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Halophytes – A resource for the future

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One of the more urgent global problems, particularly in arid and semi-arid regions of the world, is finding enough water and land to support the world's growing food needs. By some estimates, an additional 500 million acres of new croplands are required over the next thirty years to feed burgeoning populations of the tropics and subtropics. Yet only 230 million acres are available in these areas for farming to expand. And, much of this land is forested and should realistically be preserved to maintain the integrity of remaining natural stands and ecosystem functioning.

Furthermore, saline soils are a major problem of cultivated lands in semi-arid and arid areas. About 23% of the world's 1.5×10^9 ha of cultivated land is saline and 37% is sodic. Approximately one third of the world's irrigated land is salt-affected due chiefly to unsustainable irrigation practices. Freshwater resources are also being rapidly depleted and current agricultural irrigation practices are steadily increasing salinity levels in many regions. Rapid increases in population pressure are leading to greater utilization of remaining meager freshwater supplies for drinking, leaving even less for agriculture. In this complex scenario, it has become imperative to consider development of non-conventional agricultural technologies which might more effectively utilize degraded, marginal and saline lands for agriculture by using, the 'so-called', poor quality water (brackish water, seawater, and wastewater).

An attractive option is the use of seawater or brackish water agriculture, and this has worked well in both inland and coastal sandy soils of some desert environments. Saline water aquifers exist in many arid lands of the world but these have been greatly under-utilized. This brackish water could be a major resource in saline agriculture to produce food, feed, and fiber and oil seeds on currently non-productive, saline arid lands. In further support of saline agriculture, there would be no shortage of water since seawater in the oceans makes up 97% of water on earth. Desert land is also plentiful, with around 43% of the earth's total land surface being arid or semi-arid. A small portion of this (about 15%) is close to the sea and this would be convenient for growing crops using saline agriculture. This amounts to 130 million hectares of 'new' land that could arguably be brought into human or animal food production – without cutting down more forests or diverting scarce fresh water resources from current agricultural and community needs.

Salt tolerant plants (halophytes, including salt marsh and mangrove plants) are highly evolved and specialised organisms with well-adapted morphological and physiological characteristics allowing them to proliferate in the soils possessing high salt concentrations. It is tempting to think we might exploit these plants for the better utilization of saline water, and for the rehabilitation of highly saline soils. Saline agriculture, however, must fulfill two conditions to be cost-effective. First, it must produce useful crops at yields high enough to justify the expense of pumping salty water. Second, researchers must develop successful agronomic techniques for growing saline, water-irrigated crops in a sustainable manner. These methods must also not contribute to further damage of natural environments. If applied successfully, this approach would lead to the domestication of wild, salt-tolerant plants for use as food, forage, and oilseed crops.

At the recent International Botanical Congress in St Louis MO, in August 1999, these issues were discussed by a leading group of salt marsh plant researchers from around the world. These discussions resulted in six original, state-of-the-art works, presented in this special issue covering a range of current topics, including: seed bank dynamics, seed germination, growth, competition, and physiology under saline conditions.

It was estimated that about 2500–3000 plant types occur naturally in salt marsh habitats. This has enormous potential as a resource in itself, but it also serves as an essential gene bank from which to develop economically viable cash crops. In order to realize this goal, the ecology and physiology of these plants must be thoroughly investigated. The study on the seed bank presents a comprehensive review of work done in the field and provides vital information from which we might regenerate salt marsh plant communities under saline conditions. Seed germination of salt marsh species are reported to vary with changes in temperature. The success of salt marsh species was thought to be ultimately dependent on their ability to cope with high stem densities and high salt concentrations during growth. Stress on metabolic systems under saline conditions might also be assessed easily by measuring respiration rates. This quick method appears to be an accurate technique for determining stress levels of salt marsh plants. The interest in saline agriculture using cash crop halophytes is rapidly increasing, particularly in arid and semi-arid regions of the world. We hope this special issue will stimulate further research and collaboration among scientists around the world.