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Experimental cultivation of *Gracilaria edulis* (Gmelin) Silva in Gulf of Mannar at Tuticorin

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ABSTRACT

Experiments have been conducted to cultivate *Gracilaria edulis* in the Gulf of Mannar at Hare Island of Tuticorin during 1996-97. This agarophyte has been successfully cultured by vegetative propagation method using the fibreglass tank, cement tank, coir net frame and long line coir rope. In these experiments 3.5, 3.7, 16.1 and 13.2 fold increase in biomass after 80, 60, 74 and 86 days respectively have been obtained. The culture techniques of this species, favourable period for culture and influence of environmental parameters are discussed.

Introduction

The aim of seaweed culture is to increase seaweed production to meet the present requirements of Indian agar and algin industries. Since the production of *Gracilaria edulis* (Gmelin) Silva has come down considerably due to over exploitation, the culture of this fast growing species was undertaken at Tuticorin in 1996. Culture work on *G. edulis* was carrried out earlier by Raju and Thomas (1971) and Umamaheswara Rao (1974) in a sandy lagoon on the eastern side of Krusadai Island and nearshore areas around Mandapam respectively.

Materials and Methods

In the initial trials, though different sites were selected for culturing *G. edulis*, negative results were obtained due to sedimentation of mud, acidity and low salinity from Karapad pond and creek (CMFRI) and fly-ash from the Thermal Power Plant, Tuticorin. Hare Island (Pandian Tivu) at Tuticorin (8° 47' N and 78°12' E) is a well protected area from high winds, strong currents and drift *Sargassum* (Fig. 1). The water is clear with sandy and rocky bottom where the environmental parameters of the sea are normal with the optimum salinity ranging from 28.08 to 30.33‰ (Table 1). Hence Hare Island was selected as the site for these experiments. The period from February to May is most suitable for these experiments at Tuticorin coast because the water is clear and calm without wave action (Table 2).

Results

Four sets of experiments were conducted and the results are presented in Table 3. In the first experiment, *G. edulis* collected

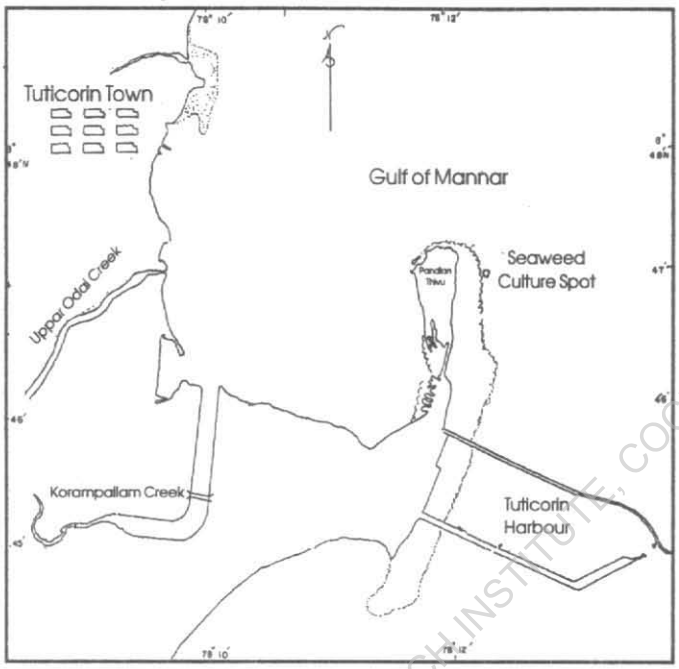

Fig. 1 *Seaweed culture site at Hare Island (Pandiyan tivu) Tuticorin*

Table 1. *Data collected on environmental parameters in culture of* Gracilaria edulis

Culture site	Culture period	Seawater temperature (°C)	Salinity (‰)	Dissolved oxygen (ml/1)	pH
Onshore in fibre glass tank	Sept.-Dec. '96	27.2 - 31.8	28.08 - 31.70	6.20 - 8.20	7.8 - 8.1
Onshore in cement tank	Jan.-Mar. '97	28.4 - 30.1	28.16 - 33.61	5.12 - 6.71	7.8 - 7.9
Nearshore area at Hare Island	Mar.-July '97	28.0 - 32.0	30.33 - 34.54	2.73 - 4.12	7.8 - 8.8

Table 2. *Environmental and hydrological conditions in the seaweed culture sites at Tuticorin*

Period	Environmental / hydrological condition
February - May	Water is clear without wave action
June - September	Heavy wind and water current due to south-west monsoon
October - January	Turbid water and heavy sediments due to north-east monsoon; epiphytic growth of *Chaetomorpha antennina, Hypnea musciformis* and attachment of gastropods and youngones of Aplysia.

Table 3. *Data collected on culture of* Gracilaria edulis

Culture site	Method of culture	Culture period	No. of days of growth	Mean initial length (cm)	Quantity of seed material introduced(kg)	Mean harvested length (cm)	Quantity of crop harvested (kg)	Increase in yield (fold)	Production (g / day)	Growth rate (mm/day)
Onshore in fibre glass tank	Broad-casting	Sept.'97 - Dec.'97	80	5.0	0.8	26.4	2.80	3.5	25	2.7
Onshore in cement tank	Broad-casting	Jan. '97 - Mar.'97	60	5.0	1.5	26.6	5.60	3.7	68	3.6
Nearshore area at Hare Island	Coir net frame	Mar. '97 - Nov.'97	74	5.0	2.5	36.8	40.21	16.1	543	4.3
Nearshore area at Hare Island	Long line coir ropes	Apr. '97 - Jul.'97	86	5.0	0.8	36.7	6.61	13.2	67	3.7

from the natural stock in Hare Island at Tuticorin was cultured in fibreglass tanks of 275 x 115cm size at Karapad Field Laboratory of CMFRI, Tuticorin (16-9-96 to 5-12-96). The initial length and weight of the seed material were 5.0 cm and 0.8 kg respectively. After 80 days the length increased to 26.4 cm and weight to 2.8 kg. The rate of growth was very poor (2.68 mm/day) and it was heavily covered by the epiphytic algae like *Chaetomorpha antennina* and *Hypnea musciformis*.

In another experiment *G. edulis* was cultured in a cement tank (3 x 2 m size) at Karapad Field Laboratory of CMFRI from 28-1-97 with initial length and weight of 5.0 cm and 1.5 kg seed material respectively. After 60 days the length of the alga increased to 26.6 cm and weight to 5.6 kg only. In this experiment also the rate of growth was very poor (3.6 mm/day).

The third culture experiment was conducted in the field at 1 m depth on the eastern side of Hare Island near Tuticorin. Coir net frame of 2 x 2m and 10 cm mesh size fabricated with 1" thick coir rope was used for this experiment. Young and healthy plants of *G. edulis* collected from the subtidal region in the Hare Island was used as seed material. A total of 2.5 kg of *G. edulis* fragments of 5.0 cm length were inserted in the twists of the coir net frame on 18-3-97.The seeded frame was tied loosely, to the casuarina poles fixed in the culture site, above 0.5 m from sea bottom in a submerged free floating condition so as to facilitate its going up and down vertically with the tide.

The fragments of *G. edulis* grew rapidly and reached harvestable size. The harvest was done on 31-5-97 by hand picking. The quantity of material harvested was 40.21 kg which was 16.1 fold increase

over the seed material. The plants grew to a mean length of 36.8 cm in 74 days. The biomass yield of the crop was 10.05 kg/m^2 on coir net frame and the growth rate was 4.3 mm/day. The harvested material was almost pure except for a few organisms such as gastropods, ascidians and some epiphytic plants particularly *Chaetomorpha antennina, Hypnea musciformis* and the young ones of *Aplysia* and they were removed before taking weight.

Finally the long line coir rope culture experiment was conducted in the Hare Island at Tuticorin from 10-4-97. In two ropes of 3.0 cm diameter and 8 m length, 0.8 kg of *G. edulis* fragments of 5.0 cm length were inserted in the twists. Harvesting was made on 5-7-97 after 86 days and 10.57 kg of crop with a mean length of 36.7 cm was obtained. The production of *G. edulis* was 6.61 kg/m from the seed material of 0.5 kg and it was found 13.2 fold increase.

Discussion

The rate of production of *G. edulis* in the net culture experiment of the present study was 540 g / day which was higher than that obtained in tank culture experiments. The alga grew rapidly and reached harvestable size in 74 days and the rate of production in the present experiment was more than that recorded in the culture experiments of *G. edulis* by Chennubhotla *et. al.* (1978). In the natural seaweed beds, the mean growth rate of *G. edulis* was 1.34 cm/day (Umamaheswara Rao, 1973). In the present study, the mean growth rate was less than that of the culture experiments conducted on *G. edulis* by Raju and Thomas (1971) and Umamaheswara Rao (1974). From the present study it is clear that the coir net method is ideal for the culture of *G. edulis*. The shallow water in the vicinity of Gulf of Mannar Islands near Tuticorin is suitable for the commercial scale cultivation of *G. edulis* by vegetative propagation method using coir net and long line coir rope methods.

According to the present study, 0.625 kg of seed material of *G. edulis* would yield on an average 10.053 kg/m^2 of net after 74 days. In one ha area of nets, 101 tonnes of fresh *G. edulis* could be obtained in a single harvest. These observations show that the submerged free floating condition is suitable for the culture of *G. edulis* to yield harvest without contamination and much sedimentation.

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