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Sea purslane research at Mote Aquaculture Research Park

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Expanding vegetable resources with marine aquaponic systems

Sea Purslane is an edible halophyte plant that also helps protect the fragile coastlines and dunes from erosion. Therefore, wild harvest of this plant is strongly discouraged.

Sea Purslane *(Sesuvium portulacastrum)* is an herbaceous perennial halophyte plant [plants that grow in saline environments] and is found throughout much of the world's coastal areas – especially on the continents of Africa, Asia, North America, South America and Australia. In North America, sea purslane is found in wet sandy habitats of the southern coastal states, but it has been reported as far north as the Delaware River in Pennsylvania. Sea purslane is not only an edible halophyte plant, but it also helps protect the fragile coastlines and dunes from erosion. Therefore, wild harvest of this plant is strongly discouraged.

Sea Purslane is sold for food and medicinal purposes in markets around the world, especially in small local markets in the Caribbean, Asia, India and Europe. This edible halophyte plant is native to coastal habitats in Florida, and researchers from Mote Marine Laboratory's Mote Aquaculture Research Park (Sarasota, Fla., USA) are farming sea purslane and redfish (*Sciaenops ocellatus)* in a brackish water (salinities ranging from 10 to 18 ppt) **marine aquaponic system** (https://doi.org/10.1016/j.ecoleng.2018.06.003). Marine aquaponic systems can be used to produce halophyte plants that tolerate saline conditions together with fish (aquaculture) in the same aquatic environment.

Health benefits

Sea purslane has many reported benefits. Plant leaves are high in antioxidants, such as beta carotene, and are an excellent source of vitamins and minerals. Table 1 shows the concentrations of vitamins and minerals from samples of sea purslane grown in the Mote Aquaponics system.

Main, sea purslane, Table 1

Nutrient	Value (per 100 g)
Beta carotene	680 mcg
Calcium	23 mg
Magnesium	49.7 mg
Phosphorous	33.4 mg
Sodium	808 mg
Vitamin C	6.95 mg
Vitamin K	164 mg
Vitamin B1	0.02 mg
Vitamin B2	0.06 mg
Folate	17.4 mcg
Niacin	0.24 mg
Pantothenic acid	0.17 mg

Table 1. Concentrations of vitamins and minerals from samples of sea purslane grown in the Mote aquaponic system.

In addition, sea purslane is also known to contain omega-3 fatty acids, surprisingly more than any other leafy vegetable plant. It is an excellent source of vitamin A and rich source of vitamins C, B complex, as well as minerals such as magnesium, iron, calcium, manganese and potassium. Sea purslane has been reported to be an excellent source of protein and dietary fiber. Lastly, oil extracted from sea purslane leaves has also be reported to contain **medicinal properties** (https://doi.org/10.1016/j.jep.2005.07.024) such as being an antimicrobial (**antibacterial and antifungal** (https://pubmed.ncbi.nlm.nih.gov/21780546/)) agent against some tested human pathogenic organisms. As a cautionary note, sea purslane does contain oxalic acid, a naturally occurring substance found in vegetables, such as spinach, beets, rhubarb and kale. People with known oxalate urinary tract stones are advised to avoid eating purslane.

Edibility

Sea purslane can be eaten a variety of ways, including raw or cooked (sautéed, roasted, or steamed). Although the stems near the roots can be tough and should be cut away, the remainder of the plant (stalk and leaves) is very edible. We are also in the process of writing a sea purslane cookbook containing a large number of recipes compiled from local chefs, colleagues and from the internet.

Aquaponics

Mote Aquaculture Research Park scientists began cultivating sea purslane in a sustainable marine aquaponic system in 2014. Aquaponics technology developed for freshwater systems has been adapted to develop a prototype saltwater aquaponic system. Currently, the majority of aquaponics

farming is done with freshwater plants and fish, thus creating a real need and opportunity to develop and identify plant crops that will flourish in saltwater aquaponic systems. The combination of purslane and redfish has proven to be a viable option for a successful marine aquaponic system.

Views of the aquaponics system and purslane production.

Mote's prototype saltwater aquaponics system not only produces healthy sustainable plants and fish, but this technology and knowledge can be easily transferred to individuals, local communities and businesses that want to produce healthy and sustainable local aquaculture products. In addition, edible sea purslane vegetables have been well received by the community and are successfully sold in local restaurants and farmers markets.

With the right conditions, equipment and knowledge, sea purslane is fairly easy to grow in marine aquaponic systems. Plant cuttings are started in small containers/pots utilizing a coconut husk medium. Plant pots are suspended in a floating raft that keeps the edible part of the plant above, while allowing the purslane roots to access and utilize the nutrients in the water system.

This land-based sustainable aquaculture system links fish tanks and vegetable raceways into one system. Water leaving the fish tanks is filtered to remove solids, after which it enters a biofilter to reduce ammonia and nitrite but is still high in nitrate. After biofiltration, water is UV filtered and then flows through plant raceways, where plants uptake and assimilate additional nitrogen nutrients (especially nitrates) from the water. Water then returns at a higher quality to the fish tanks. This eco-friendly recirculating system is totally self-contained, where the fish provide nutrients to the plants and the plants return clean water to the fish tanks.

Harvested sea purslane packed for the market.

Perspectives

Global seafood consumption is on the rise and is predicted to grow at a faster rate in the coming decades. Therefore, aquaculture producers must continue to find ways to provide high quality aquaculture products to meet increasing consumer demand using sustainable, environmentally friendly technologies.

The aquaponic system at Mote Aquaculture Research Park is operated as a sustainable recirculating aquaculture system. A pilot-scale system is under construction to expand both fish and vegetable production. The expanded system will provide opportunities to demonstrate year-round production of high-value seafood products and to expand technology transfer to local farmers that are interested in providing farmed seafood products to local markets.

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