Biostimulants World Congress

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Biostimulant effect of two *Fucus sp*. algal residues on pea, rice, and tomato germination and growth

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Introduction

Seaweed-based bioproducts are increasingly recognized for their phytostimulatory properties, promoting plant growth and enhancing resistance to various stresses. Notably, *Fucus vesiculosus*, a brown seaweed, has shown promise as a biostimulant[1]. *Exopolysaccharides* (EPSs) constitute different classes of organic macromolecules that can have multiple applications. ***This study investigates the bioestimulant effects of* Fucus *sp. on the germination and early growth of pea, rice, and tomato, utilizing two algal extracts—one with EPS and another without EPS. The goal was to assess the impact of the algal residues on seed germination and initial plant development and provide insights into their potential as sustainable biostimulants.***

Materials and methods

❖ Algal material

Fucus sp.

EPS extraction

Preparation of coating films for food use

Algal fraction without EPS
freeze-dried and homogenized
(BS-EPS)

Algal fraction with EPS
freeze-dried and homogenized
(BS+EPS)

❖ Plant material

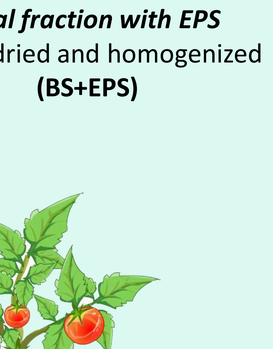
Pea var. 'Tom thumb'

Rice var. 'Nipponbare'

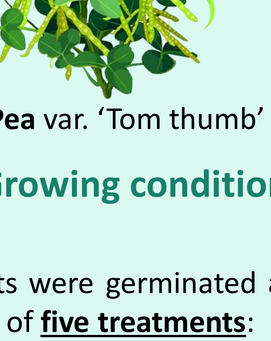
Tomato var. 'Coração de boi'

❖Growing conditions

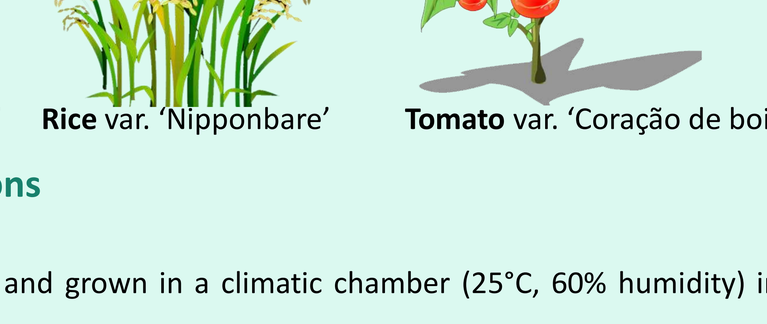
- Plants were germinated and grown in a climatic chamber (25°C, 60% humidity) in a total of **five treatments**:
  - **Control**, in which only the planting substrate was used as the substrate (COMPO SANA, a mixture of peat, Perlite, Agrosil, Guano and NPK fertiliser, pH=6, 97% organic matter).
  - **Four treatments** in which a mixture of planting substrate and each of the two algal residues (without and with EPS), was used in two different concentrations, 0. 05% and 0.5% w/w (**BS-EPS 0.05%, BS-EPS 0.5%, BS+EPS 0.05%** and **BS+EPS 0.5%,** respectively).



Mixing algal residue with COMPOSANA substrate



Sowing

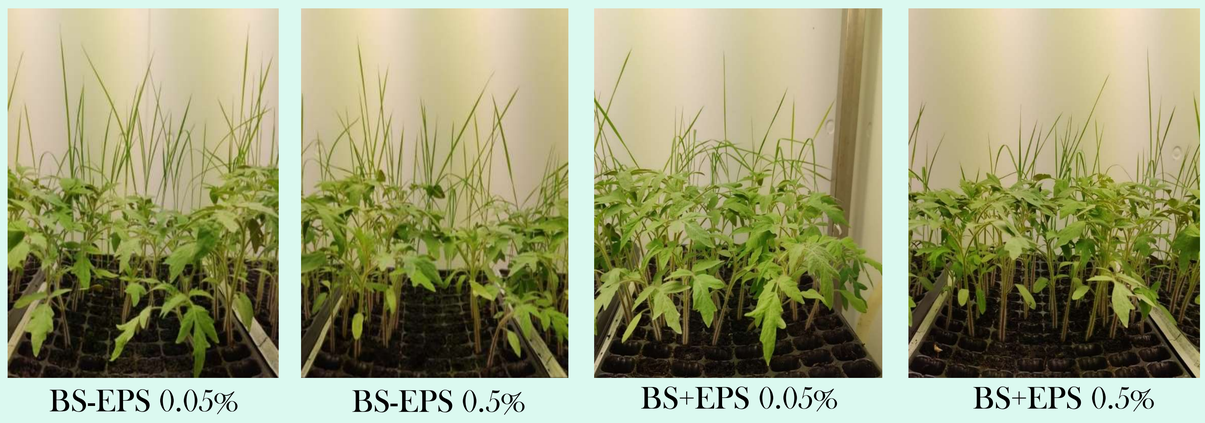


Growing conditions in the climate chamber

❖Data collection

- **Germination rate (%)** at 14 days after sowing (DAS).
- **Shoot and root length** at 14 DAS (pea), at 22 DAS (rice) and at 28 DAS (tomato).
- **Shoot and root dry weight** after 3 days at 55°C, at 14 DAS (pea), at 22 DAS (rice) and at 28 DAS (tomato).

Results



BS-EPS 0.05% | BS-EPS 0.5% | BS+EPS 0.05% | BS+EPS 0.5%

❖Germination rate

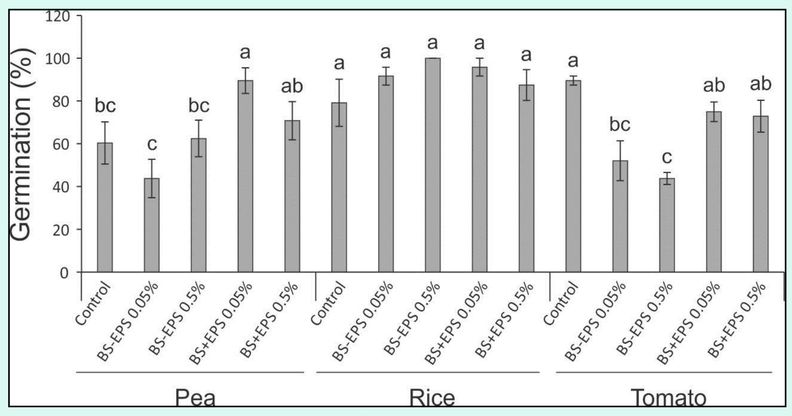


Figure 1– Germination rate (%) of pea, rice and tomato. Different letters indicate significant differences at $p < 0.05$.

BS+EPS 0.05% increased **pea** germination by 48% compared to the Control (Figure 1).

❖Shoot and root length

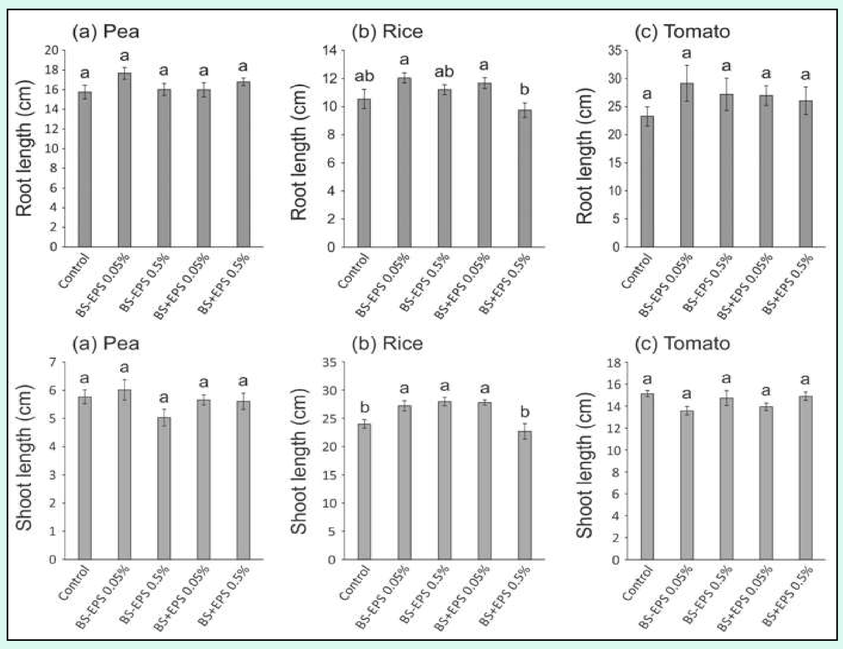


Figure 2– Root (up) and shoot (down) length of pea, rice and tomato. Different letters indicate significant differences at $p < 0.05$.

Significant differences were only observed for the **average shoot length** of **rice**, which increased significantly by 14%, 17% and 16% in **BS-EPS 0.05% and 0.5%**, and in **BS+EPS 0.05%,** respectively, compared to the Control (Figure 2).

❖ Shoot and root dry weight

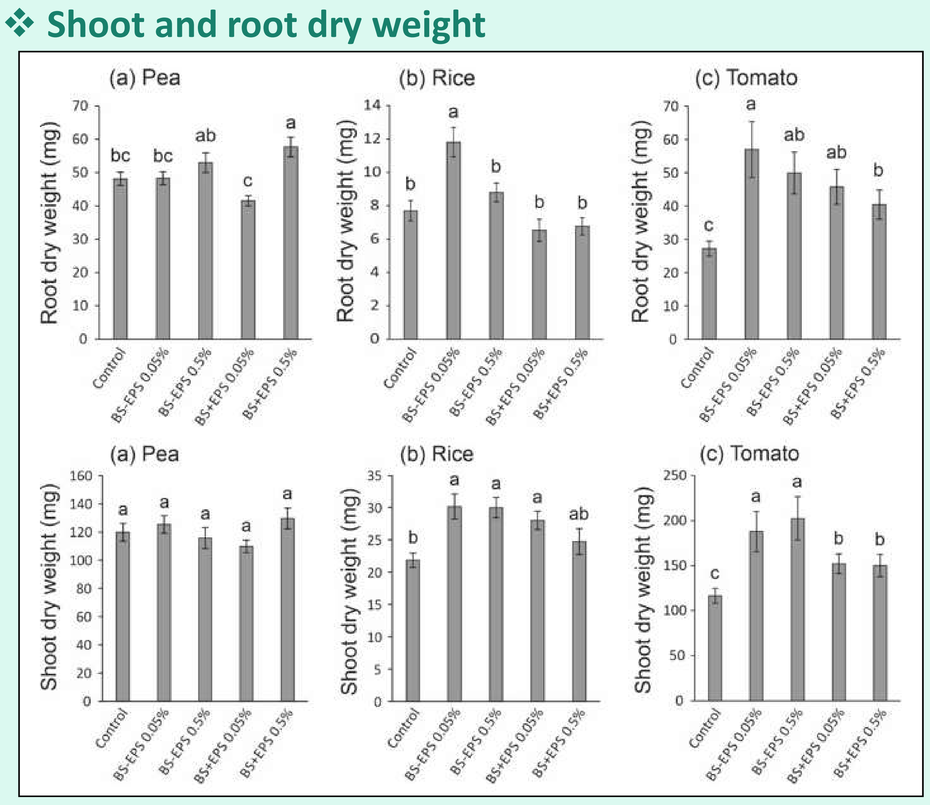


Figure 3– Root (up) and shoot (down) dry weight of pea, rice and tomato plants per treatment. Different letters indicate significant differences at $p < 0.05$.

Root dry weight (RDW) was significantly higher by 20% in the BS+EPS 0.5% in **pea**. In **rice** and **tomato**, the BS-EPS 0.05% increased RDW by 53% and 64%, respectively.

Shoot dry weight (SDW) was significantly higher by 38%, 37%, and 28% in BS-EPS 0.05%, BS-EPS 0.5% and BS+EPS 0.05%, in **rice**; for **tomato**, the four treatments significantly increased SDW.

Conclusions

The three crops responded differently to applying algae extracts in the substrate as a biostimulant. The most promising results were obtained for rice and tomato since they showed a biostimulating effect on crop growth in the early stages of development, which was demonstrated mainly in the significant increase in plant dry biomass. Ultimately, the algae residue without EPS (BS-EPS at both concentrations) gave better results than the algae residue with EPS, as it significantly promoted the development of rice and tomato seedlings.

References [1] Krautforst, K., et al. (2023). *Sci Rep* 13, 10065.

Acknowledgments

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