical parameters Water stress significantly increase Fig. 6 <u>Water stress effect</u> on CONCLUSIONS enzymatic (A) and non-enzymatic (B) ROS scavenger enzyme activity, ABA, parameters. Data are expressed as **A** ^{3,0} B H_2O_2 and proline content (**Fig.6**), 3,0 relative content, comparing the ROS scavenger enzyme activity 2,5 parameters strongly involved in the obtained measurements **e Content** 2,0 1,5 by 2,5 + H₂O₂, ABA, proline * * ^R untreated/stressed and stress response. Enzymatic and non-0,2 **He** Photosynthetic pigments ^E untreated/unstressed (bars). The enzymatic measurements confirmed Stem water potential



test.



REFERENCES

- 1) O Elansary, H. et al. (2020). Effects of water stress and modern biostimulants on growth and quality characteristics of mint. Agronomy, 10(1), 6.
- 2) Campobenedetto, C et al. (2021). A Biostimulant Based on Seaweed (Ascophyllum nodosum and Laminaria digitata) and Yeast Extracts Mitigates Water Stress Effects on Tomato (Solanum lycopersicum L.). Agriculture, 11(6), 557.