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SEAWEED CULTURE AND ITS PROSPECTS IN INDIA

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INTRODUCTION

For centuries, seaweeds of various kinds have been put to several uses in the countries of south and south-east Asia (Chapman and Chapman, 1980). The utilisation of these seaweeds has come up step by step starting with using them as food, later as raw material for industrial, medicinal, pharmaceutical and cosmetic purposes.

The extended coastline of India of about 7500 km long with wide shelf area of 0.451 million sq. km. provide the most suitable environment for seaweed growth. The extensive shallow bays, coral reefs and lagoons, characterised by slow to moderately strong currents coupled with sandy and coralline bottoms make the Indian coastal belts, the ideal habitat for many economic seaweeds.

The geographical distribution of seaweeds is very extensive and the main areas are 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. From the resources survey conducted along the various maritime states the seaweed resources of India is estimated at 2 lakh tonnes (Chennubhotla, 1992).

The total agar-yielding seaweeds of India are estimated to be around 18085 t and of algin yielding seaweeds 9000 t. But the demand from the phycocolloid industry of the country is so great that the present production from natural resources are far from sufficient to cater to these requirements. Hence the necessity to augment the seaweed production through culture practices to bridge the gap between supply and demand.

Culture experiments

In India successful experimental trials with encouraging results have been carried out with selected agar yielding as well as algin rich seaweeds such as *Gelidiella acerosa, Gracilaria edulis, Hypnea, Hormophysa, Ulva, Acanthophora* etc., using different culture techniques. These studies have revealed that *Gelidiella acerosa* and *Gracilaria edulis* can be cultivated successfully on coral stones and long line coir ropes respectively (Chennubhotla *et al*, 1987).

The experimental field culture with *Gelidiella acerosa* at Ervadi in Gulf of Mannar on coral stones yielded a 33 fold increase over the initial seed material in about 90 days period (Patel *et al*, 1979).

In *Hypnea musciformis* a 4 fold increase was obtained on long line rope in the lagoon of Krusadi Island in 25 days time (Rama Rao and Subbaramaiah, 1980).

The field cultivation of *Gracilaria edulis* in Gulf of Mannar has yielded a 3 fold increase in 60 days time (Chennubhotla *et al*, 1978). With a view to finding out the suitability of Lakshadweep lagoons for cultivation of *Gracilaria edulis*, experimental cultivation was undertaken recently in Minicoy lagoon (Lat 8° 17'N and Long 73°04'E). The results obtained were encouraging and showed a biomass increase of 6 to 7.3 fold for a duration of 2 months. But in one particular year (Chennubhotla 1992) a maximum production value of 31 fold increase was obtained in 71 days in September and 18.6 fold increase in November. Thus indicating the real potential of the seaweed to attain its maximum growth.

Grazing

In Lakshadweep, the seaweed production was reduced in subsequent periods due to heavy grazing by fishes. The grazing of the well grown crop by the fishes and other marine organisms is not an uncommon feature and it was reported earlier by James *et al* (1986) for Gulf of Mannar waters. To confirm that these seaweeds were being grazed by fishes, gillnet and set gillnet operations were carried out and a total of 122 numbers of fishes caught in the vicinity of seaweed culture sites. Out of these 22 Nos had algal material in their guts and amongst these seven Nos had specifically fed on *G. edulis*. These species of fishes included were *Abudefduf septemfasciatus, Acanthurus triostequs, A. lineatus, Gerres lucidus, Kyphosus vaigiensis, Lethrinus mahsena* and *Polynemus sexfilis*. The gut contents showed moderate to active feeding by most of the fishes studied which indicates that these fishes were in continuous feeding spree on *G. edulis* and thus causing a set back to the culture operations (Chennubhotla *et al*, 1993).

Economics of seaweed culture operations

The Central Marine Fisheries Research Institute based on the data obtained by field culture of *G. edulis* in Gulf of Mannar by net method, has worked out the economics for one hectare area by a farmer and his family with an average yield rate of 3 kg/m^2 (Chennubhotla *et. al*, 1987). The total harvest of 2 Crops of 60 tonnes when dried (75% moisture) resulted in 15t of dry weeds. The dry seaweeds fetches about Rs. 45,000/- (@ Rs. 3000 per tonne) with a net profit of Rs. 9000/-. If agar-agar is extracted and sold at the rate of Rs. 150/- kg the returns will be higher.

Lindeblad (1989) gave the economics of seaweed farming for 0.1 ha area and agar extraction at the Village level in India. At a production level of 800 kg for a 0.1 ha area of dry weight, it was concluded that selling price of not less than Rs. 125 per kg of agar produced would be economically viable. According to him, if the seaweed production fell to 500 kg/annum, the cost of agar-agar should be enhanced to Rs. 150 per kg.

Along the peninsular India, if seaweed farming is taken up in one hectare area, a return of Rs. 45,000/- is assured in an year for an investment of Rs. 36,000/- making a profit of Rs. 9,000/- assuming the production rate to be 3 fold and that two harvests only can be taken in an year; while in Minicoy lagoon the input requirement (infrastructure) is less and the production rate is high (average of 15 fold) and hence the net profit works out to around Rs. 20,000/- (with a gross return of Rs. 45,000/-) for an investment of Rs. 25,000/- in an year with 3 harvests.

In Minicoy lagoon (Lakshadweep)

Fig. 1. Culture rope showing 30 days growth of *Gracilaria edulis.*

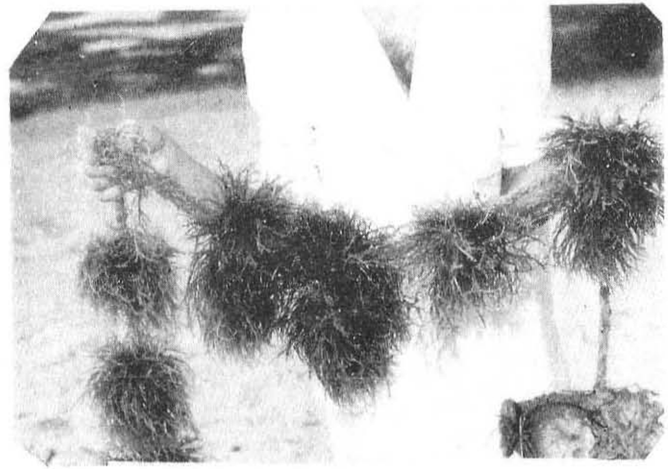

Fig. 2. Closer view of the same

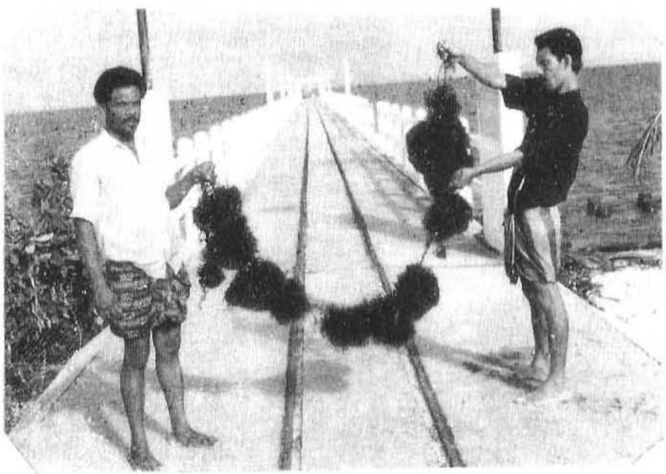

Fig. 3 Cultured *G. edulis*

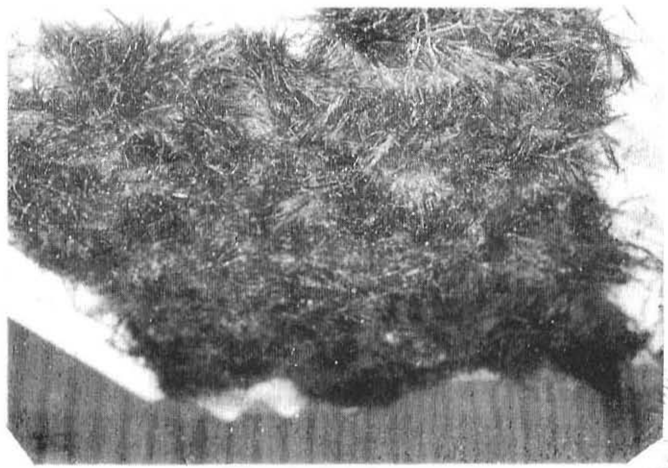

Fig. 4. Harvested seaweed, *G. edulis*

Prospects of seaweed culture in India

Based on the existing information on seaweed research and development in seaweed cultivation and utilization a few priorities have been identified.

Of late the algal genetics is gaining importance to evolve improved varieties of algal species through tissue culture technique. The most widely used approach has been that of simple strain selection, that is the screening of wild plants for desirable traits such as fast growth. In some countries strain selection experiments have been conducted on several economically important seaweeds including *Chondrus, Eucheuma, Gigartina, Porphyra, Laminaria* etc. The most notable success in the genetic improvement of seaweeds has been the Chinese *Laminaria japonica*, a plant not native to Chinese waters.

Our knowledge on the seaweed resources of Andaman & Nicobar Islands is still incomplete as a few islands have only been studied and much work in this direction remains to be undertaken for resource survey and cultivation experiments.

Edible seaweeds of India such as *Gracilaria edulis*, species of *Caulerpa, Acanthophora, Ulva* etc. have to be popularised as food and attempts must be made to develop culture technoligies for the same.

The extraction of bio-active agents from seaweeds is a new line of work which has opened up further possibilities of utilising this resource. Connected with this would be the better utilisation of seaweeds for production of many important pharmacological products.

The seaweeds of economic importance and high yielding varieties such as *Eucheuma*, which is being cultivated on a large scale in South East Asian countries like Philippines, Indonesia and USA as a source of kappa carrageenan, is an ideal one for introduction in our coastal waters.

The Aquaculture effluents discharged are rich in nutrients, plankton, other micro-organisms and suspended organic and in–organise matter. This waste water would be ideal for growing. seaweeds in addition to other marine organisms. By using this biological tool, the shrimp farm wastes can be transformed into wealth by bringing the twin benefits of both treatment and additional food production. It is of interest to mention here that in North Atlantic two red algae were successfully cultured through this re-cycling system.

Suitable personnel must be trained abroad for taking up cultivation of *Eucheuma, Caulerpa* etc. by field culture and tissue culture techniques.

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