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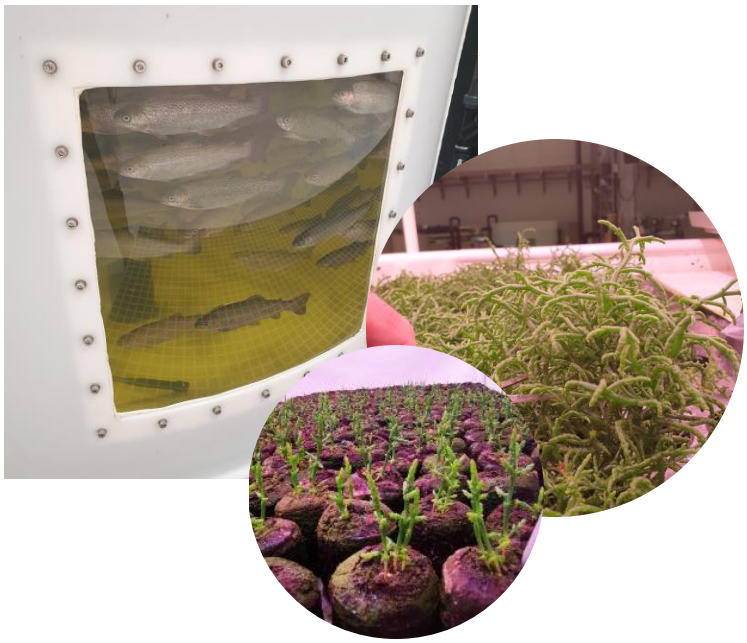

Cultivation of *Salicornia* spp. using effluent water from Recirculatory Aquaculture System (RAS) culturing rainbow trout.

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How will nutrients based solely on fish effluent water will affect the growth of *Salicornia*?

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The circular approach of AQUACOMBINE combines aquaculture, farming and bioprocessing to utilize all fractions of the produced biomass and produce value added food, feed, bio-compounds and bioenergy.

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Cultivation of *Salicornia* europaea in a decoupled aquaponic system using effluent water from Recirculatory Aquaculture System (RAS) culturing rainbow trout.

How will nutrients based solely on fish effluent water will affect the growth of *Salicornia*?

The effluent water from RAS culturing steelhead trout (*Oncorhynchus mykiss*) was used for producing high-value halophytes *Salicornia* in a two-storey 'decoupled' aquaponic system. It means that the fish process water was used for cultivating halophytes, but the water from the aquaponic unit was not reused again in the RAS unit.

The RAS system consists of a water treatment unit (nanoRAS) and two culture tanks (3 m^3 each) with a total system volume is 7.5 m^3 and a water recirculation rate of >96%. The water treatment unit consists of a drum filter for removing the solid waste, a gas balance chamber to remove CO_2 produced in the system, and a biofilter unit for converting ammonia waste generated by fish into a less toxic nitrate through the nitrification process.

The two tanks contain 200-300 g size rainbow trout at a density of 45-50 kg/ m^3, fish were fed with a commercial feed with 45% protein content. The water salinity was maintained between 14-16 ppt (a mixture of seawater and freshwater) to provide an optimal growing condition for *Salicornia*. Other water parameters such as temperature, salinity, pH, ammonia, nitrite, and nitrate were monitored continuously (both at the RAS unit and aquaponic unit). Based on the previous production cycle, 20-25 l/day of RAS process water (after the drum filter) was continuously pumped into the aquaponic sump tank.

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The four batches of *Salicornia europaea* seeds were germinated with a gap of 4 weeks to evaluate growth and the presence of bioactive compounds at different stages of plant development. *Salicornia* seeds were germinated in jiffy pots and transplanted into the growing rafts after 4 weeks. During the production cycle, the nitrate concentration in an aquaponic unit varied between 45-125 mg/l with an average value of 70 mg/l. The pH on the RAS unit was always maintained between 7.0 -7.5 (by addition of sodium-bicarbonate), however, the pH on the aquaponic unit constantly remain on the higher end (7.7 – 8.0).

The plant showed good growth and development until the first green harvest (4 weeks after transplantation), then it started flowering and maturing (lignifying) quite early. Therefore, the total biomass harvested was approximately 12 times less (9.25 kg i.e 0.58 kg/m^2) compared to the first two production cycles using artificial fertilizer. The analysis of water from the RAS unit showed a deficiency of micronutrients, thus, the reasons for early flowering and maturation could be related to insufficient nutrients in the fish process water or higher pH in the aquaponic unit affecting the uptake of nutrients by the plants.

Based on the present results, the decouple aquaponic unit with supplementation of deficient micronutrients in the fish process water would be optimal and recommended for growing Salicornia. This will be further tested at the Alpha Aqua demonstration unit.

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