



CULTIVATION OF SEAWEEEDS

INTRODUCTION

- **Marine macrophytes. Many are benthic and some are floating. Shallow waters (<200m)**
- ***Macrocystis* is the largest sea weed (single plant).**
- **3 groups based on pigmentation: Chlorophyceae (green), Phaeophyceae (brown) and Rhodophyceae (red).**
- **Alternation of generations in life cycle.**
- **Visual colour may not match their taxonomic colour.**
- **Commercial applications and use in aquaculture industry.**
- **Used as food, fodder, and industrially important products like agar and manure and pharmaceuticals are obtained.**
- **Around 20,000 sp. globally.**



IMPORTANT SPECIES

SEA WEEDS

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graph TD; A[SEA WEEDS] --> B[GREEN]; A --> C[BROWN]; A --> D[RED]; B --> B1[Monostroma]; B --> B2[Enteromorpha]; B --> B3[Ulva]; B --> B4[Caulerpa]; C --> C1[Undaria]; C --> C2[Laminaria]; C --> C3[Sargassum]; C --> C4[Dictyota]; C --> C5[Sargassum]; D --> D1[Porphyra]; D --> D2[Gracilaria]; D --> D3[Gelidium]; D --> D4[Gelidiella]; D --> D5[Eucheuma]; D --> D6[Laurencia];
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GREEN

Monostroma
Enteromorpha
Ulva
Caulerpa


BROWN

Undaria
Laminaria
Sargassum
Dictyota
Sargassum

RED

Porphyra
Gracilaria
Gelidium
Gelidiella
Eucheuma
Laurencia

SELECTION OF SEEDLINGS

- **2 options for culture - Reproductive unicellular (sexual) and vegetative propagation (asexual) methods.**
 - **Vegetative method using mother plant segments (rhizoids) is simpler and preferable.**
 - **Seeds are the vegetative propagules and the spores that can be utilised as the planting material.**
 - **Mother plant should be healthy, fleshy, elastic in texture, and should be free from foreign material and epiphytes.**
 - **If spores are to be used then either natural spores can be obtained by cultivation on artificial substrata in dense and healthy algal population or sporelings can be produced in hatcheries set-up on nearby land.**
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CULTURE METHODS

❖ **Species selection based on.....**

➤ Easy availability, fast growth rate, easy cultivability, mode of reproduction, tolerance to wide range of physico-chemical parameters, extractability of products, nutritional and market value.

❖ **Site selection:**

➤ Calm, nutrient rich waters with optimum water movement.

➤ Areas having a natural growth of sea weeds.

➤ Nature of substratum, salinity changes, waves and currents, water depth, availability of light and accessibility.

➤ Rocky substratum for majority of them.

➤ Salinity- critical factor, most spp. need 30-35ppt.

➤ Low temp.of 10-20° C is preferred by most of the seaweeds.

➤ Suitable depth and transparency. Avoid turbid areas.

➤ Nutrients – limiting factor.

➤ Site cleaning in the beginning and at regular intervals to remove sea urchins, star fishes, clams, other seaweeds etc.



DIFFERENT CULTURE METHODS

- Line farming, net farming, raft culture, pond culture and on-bottom culture.
- **LINE FARMING:**
- Seedling materials collected from the fragments cut from the apical parts of healthy mother plants.
- Inserted in the twists of plastic or nylon ropes (5mm thick) at 5 cm intervals.
- Ropes tied to poles fixed in the sea and the whole unit is submerged at 1-2 m depth.
- Additional stakes are used to prevent the ropes from sagging.
- Periodical cleaning.
- Harvested after 2-3 months using scissors leaving the basal portion on the ropes for regeneration.



LINE FARMING

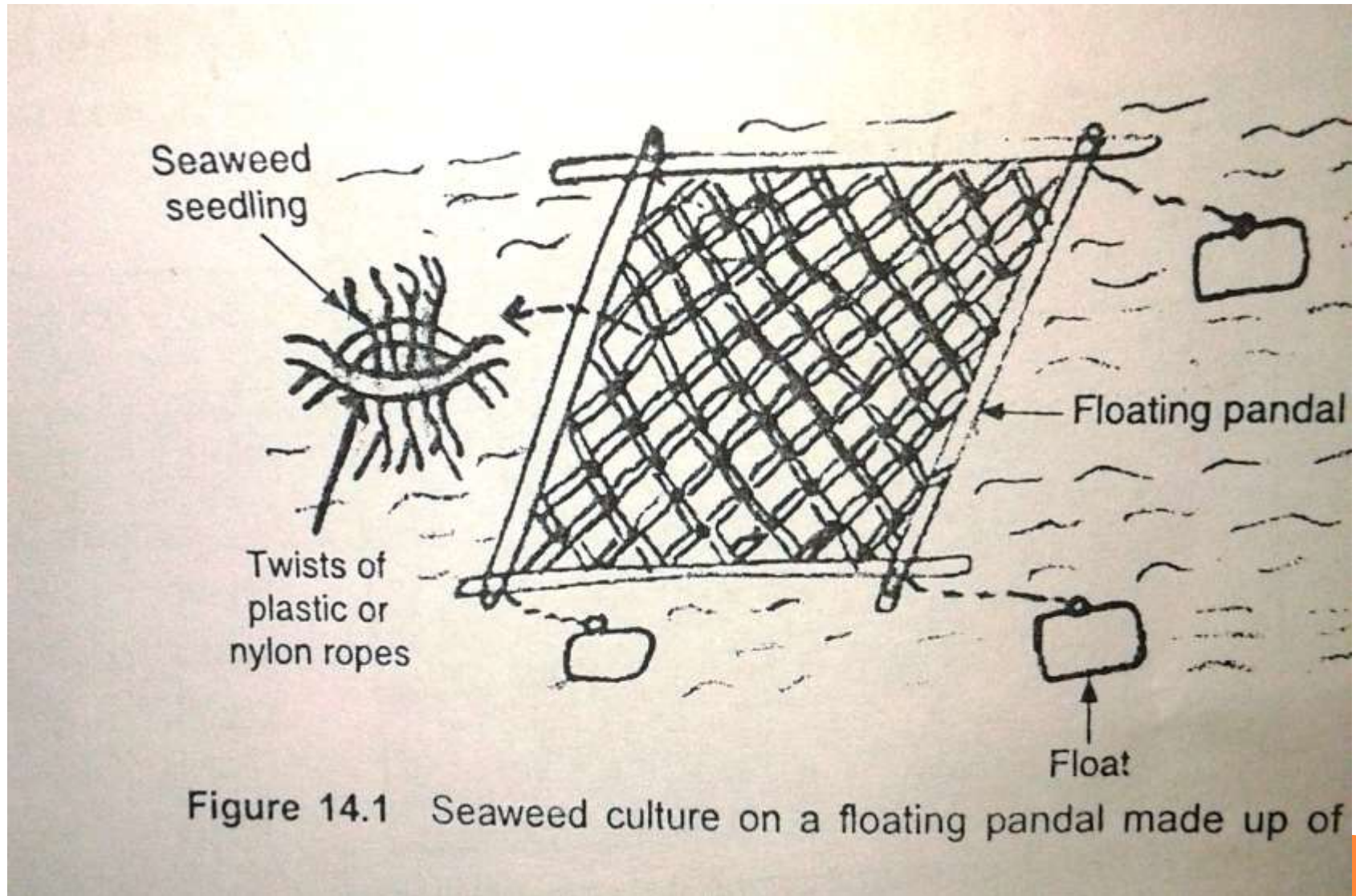


Figure 14.1 Seaweed culture on a floating pandal made up of

DIFFERENT CULTURE METHODS....

○ **NET FARMING:**

- Coir nets of various size (1m x 1m) with a mesh of 7.5-15 cm are used.
- Seedlings inserted in the twists of coir ropes.
- Nets are tied to the poles which are already erected at the cultivation site and placed horizontally and kept in submerged position making sure that a depth of 0.5m even at the lowest tide.
- **Nets can be fixed....**
 - 1) at the bottom using cement or concrete blocks,
 - 2) or kept in semi-floating state,
 - 3) or floating state using floats.
 - Plastic, aluminium or fibreglass floats are used.
 - Periodical cleaning.
 - 60-80 days culture.
 - Harvested using scissors leaving the basal portion for further growth.



NET FARMING:

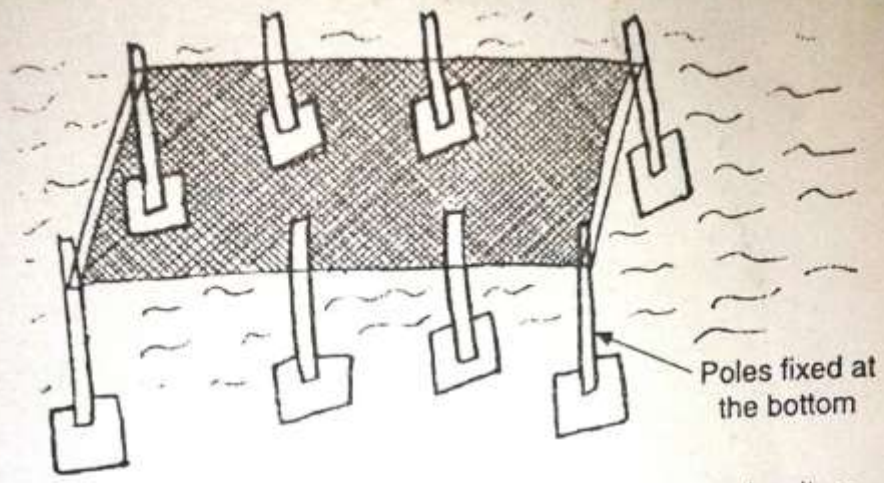


Figure 14.2 Use of fixed net pandal in seaweed culture.

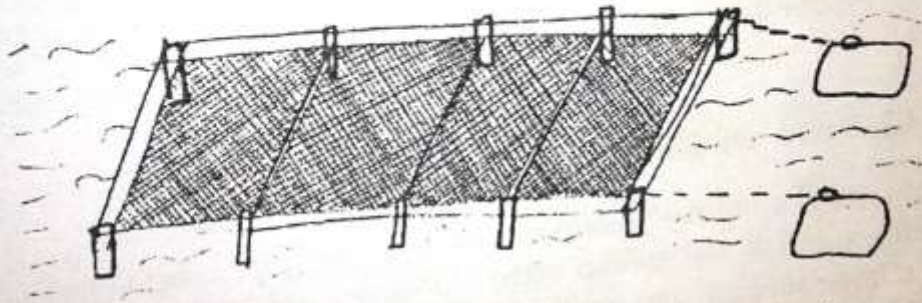


Figure 14.3 Use of semi-floating nets for seaweed culture.

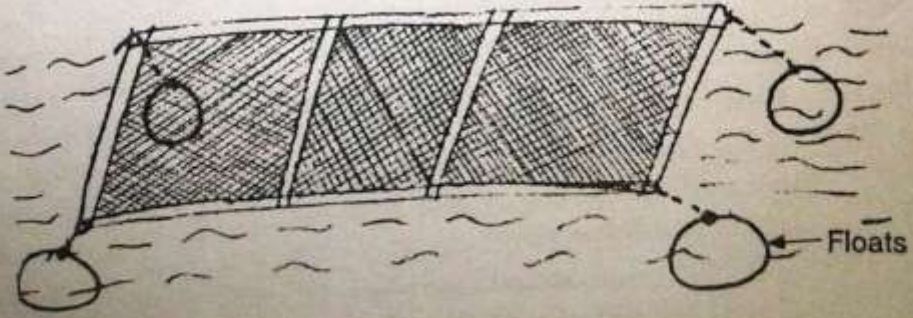
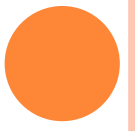


Figure 14.4 Floating nets used in seaweed culture.




DIFFERENT CULTURE METHODS....


○ **RAFT CULTIVATION:**

- Cultivation on bamboo rafts of 2.5 x 2.5m with lines and plants submerged at 30cm in water.
- The raft is anchored either at the bottom with a stone or concrete block or it is tied to bamboo poles and positioned either parallel to or perpendicular to the water current.
- Surface weather conditions influence this method.
- Raft method is suitable in areas with unfavourable tidal range and water depth.

○ **POND CULTURE:**

- Shrimp ponds or fish ponds can be used for the culture of green seaweeds like *Caulerpa* and red seaweeds like *Gracilaria*.
 - *Caulerpa* is a purely marine succulent green sea weed.
 - *Caulerpa* planting is done in pond drained up to 0.3m.
 - After planting water level increased gradually to 0.5-0.8m
 - Bury the plant cuttings into the mud.
 - Change water every 3-4 days.
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○ POND CULTURE....

- Fertilization is done using organic/inorganic manures by spreading the fertilizer solution as spray or dripping from fertiliser bags suspended above the water column.
 - Weeding is also practiced.
 - *Caulerpa* is harvested after 2 months.
 - *Gracilaria* is a euryhaline red seaweed suitable for pond culture. 20-28 ppt is the optimum salinity.
 - *Gracilaria* poly culture with shrimp/crab is possible.
 - Salinity beyond 30 ppt is common in summer which is harmful to *Gracilaria* and therefore freshwater must be available for dilution.
 - Pond bottom should be sandy loam with slightly alkaline water.
 - Water depth is maintained 30-40cm above the *Gracilaria*.
 - Fertilization is done for better growth.
 - 3 months culture.
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DIFFERENT CULTURE METHODS....

- **BOTTOM CULTURE ON CORAL STONES:**
- Coral stones are used as substratum and kept in the natural habitat of the desired species.
- The spores get settled on the coral stones and the sporelings are germinated. These are then transferred to the cultivation site.
- Not suitable for larger seaweed species.
- Suitable for sea weed reforestation.



SEAWEED HARVESTING


- Harvest size is species dependent but generally harvest can be done after 2-3 months.
- Cut using sharp knives or scissors leaving behind the basal portion for re-growth.
- Harvested sea weeds are washed, cleaned, and carried to the market.
- The post harvest operations depend upon the final product to be prepared from the seaweeds.



CONSTRAINTS IN SEAWEED CULTURE:

- **Environmental Calamities:** A lot of physico-chemical and envt.al factors influence the growth of seaweeds. Sudden changes in temp., pH etc. can affect the cultivation process.
- **Attack and grazing by predators:** Many species of fishes and crabs eat seaweeds or destroy by inhabiting them. Meshed protection and fencing are recommended.
- **Human interference:** Stealing of ropes, rafts, floats etc. and sometimes seaweeds as such are taken away.
- **Epiphytic algal growth on large species:** Smaller and economically unimportant species *Chaetomorpha*, *Centroceras* etc. grows on larger sp. like *Gracilaria*, *Sargassum* etc.
- **Use of unscientific harvesting methods:** Uprooting of the entire thalli including rhizoidal attachment leads to poor harvest in future.
- **Improper drying and storage facilities:** Leads to loss of harvested quality seaweeds.

TOP TEN SEAWEED PRODUCER COUNTRIES (WILD + CULTURE)

1. China.
 2. France
 3. UK.
 4. Japan.
 5. Chile.
 6. Philippines.
 7. N. Korea.
 8. S. Korea.
 9. Indonesia.
 10. Norway.
- ❖ **India is ranked 21** with negligible production.
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TOP TEN SEAWEED PRODUCER COUNTRIES (CULTIVATED)

1. China.
2. Japan.
3. Philippines.
4. N. Korea.
5. S. Korea.
6. Indonesia.
7. Chile.
8. Tanzania.
9. Malaysia.
10. Kiribati.

➤ **India is NOT listed.**



INDIAN RESOURCES AND SCENARIO

STATE / UNION TERRITORY	NUMBER OF SEAWEED SPECIES
Gujarat	202
Maharashtra	152
Goa	75
Karnataka	39
Kerala	20
Lakshadweep	89
Tamil Nadu	302
Andhra	78
Odisha	1
West Bengal	6
Andaman & Nicobar Islands	34



