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An introduction to Seaweeds

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Seaweeds are macroscopic marine algae, form one of the important living resources of the ocean.

The geographical distributions of seaweeds is very extensive and are found mainly in Chile, Japan, India, Sri Lanka, Indonesia, Brazil, Madagascar, Vietnam, Philippines, North Korea, Taiwan and South Africa. A total of nearly 700 species of marine algae have been recorded from different parts of Indian coasts, of these about 60 species are commercially important.

Classification

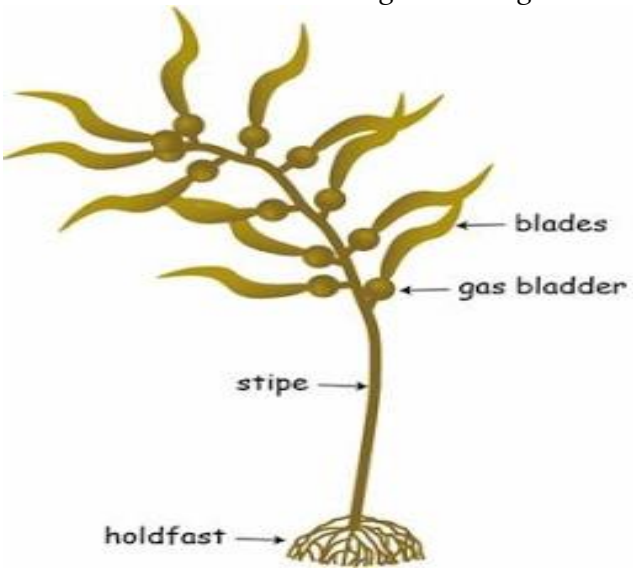
Seaweeds are of three types based on the presence of pigments; green (Chlorophyta), red (Rhodophyta) and brown (Phaeophyta). Greens have chlorophylls a and b, and reds have chlorophylls a, and browns have chlorophylls a and c. Reds have accessory pigment phycoerythrin that gives them distinct red color while browns have accessory pigment fucoxanthin that gives characteristic brown color. Most important seaweeds in India in terms of ubiquitous nature are *Ulva* and *Caulerpa*among greens, *Gracilaria, Gelidiella, Hypnea* and *Kappaphycus* among reds and *Sargassum* and *Turbinaria* among browns. The coasts of Gujarat, Kerala and Tamil Nadu have most of the seaweeds described in India. The main uses of seaweeds are as foods and as the raw material for the extraction of the hydrocolloid, alginate, agar and carrageenan etc.

Caulerpa racemosa

Gelidiella acerosa

Gracilaria edulis

Sargassum wightii



Morphology

Seaweeds are made up of three distinct parts. At the lower end a root-like structure called, the holdfast, which, secures the plant to its environment. The stem-like structure called stipe on each side is attached with leaf-like structures called; blades.Some species have air-filled bladders eg: *Sargassum sp.*

Seaweed culture

Site selection: Select area with moderate to strong water currents and wave action but not strong enough to damage the farm. Site should be distant from freshwater sources as it affects salinity and seaweed growth.The water should be generally clean and away from urban waste and pollution.Keep away fromsubstrate covered with sea grass and algal beds. The site should have a water temperature of 24-30 ^{o}C and salinity of 27 to 35 parts per thousand.

Selection of seedlings

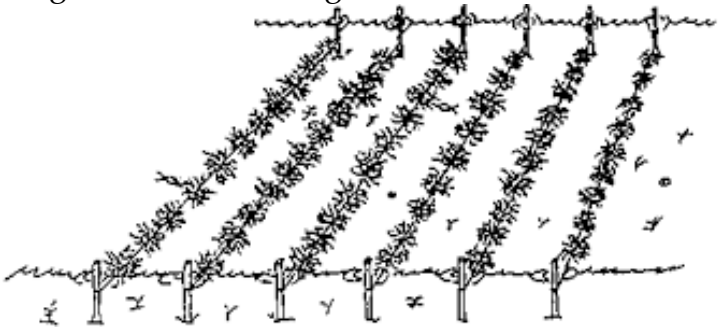
Vegetative propagation of seaweed is commercially feasible. Select seaweed with healthy branches with no signs of diseases or infection. Seedling must be smooth, slippery, and brittle, use sharp stainless steel knifefor cutting. Seedlings should be tied at the strongest point of seedling and avoid the rupturing of the branches.

Raft cultivation

Bamboo poles are preferred for raft preparation; rafts of 3x3 to 12x12 mare made with diagonal bamboo support. The depth of the sea where the rafts were placed is 0.5-1.0 m. Seaweed fragments are tied to the polypropylene-twisted ropes safely for cultivation. Plantings of approximately 100-150 g are fixed on each rope, at 15 cm intervals. To protect the seedlings from grazing, a piece of fish net is tied at the bottom of the raft. Anchors or wooden poles can be used to hold the rafts in position. Floating rafts or fixed rafts can be selected for seaweed culture.

Monoline/ longline Cultivation

In monoline culture seaweeds are grown in the main rope that is floated via buoys installed at specific intervals and ends fixed by means of anchors or wooden poles. Seaweed fragments/ seedlings are inserted on each rope. The general approach is to suspend a series of longlines of 10m in length between two wooden stakes.



Tube-net method of cultivation

In this method the seed material is not fastened with rope but held compactly, inside tube- nets having 10-15 cm dia. and mesh size of 3 cm. The algal seed material is loaded into the tube-nets with the aid of a small plastic pipe having little fewer diameters than tube-net.

Farm management

The rafts transplanted in the ocean are probable to have infestations with undesired suspended materials, drifted from different sources. In order to attain optimal production, the farmer has to visit the farm frequently, and undertake periodic cleaning of rafts and weeding of any foreign materials. The damaged rafts must be repaired to obtain satisfactory yields.

Harvest

The seedlings grown for 40-45 days attain their full growth. These rafts ready to harvest are towed ashore and the ropes are separated from raft and seaweeds are pulled out from the loops manually. The harvested crop is solar dried or the fresh crop itself procured by buyer for sap production in the factory.

Economic Importance of seaweed

Agar: Agar is a polysaccharide made up of agarose and agaropectin that had traditionally been used as a jellifying agent for foods. Agarose is a standard biochemical used by almost all molecular genetics laboratories. Agar is also used to make typical solid microbial culture medium. Major seaweeds, producing agar are called 'agarophytes', include *Gracillaria* and *Gelidiella*

Carrageenan:A high-value sulfated polysaccharide extract derived from certain species of red algae, which is used as a jellying substance. Most carrageenan is extracted from *Kappaphycussp*. Carrageenans are used in a variety of commercial applications as jelling, thickening, and stabilising agents, especially in food products and sauces. Aside from these functions, carrageenans are used in experimental medicine, pharmaceutical formulations, cosmetics, and industrial applications.

Alginic acid (Algin): The term "algin" is a generic name for the salts of alginic acid. Algin is used for sizing textiles and paper thickening textile paints and for boiler water treatment. This is the most useful colloidal carbohydrate in cosmetic industry. It is also used in the preparation of tablets and pills as granulating and

binding agents, liquor clarification in varnishes, paints, adhesives, leather polishing materials etc. Alginic acid and its salts are used as blood anticoagulants also.

Mannitol: Mannitol is an alcohol extracted from mushrooms and certain types of algae. Using in foodstuffs and as dusting powder for chewing gum as well as in the manufacture of varnishes, coatings for fancy papers and leathers, shoe polishes, soldering fluxes, and pharmaceutical products such as metal complexes and colloidal suspensions

Furcellaran (Danish agar): Based on the red seaweed *Furcellariafastigiata*, which is present along many coasts of the North Atlantic and its adjacent sea is the primary source of furcellaran**.** It is used as a substitute for agar but has found many special uses as gelling and thickening agent.

For human consumption: They are utilized as food in several countries especially in Japan, China and Korea. Seaweeds like *Porphyra, Laminaria, Undaria, Caulerpa*etc are popularly used in traditional food items and soups.

Animal feed: Seaweeds are a good source of minerals, vitamins, pigments, trace elements etc; hence they are widely used as a constituent in poultry, cattle and fish feeds. In many places in world fresh seaweeds has been used as fodder.

Fertilizers: The most established and effective use of seaweed is as a fertilizer. In coastal areas from several centuries seaweeds has been used as direct and simple manure. The large brown algae, *Macrocystis* and *Ascophyllum,* are the principal species used for manure. They are also used as soil conditioner and growth promoter because of their unusual properties.

Biofuel: Several countries including India have reported efficient conversion of macroalgae to biofuels such as bioethanol, biobutanol, biomethane and biohydrogen. Indian seaweed genera for biofuel production in India include *Ulva, Kappaphycus, Gracilaria, Gelidium, Sargassum*, etc.

Ecological Importance

Protection: Seaweeds play a major role in marine life. Seaweeds are the living, feeding, breeding and hiding places for numerous marine creatures. Seaweeds also serve as a nursery ground for many fishes, crustaceans and molluscs. Seaweed protects marine life by absorbing CO2, reducing the acidity in the water. Sea otters, urchins, and fish also find shelter within the seaweed. The seaweed is home to large and small creatures. Plankton and diatoms especially find shelter in the seaweed forests.

Food: Seaweeds form organic food molecules from CO2 and water through photosynthesis, in which they capture energy from sunlight. Similar to land plants, seaweeds are at the base of the food chain. Seaweeds produce O2 as a by-product of photosynthesis for the respiration of marine life.

Cleaners: Seaweed removes gases from the marine environment by absorbing them into its leaves. Seas with many kelp forests are healthy and clean. Thus, the organism living in the environment also is healthy.

Prevent erosion: Seaweed forest in the sea floor maintain the sand and rock from drifting away. Areas with seaweed are more constant than areas lacking seaweed.