spray made from *K. alvarezii* seaweed (SAP) was found to enhance growth and productivity of several Indian crops. Furthermore, there are indications that SAP may alleviate abiotic and biotic stress and favorably influence beneficial soil microbes.

In order to obtain plant growth promotion, SAP foliar spray needs to be applied frequently which first, is laborious and secondly, high losses occur. In combination with a low shelf life this poses a major hurdle for commercialization of SAP extract despite its obvious potential. To improve the applicability of SAP the aim of our recently started Indo-German cooperation is to develop a slow or controlled release biostimulant formulation with increased shelf life for not only Indian but also European agriculture.

We hypothesized that due to phytohormone effects (i) the application of encapsulated SAP shows a better plant growth promotion than unformulated SAP and fertilizer and (ii) encapsulated SAP will increase flowering and biomass production better than fertilizer.

The formulation consists of 2% Na-alginate, 20% bentonite and 16.7% SAP. This solution was dripped into a stirred cross-linker consisting of 1.5 % Calcium chloride. To simultaneously coat the beads 0.2 % κ- Carrageenan was added. Finally, beads were dried at 60°C. To investigate the effect of the SAP-formulation on plant performance, 1.1 g dry beads were placed between the roots of 4 week old tomato (*Solanum lycopersicum)* plantlets. Plants were allowed to grow for additional 8 weeks and were fertilized with two concentrations of Hoagland's solution to determine potential fertilizer effects of the formulation.

We found that plant height of tomatoes increased after incubation with beads containing SAP under both nutrient rich and nutrient poor conditions with a maximum of 27,9 cm ± 1,9 cm or 23,8 cm ± 1,3 cm, respectively. Under nutrient rich conditions, beads with SAP significantly increased total dry weight with a maximum of 3.2 g ± 0.2 g and in nutrient poor conditions with a maximum of 2.6 g ± 0.3 g.

Unformulated SAP decreased the plant dry weight significantly, regardless of fertilization. After incubating plants with encapsulated SAP dry weight of floral parts increased up to 0.6 g ± 0.01 g and 0.04g ± 0,01 g under nutrient rich and poor conditions, respectively.

The significantly increased plant biomass and flower production in all SAP treatments can be attributed to phytohormonal effects (i.e. gibberellins) overruling fertilizer effects. The same is true for the observed effect on plant elongation likely caused by cytokinins. Application of encapsulated SAP shows better plant growth promotion than pure SAP powder probably due to slow release over a longer period avoiding high doses. The biostimulant effect of SAP was more pronounced than the fertilizer effect. Further research into the physicochemistry of the key plant hormones and their release kinetics as a function of formulation materials properties will allow for developing new plant biostimulants for European agriculture.

063 - Einfluss der Kombinationen mehrerer AHL-produzierender Bakterien auf Kulturpflanzen

The impact of multiple AHL-producing bacteria combinations on crop plants

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N-acyl homoserine lactones (AHL) play an important role in the interactions between bacteria and plants. Generally, short chained AHL promote plants growth, while long chained AHL may enhance plant's resistance and tolerance to biotic or abiotic stresses. AHL are one of bacterial quorum sensing (QS) molecules. Gram-negative bacteria use AHL to monitor its own population density. Rhizospheric bacteria can produce AHL molecules with diverse length of the acyl chain, ranging from short (C6) to long side (up to C18). As a favourable environment for microorganisms, rhizosphere harbours significantly higher densities and diversity of AHL-producing bacteria. Therefore, AHL-based QS and AHL-priming may occur frequently in the rhizosphere. In order to accurately reflect the situation in the rhizosphere, investigation of

complex interactions between host plant(s) and multiple AHL molecules would be necessary and meaningful.

In this study, four different bacteria have been used, *Serratia plymuthica*, *Ensifer meliloti*, *Rhizobium etli* and *Paraburkholderia graminis*. They produce multiple AHL molecules with variety of acyl chains. This study is divided into three main parts. Firstly, the AHL components produced by the multiple bacterial mix will be identified by thin-layer chromatography (TLC) and AHL-biosensors. Secondly, the impact of the bacterial combinations on host plants (barley and Arabidopsis) will be assessed. Thirdly, the mechanism of AHL-priming in the host plants will be further explored. This study will help to understand the impact of AHL-production on crop plants and its possible use in sustainable agriculture.

Literatur (optional)

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064 - Einfluss von Quorum-Sensing-Molekülen auf Pflanzenwachstum und Immunität

Impact of quorum sensing molecules on plant growth and immunity

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Quorum-sensing (QS) molecules are the primary means through which bacteria mediate communication among their populations and coordinate behavioral changes. Most Gram-negative primarily produces *N*-acyl homoserine lactones (AHL), which are the best-studied groups of QS molecules. In addition to bacterial communication, AHL are also involved in mediating interactions between bacteria and eukaryotes. Plants evolved to perceive and respond to these molecules in a diverse manner; often activating specific physiological pathways resulting in augmented growth or/and resistance, phenomenon termed as AHL-priming.

Rhizosphere bacteria can produce more than one type of AHL molecules and the acyl chains of AHL molecules can vary from short to long side chains. Their impacts on plants have been extensively studied; however, most studies have assessed the interactions in a bilateral manner, a kind of interactions that occurs rarely in the nature. Therefore, in this study, we aimed to assess the AHL-response in plants in a setup that closely mimics the rhizosphere. For that, we assessed the impact of five different AHL with varying length of the acyl side chain, from 6 to 14 carbons (oxo-C6-HSL, oxo-C8-HSL, oxo-C10-HSL, oxo-C12-HSL and oxo-C14-HSL) and all their possible combinations on the model plant *Arabidopsis thaliana*. We assessed their impacts by monitoring plant growth and defense responses as well as resistance to the plant pathogen *Pseudomonas syringae* pv. *tomato* (*Pst*). Individually, some of the AHL molecules positively influenced plant growth, while others induced AHL-priming for enhanced resistance. Our results indicate that the impact of multiple AHLs on plants may result in similar outcomes as their combinations had a relatively low impact on the growth but showed to induce resistance mechanisms. Most striking outcome was that all triple, the quadruple as well as the double combination(s) with long-chained AHL molecules increased the resistance to *Pst*. These findings indicate that induced resistance against plant pathogens