

# Agricultural valorization of seaweed from the shores of Mar Menor Lagoon for obtaining plant biostimulants



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## INTRODUCTION

*Caulerpa prolifera* is a green alga colonizing most of the Spanish Mar Menor, causing an alteration in this ecosystem. In the last years, the algae growth has increased reaching in August 2020 volumes approx. 60 tons biomass (algae and phanerogam) that had to be removed and disposed as waste with grave economic and environmental impact.

Algae extracts are being used in Agriculture as **plant biostimulants**. The current European regulation (EU 2019/1009) allows the use of algae extracts from *Ascopylum nodosum* and *Eklonia maxima* exclusively, but other species could be included in future regulations. The application of these compounds have shown numerous and diverse benefits in plant cultivation, being an opportunity for the reuse-waste management and reduce the environmental pollution.



*C. prolifera* accumulated at Mar Menor lagoon shore.



**ALGARIKON** is a coordinated Spanish project focused on the Valorisation of the algae accumulated on Mar Menor shores as a result of its eutrophication.

The work presented here is a part devoted to the transformation of the algae residues to Biostimulants for plants, developed by the UAM group.



## OBJECTIVES

- 1) To develop different physico-chemical extraction methods from the lyophilized algae *C. prolifera* to obtain biostimulants for plants.
- 2) To evaluate the potential of the extracts as biostimulants promoting the germination and root length of *Lactuca sativa* seeds, applied at different doses.

## MATERIALS AND METHODS



*C. prolifera* algae was freshly recovered from Mediterranean sea, washed to remove impurities, and lyophilized, sieved, and milled.



### Physico-chemical characterization

pH	Conductivity (1:5)
6.50	21.0 mS/cm

Seven extraction methods were done at lab scale to obtain aqueous solutions in a 1:10 ratio (g algae/mL extractant)

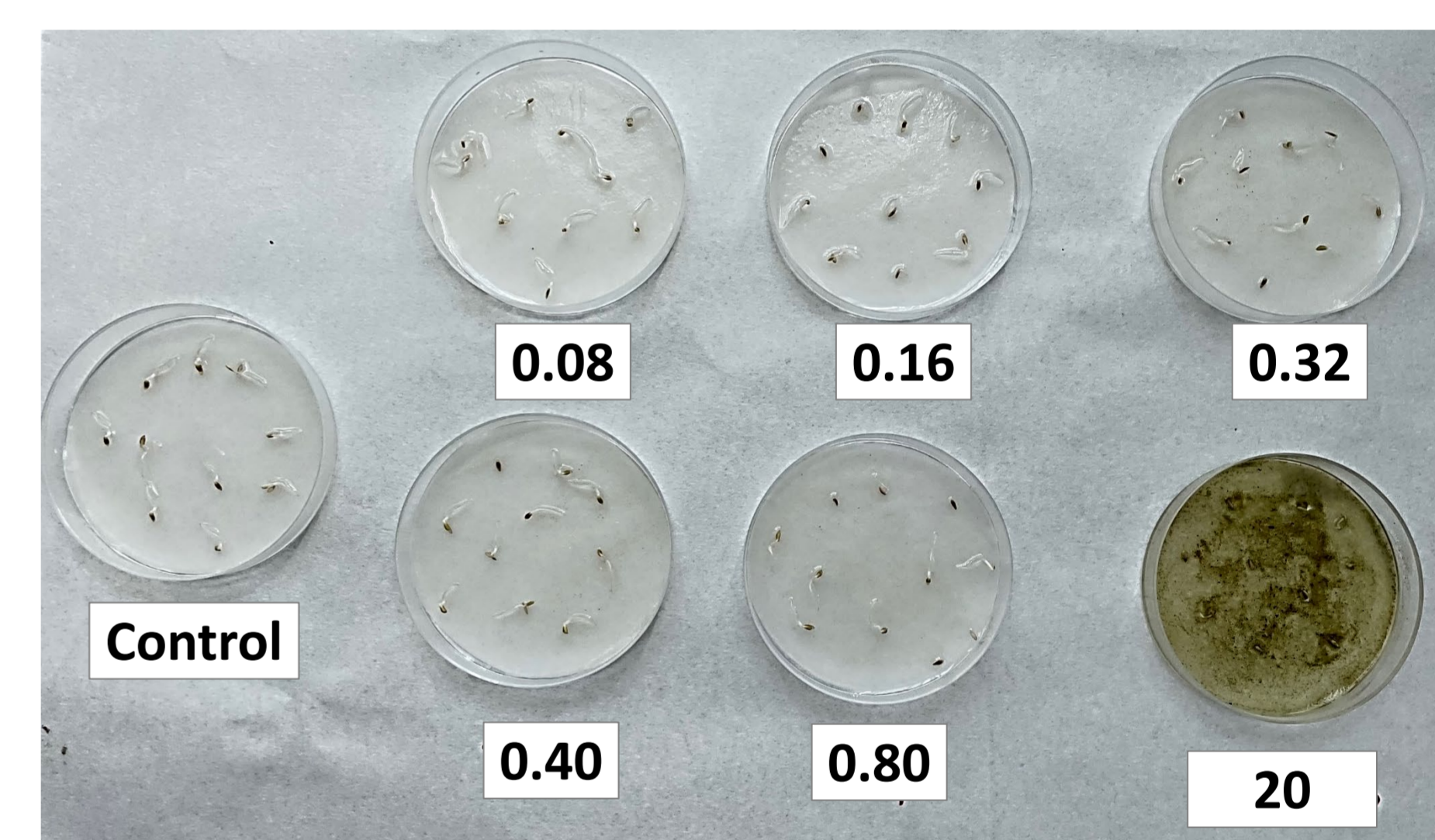
- Basic (KOH), Acid (HNO<sub>3</sub>), and Neutral (H<sub>2</sub>O)
- Microwave extract (MW)
- Sonicated extract (SONI)
- Accelerated Solvent Extract (ASE)
- Supercritical Fluid extraction (SFE)

Germination in vitro test with *L. sativa* seeds Ten seeds on Petri dishes with a paper moistened with 2.7 mL of individual extract diluted to obtain an algae concentration (mg lyophilized algae/L) of 0.08, 0.16, 0.24, 0.32, 0.40, and 0.80. Samples were kept at 28°C in the darkness for 3 days (n=3). Root length of seedlings was analyzed by WinRHIZO® image analysis system, and compared to the germination rate, obtaining germination rate (GR), root length (RL), and germination index (GI), calculated as follows:

$$GR(\%) = \frac{\text{No. germinated seeds in algae}}{\text{No. germinated seeds in control}} \times 100$$

$$RL(\%) = \frac{\text{root length seeds in algae}}{\text{root length seeds in control}} \times 100$$

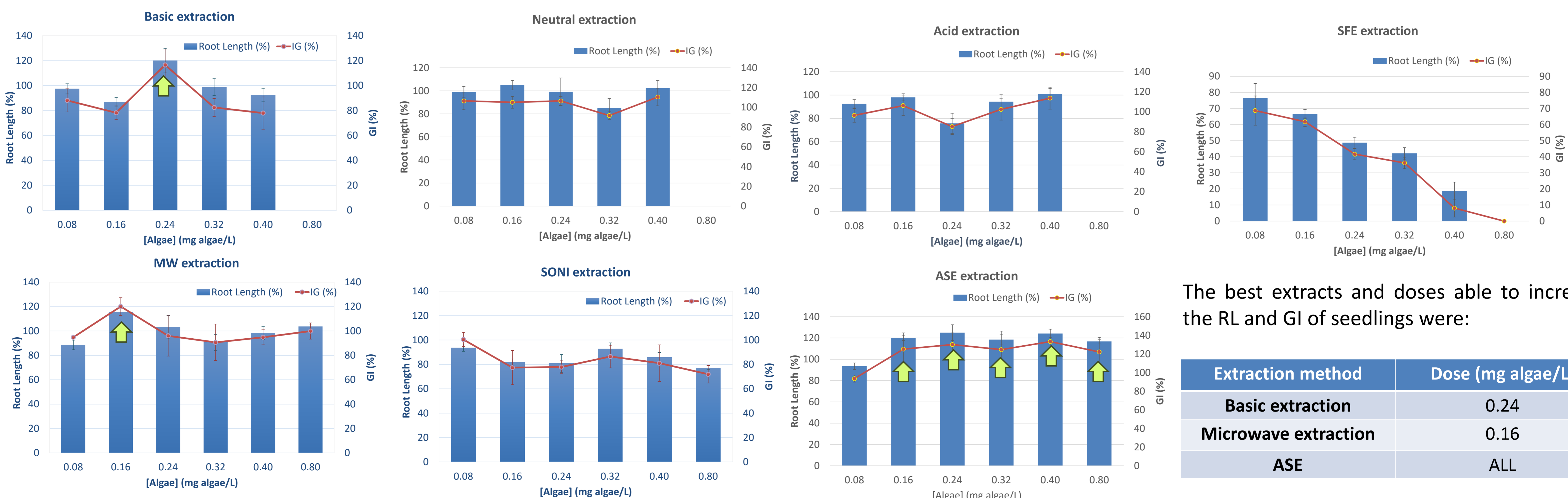
$$GI(\%) = \frac{GR \times RL}{100}$$



*L. sativa* seeds germinated after 3 days with solutions of Basic extraction at different algae concentrations (mg algae/L).

## RESULTS

### Root Length rate (%) and Germination Index (%) seedlings after application of algae extracts at different concentrations



The best extracts and doses able to increase the RL and GI of seedlings were:

Extraction method	Dose (mg algae/L)
Basic extraction	0.24
Microwave extraction	0.16
ASE	ALL

## CONCLUSIONS

- 1) The extraction methods assayed at lab scale are valid to obtain algae extracts from *Caulerpa prolifera*.
- 2) The best root length rate and germination indexes were obtained for selected extracts being able to be applied as potential biostimulants for plants.



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