Salicornia bigelovii: A VERSATILE CROP FOR THE SEAWATER AGRICULTURE

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More than 97% water found on earth is saline in nature which cannot be used in agriculture. The amount of fresh water available for agriculture is limited and it is getting scarcer as the demand for food rises with the increase in population of the world. To meet the ever increasing need of agriculture products such crops have to be found that can be irrigated with saline or seawater. *Salicornia bigelovii*, a halophyte (salt-loving plant), may prove to be a strong candidate for such exigencies. It has a great potential to be a part of both human and animal diet and it can also be used in the production of bio-fuel.

Young tender shoots of S. bigelovii *are used as a vegetable*

The genus *Salicornia* belongs to family Chenopodiaceae and subfamily Salicornioideae which includes some of the most salt-tolerant terrestrial plants that grow in coastal marshes and on seashore. One of its species, *Salicornia bigelovii*, can even be grown in hyper-saline drainage water. Arguably it is considered to be the most salt-tolerant vascular plant in the world. *S. bigelovii* is an annual plant, with erect, succulent, photosynthetic stems. Its jointed spikes are terminal on each stem. Its flowers are bisexual, consisting of merged sepals that encircle the stigma and stamens. Pollination occurs through wind. It has small thin seeds which are brown in color. The species is found in coastal areas of Mexico and the United States of America.

S. bigelovii, which is commonly known as samphire or saltwort, can be eaten either cooked or raw forms. Uncooked samphire, with its sea flavor, is ideal as a side dish with fish and other seafood, while its pickle is served as an appetizer. For cooking, samphire is usually steamed or micro-waved followed by coating either in olive oil or butter. After cooking, its flesh color is like seaweed while its texture and flavor resemble asparagus; that is why sometime it is called as sea asparagus. Different experiments show that its foliage can also be used as a fodder to replace crops like alfalfa and Rhodes grass for domestic animals including cattle, sheep and goats. It can either be given to the animals directly following desalinization or after mixing with other fodders like wheat straw and Rhodes grass.

Agriculture researches have found that the halophyte species has an immense potential to be used as an oilseed crop. In the coastal areas of deserts and wastelands, *Salicornia bigelovii* can successfully be grown using seawater for irrigation. In the desert shoreline of Mexico it has already been evaluated as an oilseed crop. Trials show that its yield is better than fresh water grown oilseed crops such as sunflower and soybean. The desert areas that line Indian Ocean, Gulf of California, Red Sea, Arabian Gulf and other similar regions can be used to cultivate it as an oilseed crop.

S. bigelovii *seed contains good quality edible oil*

High contents of oil (30%) and lower concentration of salt (less than 3%) in its seed make *S. bigelovii* a most promising oilseed halophyte crop for the future. It has high quality edible oil as its seeds contain 75% of linoleic acid, an unsaturated fatty acid essential for human diet and linolenic acid (2%), an omega 3-fatty acid, which reduces the cholesterol level of the blood. By transesterification the salicornia oil can also be converted into bio-diesel, an environment friendly fuel. According to one estimate, one hectare of salicornia can produce 225-250 gallons of bio-diesel. After the extraction of oil its meal that has high protein contents (42-45%) can be used to feed livestock and fish.

In recent years, *Salicornia bigelovii* has gotten so much attention that different breeding programs have been started in Eritrea, the USA and Saudi Arabia for the improvement of its various desirable characteristics. The emphasis in those programs is to evolve better oilseed salicornia varieties which are suitable for their respective conditions.

To see the performance of *Salicornia bigelovii* in the United Arab Emirates, the International Center for Biosaline Agriculture (ICBA) conducted experiments in its vicinity. The seed of different *S. bigelovii* lines was provided by BEHAR (Arabian Saline Water Technology Company Limited) Saudi Arabia that had been working on this halophyte species for some years. The experiment was carried out on sandy soil and pure seawater was used for irrigation. The results were quite encouraging. The performance of the six prominent salicornia lines tested at ICBA showed that it can be adopted in the UAE as a vegetable, fodder and oilseed crop.

The Masdar Institute of Science and Technology, UAE with the support of Boeing, Etihad Airways and UOP Honeywell has embarked on a project to cultivate salicornia in Abu Dhabi to produce bio-fuel for aviation industry. For this salicornia project only seawater will be used for irrigation. ICBA is also lending its expertise to the project.

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