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Analysis the progress of Sea-Weed cultivation In India (Tamil Nadu)

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ABSTRACT

Seaweeds farming rapidly increasing in India for their commercial importance. On my work, not only described the culture pattern of seaweeds in India, also described the commercial important with the present scenario of seaweeds in India & global market. My work also discusses about the disease of seaweeds. My work displays the relation between water parameter & seaweeds. Also, analysis the growth factor for seaweeds farming. Present the global history including India of Seaweeds farming. Outdoor & Indoor methodology for seaweeds farming, briefly discussed with required materials including site selection and economic structure. In my paper, also point out the entrepreneur story in Seaweeds farming that comes in social work. Overall, in my paper briefly described all details about seaweeds farming in India (Tamil Nadu) including culture pattern, seed resource, benefits, significance, history, estimate culture cost, etc.

KEYWORDS Seaweeds, Cultivation, Tamil Nadu

INTRODUCTION

Sea weed cultivation is a farming of sea weed species that identifying in specified area by methods of intensive care for commercial. Sea weed farming basically increased as alternative to growth economic condition. It also reduces pressure and over exploitation on other resource of Aquaculture. Sea weed cultivation is a farming, to diverse the range of farming that corelated with the environment in different ways. It comfortable on surface level of the water for farming. Sea-Weeds are very important & potential in eco-system management to produce bio-plastics & as feed stock for bio-fuel production. Sea-weeds are very important nutrient source in aquaculture due to High Vitamin, minerals & fibre contamination in it. Costal area is an appropriate place for sea-weed farming. 2-4 metre depth is optimal for sea-weed farming. A range of 30 ppt stagnant salinity water is better for seaweed farming. Water temperature 26-30˚C & less turbidity is appropriate for sea-weed Farming. Clean Water & water flow is needed for sea-weed farming. *Kappaphycus alvarezii* is an economically important species in algae group that plays a vital role for polysaccharide. It used to prepare chocolate milk, jellies, food product, cream, sauses, etc. It also used to make pharmaceutical formulation, cosmetics and carraageeans. Sea weeds is a macroscopic alga that lives in the surface area in water bodies. It is a very important food source. This species one type of food source for the fish in the surrounding area. It yield & free certain minerals which benefit the habitat in it located place. Generally, it found on reef flats & the side of

the reef dissimilar in-depth place. The species lives anywhere from one to five meters depth. This species can attach itself to corals. This algal mat can work as UV protection for fish & a food source for aquatic life. These seaweeds have the power to connect themselves with coral reefs when their invasive skills are observed condition. When attached with coral, they can resist high wave energy environments. Physical disturbance is the main cause of the species to migrate and perhaps it gives a chance to managed itself in a new environment.

MATERIALS & METHODOLOGY

Materials - Plastic transparent jar, Aeration pipe, Stone, Power electronic box, Aerator, Salinity meter, Ampep solutions, NaNO3 solutions, Pipe, Tag, Rope, Weight machine, Microscope, FRP tanks, RCC tanks, GeO2 solutions, Scale, Light, Chitosan solutions, Blower, Cement tanks.

Figure 1: Jar for tissue culture

Figure 2: Blowers for indoor culture

Methods

Indoor culture (micropropagation technique)

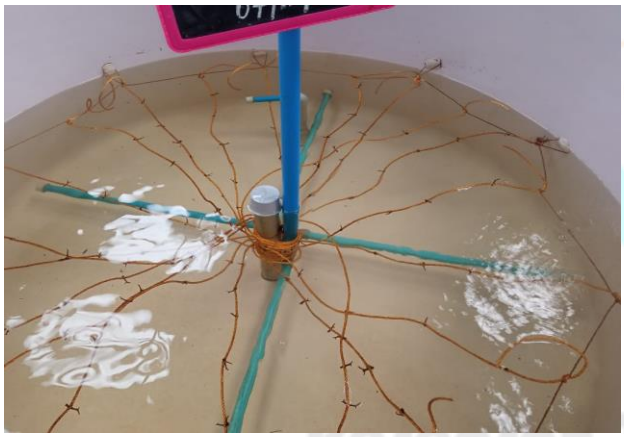


Figure 3: RCC Tank

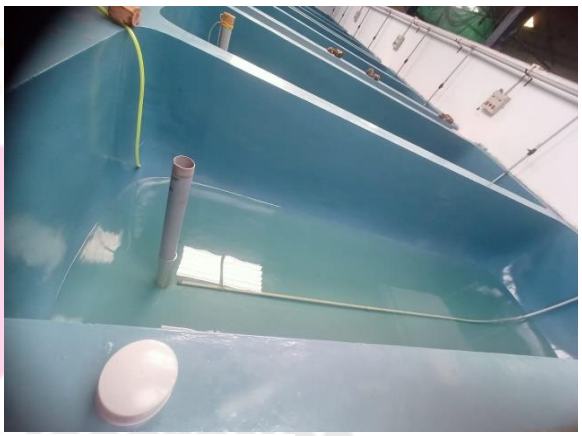


Figure 4: FRP Tank

Acclimatization of seaweed in large tanks

The seaweed which has brought from Tamil Nadu is acclimatizing in 1000L FRP and 10,000L RCC tanks respectively. The mother plants must adapt the environment and allowing its branches to grow further. Acclimatization takes place for more than 20 days to get better growth. During Acclimatization, nutrients such as AMPEP 3mg/L AND NaNO3 1mg/L were added.

Figure 5: Culture in FRP Tank

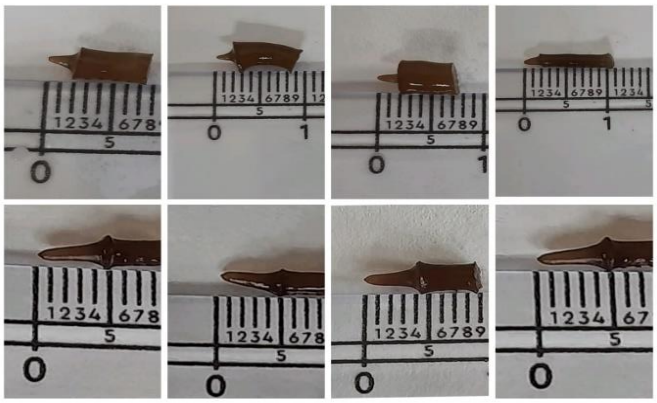
Figure 6: Seed growing in FRP tanks

Collection and Acclimatization of Primary branches of *Kappaphycus alvarezii*

The primary branches were collected from the mother plant source in Acclimatization tanks. Only primary branches which are collected for culture work. The branches are long, rigid with no emerging shoots.The branches were washed three times with Sterile Seawater and put in a 5L Plastic Transparent Jar 3 days for Acclimatization.

Preparation of explant

The primary branches were surface sterilized with 0.5% P.I solution and rinse three times with SSW. Then, edges of each branch were cut and removed with the help of sterile surgical blade and the balanced part were cut into 5mm in sections. From 100g of primary branches we can get up to 2000 sections in the length of 5mm each.



In micropropagation technique, the culture media will be in liquid form. Each 5L jar contains, 5L of sterile seawater. 3mg/L of AMPEP and PGR such as Kinetin 1mg/L were added.

Micropropagation Method

In each culture jar, 500 section were added along with culture media. The culture jars were placed in a culture rack with proper aeration and light intensity was 30-40 µmol m sec-1 m^{-2} s^{-1} light intensity, 13:11 hours light and dark period and at 22 - 25° C temperature in the culture racks.

Outdoor Culture (Net Methods)

Materials Bamboo, Rope–2mm.4mm, 6mm, Fishing Net, Tags, Hacksaw Frame, Blade, Aeration, Monoline net, Floats, plastic bottle, Anchors, Birder pipe, coconut rope, Weight machine.

Figure 1: Raft making for installation

Figure 2: Raft method installation

Seaweed is one of the economically important red a… tured in the world through different ways But in India basically it Cultur… ethods and another one is monoline methods. Out of two methods, first net method culture started widely. Due to long-life of used materials in Net methods (floating raft), this method popular for Commercial culture (*Kappaphycus alvarzii*).

Figure 4 Seed stocking in raft method

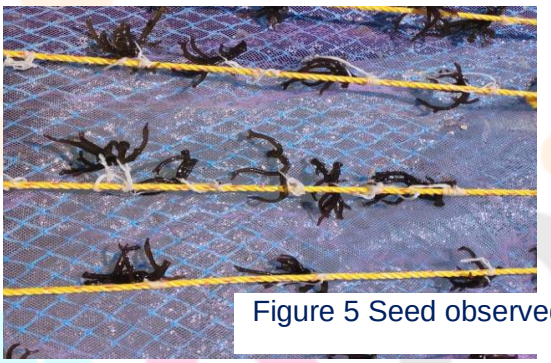


Figure 5 Seed observed after stocking

floating raft is Create of bamboo 3x3 mainframe and 4x4 for oblique. In every raft minimum 20 above monoline rope are used for cultivation. The piece approximately 15 cm tied Gaping 10-15 cm rope. in a raft minimum. 20-25 point in one line rope in one raft minimum to stocking 40 – 60 kgs. To protect *K. alvarzii* from predator, need covers with fishing net at 4m*4m size at bottom levels. One anchor holds a lot of rafts. During 10-12 rafts minimum 3-4 anchor are required. After installation the frame structure, need to check water parameter and then we will stock the species. After 15 days stocking need to observed growth rate. Total culture duration 45-60 days. The daily growth rate calculation id following by the mentioned formula (Dawas et. Al,)

$$\text{DGR\%} = \frac{In(W_f - W_0)}{t} \times 100$$

W_f is final fresh weight (g) at "t" days

W_0 is the initial fresh weight (g)

t is the number of culture days

Before cultivation need to check water parameter including pH, salinity, water temperature for optimum range. outdoor culture mainly natural water condition. Basically, February to October month is good for culture. We culture approximately minimum 1-2 m depth at low tide where water motion was good. Before installation remove all seagrasses and sea urchin. These primary methods we are cultured, and also observed the water motion and turbidity, before installation we are check law tide water condition and depth

STUDY AREA

For seaweeds farming through outdoor method, first important thing is place identifying. In coastal area where water quality is good and that place sheltered from very strong wave & wind. For seaweeds farming need to avoid fresh water mouth area because fresh water affects badly in seaweeds farming. Salinity is the most important factor in seaweeds farming, Basically seaweeds growth depends on salinity. For seaweeds farming optimum salinity is 25-35 ppt. For *Kappaphycus alvaerzii* optimum salinity is 30-35 ppt. Culture is ensuring, salinity does not fluctuate. Slow Water movement best for seaweeds culture. Also, area ensure nutrient base. For seaweeds farming water depth required 1-2 meter with pollution free environment. Water temperature 22-28˚C will be good.

Figure 8: Weekly monitoring

Figure 7: Raft condition checking

ties, tourist activities, etc.

Figure 9: Study area

RESULTS

As below given the results of seaweeds (*Kappaphycus alvarzii*) growth in nursey stage through indoor methods (micropropagation method)

K. alvarezii stocking details through micropropagation method-Nursery stage 1.

STOCKING DETAILS (Culture in Can/Jar)				
Code no	Date of chopping	No of pieces	Weight initial/Pcs	Length initial/Pcs
KAP1	02-09-22	1074	76mg	1cm
KAP2	02-09-22	1123	73mg	1.1cm
KAP3	02-09-22	1738	78mg	1.2cm
KAP4	03-09-22	2874	86mg	1.3cm
KAP5	03-09-22	2342	75mg	1cm
KAP6	03-09-22	2097	69mg	0.9cm
KAP7	03-09-22	2541	77mg	1cm
KAP8	04-09-22	2765	68mg	0.9cm
KAP9	04-09-22	1970	85mg	1.3cm

K. alvarezii growth rate through micropropagation method-Nursery stage 1.

GROWTH DETAILS							
Code no	Date of outdoor	No of Explants	D.O.C	SR %	Final weight/Pcs	Final length/Pcs	DGR (mg)
KAP7	26-10-22	2498	54	98.30	136mg	1.7cm	0.79
KAP8	26-10-22	2693	53	97.39	129mg	1.5cm	1.35
KAP9	27-10-22	1903	54	96.59	148mg	1.9cm	1.24
KAP6	27-10-22	2015	55	96.08	128mg	1.4cm	1.49
KAP4	28-10-22	2738	56	95.26	147mg	2.1cm	2.42
KAP5	28-10-22	2226	56	95.04	135mg	1.6cm	2.07
KAP3	29-10-22	1632	57	93.90	137mg	1.8cm	1.8
KAP2	03-11-22	1054	62	93.85	131mg	1.6cm	1.11
KAP1	06-11-22	1003	65	93.38	135mg	1.6cm	0.90

K. alvarezii stocking details through micropropagation method-Nursery stage 2.

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STOCKING DETAILS (Culture in FRP Tank)				
Code no	Date of chopping	No of pieces	Weight initial /Pcs (mg)	Length initial/Pcs(cm)
FRP1	28-10-22	3500	131	1.6
FRP2	28-10-22	3500	135	1.6
FRP3	29-10-22	3500	128	1.4
FRP4	03-11-22	3500	147	2.1
FRP5	06-11-22	3500	135	1.6

K. alvarezii growth rate through micropropagation method -Nursery stage 2.

GROWTH DETAILS							
Code no	Date of outdoor	No of Explants	D.O.C	SR %	Final weight/Pcs	**Final Length/Pcs**	DGR (mg)
FRP1	17-12-22	3312	50	94.62	269mg	3.97cm	2.76
FRP2	17-12-22	3165	50	90.42	282mg	4.17cm	2.94
FRP3	18-12-22	3190	50	91.14	268mg	3.94cm	2.8
FRP4	23-12-22	3260	50	93.14	302mg	4.47cm	3.1
FRP5	26-12-22	3200	50	91.42	280mg	4.14cm	2.9

Water parameter report during culture.

Water Parameter					
Water parameter	8-11-22	16-11-22	24-11-22	02-12-22	10-12-22
Salinity	32 ppt	32ppt	32ppt	32ppt	32ppt
Temperature	26˚C	26˚C	26˚C	26˚C	26˚C
pH	8.6 ppt	8.6 ppt	8.6 ppt	8.6 ppt	8.6 ppt

As below given the results of seaweeds (*Kappaphycus alvarzii*) growth in nursey stage through outdoor methods (bamboo raft net method)

K. alvarezii stocking details in bamboo raft net method.

STOCKING DETAILS				
Code no	Date of chopping	No of pieces	Weight initial/ Pcs (gm)	Length initial/Pcs (inch)
RAFT1	02-12-22	155	80	5.8
RAFT2	02-12-22	148	80	6.2
RAFT3	02-12-22	146	80	5.9
RAFT4	02-12-22	152	80	5.7
RAFT5	02-12-22	145	80	6.1

K. alvarezii stocking details in bamboo raft net method

GROWTH DETAILS (Weight & length measured per Pcs)							
Code no	Date of outdoor	No of Explants	D.O.C	SR %	Final weight	Final length	DGR (gm)
RAFT1	06-01-23	142	35	91.61	368	8.7	8.22
RAFT2	06-01-23	138	35	93.24	431	7.9	10.02
RAFT3	06-01-23	137	35	93.83	387	8.9	8.77
RAFT4	06-01-23	146	35	96.06	398	8.8	9.08
RAFT5	06-01-23	140	35	96.55	354	9.0	7.82

Water parameter report during culture (Outdoor method).

Water Parameter					
Water parameter	02-12-22	10-12-22	18-12-22	26-12-22	06-01-23
Salinity	32	32	31	31	32
Temperature	26˚C	24˚C	23˚C	22˚C	21˚C
pH	8.4ppt	8.3ppt	8.2ppt	8.2ppt	8.1ppt

DISCUSSION

My study about *Kappaphycus alvarezii* species, started on September month of 2022. First seed stocked on 2nd September of 2022 in three jar (five litre capacity) for indoor culture (nursery stage 1) through micropropagation method then 3rd and 4th September seed stocked in four and two jar respectively. Seed stocking jar tagged by code KAP1, KAP2, KAP3, KAP4, KAP5, KAP6, KAP7, KAP8, KAP9 and in this jar stocking details are respectively 76 mg weight (1074 pieces) ,73 mg weight (1123 pieces), 78 mg weight (1738 pieces), 86 mg weight (2874 pieces), 75 mg weight (2342 pieces), 69 mg weight (2097 pieces), 77 mg weight (2541 pieces), 68 mg weight (2765 pieces), 85 mg weight (1970 pieces). In my observation after first stage (Nursery stage 1) of culture survival rate and daily growth rate are respectively KAP1 (93.38% & 0.90mg), KAP2 (93.85% & 1.11mg), KAP3 (93.90% & 1.8mg), KAP4 (95.26% & 2.42mg), KAP5 (95.04% & 2.07mg), KAP6 (96.08% & 1.49mg), KAP7 (98.30% & 0.79mg), KAP8 (97.39% & 1.35 mg), KAP9 (96.59% & 1.25mg)

Second seed stocked on 28th & 29th October, 3rd & 6th November of 2022 in five FRP tank for indoor culture (nursery stage 2) through micropropagation method. Seed stocking FRP tank tagged by code FRP1, FRP2, FRP3, FRP4, FRP5 and in this FRP tank, stocking details are respectively 131 mg weight (3500 pieces) ,135 mg weight (3500 pieces), 128 mg weight (3500 pieces), 147 mg weight (3500 pieces), 135 mg weight (3500 pieces). In my observation after first stage (Nursery stage 1) of culture survival rate and daily growth rate are respectively FRP 1 (94.62% & 2.76mg), FRP 2 (90.42% & 2.94mg), FRP 3 (91.14% & 2.80mg), FRP4 (93.14% & 3.1mg), FRP5 (91.42% & 2.9mg).

Third seed stocked on 2nd December in five rafts in bamboo raft methods. Seed stocking raft tagged by code RAFT1, RAFT2, RAFT3, RAFT4, RAFT5 and in this RAFR methods, stocking details are respectively 80 gm weight (155 pieces) ,80 gm weight (148 pieces), 80 gm weight (146 pieces), 80gm weight (152 pieces), 80 gm weight (145 pieces). In my observation after first stage of culture survival rate and daily growth rate are respectively RAFT1 (91.61% & 8.22gm), RAFT2 (93.24% & 10.02gm), RAFT3 (93.83% & 8.77gm), RAFT4 (96.06% & 9.08gm), RAFT5 (96.55% & 7.82gm). In my overview on this culture, seaweeds farming of *Kappaphycus alvarezii* species, bamboo raft method is best for grower stage but micropropagation method better for nursery stage. Bamboo raft method basically used for commercial culture but micropropagation method used for commercial culture and research purpose. Bamboo raft method used more due to its easy procedure and low cost. Micropropagation method is very sensitive and required trained worker. In micropropagation method survival rate is high compare to bamboo raft method. Basically, disease outbreak seen in bamboo raft method but in micropropagation method its very lightly seen. In my study disease not found. In culture procedure water parameter play important role. In my study, observered salinity, pH and water temperature are major factor for seaweeds farming. Salinity checked by salinity refractometer machine, and pH checked in pH kit, and water temperature check through water thermometer. My study during about Kappaphycus alvarezii species from seaweeds group, express whole life cycle including taxonomy to cultivation. My study not only express the taxonomy and cultivation of the species, also blooming the commercial important and significant that co-related with our country. In my study I am discuss about this species step by step. Here mainly I highlight the future economic importance about the farming of Kappaphycus alvarezii that process through micropropagation method. In my paper I am discuss another culture process out of micropropagation method that called by Monoline method & bamboo raft methods. In India out of these three methods, monoline method is very popular due to its easy handling with low budget. I started the culture in marine sallow water, with bamboo raft and monoline methods in mandapam area of Tamil Nadu. seaweed is suitable for more than 30 ppt water marine water, the ideal temperature was 24˚C. Each bamboo raft minimum 3×3 meters and every raft poles have 10 to 15 cm. Every raft floating freely, K. alvarezii is very sensitive seaweed, basically women are working in site, in culture period also maintained temperature, turbidity, salinity, pH. its most important factor in seaweed growth. And observe the water motion, every week we are observed the growth. Seaweeds cultivation is not only a farming or part of research, it is a big scope of earning in India. Importance of seaweeds farming increasing day by day in India. From seaweeds group, culture of Kappaphycus alvarezii species is increasing rapidly due to its good survival rate.

Also, economic value of its is very high in global market including India. Behind the economic value of this species have various reason. It used on medicine industry, animal food industry, chemical industry, etc. Due to used in medicine industry, Its economic value increasing rapidly like log phase of bacteria growth in global market like India,

Production cost for 4.5 tons biomass of *K. alvarezii*

Budget of Seaweeds Farming		
Sl. No	Component	Cost
1	Total bamboo	2000
2	Tube net	2500
3	Anchor	1500
4	Tags, Ropes, Floats	3000
5	Plastic jar	2800
6	Blower	26000
7	refractometer	2900
8	Chemicals	5700
9	Pipes	6600
10	Weight machine	3300
11	FRP tank (5)	41,700
12	Light	4400
13	Microscope	14,700
14	Employs expenses	70,000
15	Electricity	5500
16	Other	6000
17	**Total Cost**	**1,98,600**
18	**Selling price/ Kg**	**90**
19	**Harvest Biomass (Tons)**	**4.5**
20	**Gross revenue**	**4,50,000**
21	**Net Profit**	**2,06,400**

CONCLUSION

In the present study it is concluded that seaweed farming is very popular cultivation in India. Sea weed farming is a very low budget and high-income source. In my study period I cultured in two types processes one is indoor micropropagation and another one is outdoor methods (bamboo raft), bamboo raft methods are the most common and low budget methods, and micropropagation methods is a modern and highly budget method. Seaweed farming rapidly growing with some new and modern technology. After the study it is concluded that k. alvarezii can be used in raft method. Due to consists to high nutrition value, it meets to protein resource criteria in food consumption.

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