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Cultivation of Kappaphycus and its Factors

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ABSTRACT

Seaweed cultivation is highly dependent on proper cultivation techniques and with appropriate cultivation methods. The selected cultivation method should be able to provide good growth, easy to apply and the raw materials used are cheap and easy to obtain. Seaweed business development opportunities include the development of seaweed products, namely in addition to being produced in dry form, seaweed can also be used as SRC (Semi Refined Carrageenan) and RC (Refined Carrageenan) whose selling price is tens of times compared to only produced in the form of dried seaweed (raw materials). Barriers that arise in seaweed cultivation include the quality of population resources coastal areas as grass farmers are still relatively low, resulting in seaweed of poor quality. The poor quality is due to the mixing of seaweed production with other objects such as salt, nails, and iron and the inappropriate application of the cultivation period. Based on the background above, the formulation of the problem can be drawn as follows: How is the cultivation technique of *Kappaphycus alvarezii* seaweed. This paper discussed the cultivation of red alga (*Kappaphycus*) and the factors which may give impact during its cultivation, such as: Site selection criteria, bottom type, water movement, sunlight, water temperature, water depth, and water pollution.

Keywords: Seaweed, Red Alga, Kappaphycus, Seaweed Cultivation

Introduction

The successful of seaweed cultivation is highly dependent on proper cultivation techniques and with appropriate cultivation methods. The selected cultivation method should be able to provide good growth, easy to apply and the raw materials used are cheap and easy to obtain. According to Atmadja (1996), cultivation methods developed in Indonesia include the floating raft method, the off-bottom method and the longline or spanning method.

Barriers that arise in seaweed cultivation include the quality of population resources coastal areas as grass farmers are still relatively low, resulting in seaweed of poor quality. The poor quality is due to the mixing of seaweed production with other objects such as salt, nails, and iron and the inappropriate application of the cultivation period. Marketing of seaweed is still in the form of export-scale raw materials. Another obstacle in seaweed cultivation is the attack of pests and diseases such as the

attack of baronang fish (Siganus sp.) and ice-ice disease as well as weather conditions that change depending on the season, another problem is a disease that attacks seaweed called ice-ice which causes plants to turn white. Another disease that always attacks seaweed is white spot. In accordance with the opinion (Anggadiredja, 2006) that white spot disease is characterized by a change in the thallus from yellowish brown to white then spreads and eventually rots.

Seaweed business development opportunities include the development of seaweed products, namely in addition to being produced in dry form, seaweed can also be used as SRC (Semi Refined Carrageenan) and RC (Refined Carrageenan) whose selling price is tens of times compared to only produced in the form of dried seaweed (raw materials).

Based on the background above, the formulation of the problem can be drawn as follows: How is the cultivation technique of *Kappaphycus alvarezii* seaweed. What are the obstacles that often occur, and what are the business development opportunities from Kappaphycus alvarezii seaweed cultivation, This paper discussed the cultivation of red alga (*Kappaphycus*) and the factors which may give impact during its cultivation.

Red Alga (*Rhodophyta*)

Red alga (Rhodophyta) is a type of macroalgae that has a network of vessels that transport water and food such as higher plants (terrestrial), body cells are autotrophic and contain the main photosynthetic pigments, namely phycoerythrin and xanthophyll, as well as other pigments such as chlorophyll a, and chlorophyll. c. This type of red algae can live in deep sea waters such as Sargassum sp., as well as in shallow waters such as *Euchema spinosum*. Red algae generally grow attached to certain substrates such as coral rocks, mud and sand around the beach or other hard objects using their body parts called holdfast (Ghazali & Hijjatul Husna, 2018).

In Indonesia, it is reported that many red algae species are attached to parts of the mangrove forest which are areas of high nutrition. One area in Indonesia that has an extensive mangrove forest is Serewe Bay, East Lombok Regency (Ghazali & Hijjatul Husna, 2018). Utilization of red algae (Rhodophyta) is generally used as raw material for making agar and food ingredients (*Gelidium robustum, Gracilaria* sp., *Kappaphycus*, etc.).

Red algae have cell wall components consisting of fibrillar, and consisting of mannan and xylan and non-fibrillar components. This non-fibrillar component is attracting attention because it contains stabilizers, to form cells such as carrageenan and agar (sulphate-containing galactans) (Sulisetijono, 2000). This type of algae can also be cultivated and is usually used as an ingredient for making gelatin. Besides being made for gelatin, this algae is also commonly used as soup.

Kappaphycus contains enzymes, nucleic acids, amino acids, vitamins A, B, C, D, E and K as well as minerals such as sodium, potassium, phosphorus, iron and iodine (Anggadireja, et al., 2006). It can be used as an ingredient for making pastries, seaweed ice, food thickeners, and as desserts.

Cultivation approaches based on the optimal seasons for algae growth and changes in the environmental conditions of the water are expected to serve as a reference for the management and use of marine farmland to optimally and productively increase algae production (Kumar et al 2014; Radiarta, et al 2014). Seaweed K. alvarezii is a major export product of Indonesian aquaculture products (Radiarta, 2013).

Site Selection Criteria

According to Winarno (1990), the location of seaweed cultivation should be chosen in waters that are free from pollution, both pollution from domestic waste and from industrial waste. Observations from the field study site, June-December is the best time for seaweed production.

- Water must be allowed to move or flow slowly between the seaweed to permit it's the intake of nutrient from the seawater.
- The area must be protected from strong water currents, waves and wind. Sandy area and area which contain coral reef are the most preferred. Avoid estuarine area or area where fresh water and salt water mingle because it will fluctuate saltwater content in that area.
- Salinity should be between 27-35 (ppt).
- Water temperature should be between 25^{o}C to 30^{o}C.
- The depth of the water should not be less than 0.15 meter deep during low tides and 2 meter at high tides.
- Seabed should be strong enough to be able to hold fencing or other man-made structure intact.
- Other point that needs to be considered are the availability of labour, easy excess and trouble-free communication.
- Minimum water salinity required is about 28 ppt (parts per thousand) or more. Salinity is the term used to indicate the amount of salt you can measure in sea water.
- Be sure that do not plant seaweed in front of a river mouth or in fresh water, as fresh water will kill the seaweed.

Bottom Type

According to Soegiarto (1982), the depth should not be less than two feet (approximately 60 cm) at the lowest low tide and should not exceed seven feet (approximately 200 cm) at the highest tide.

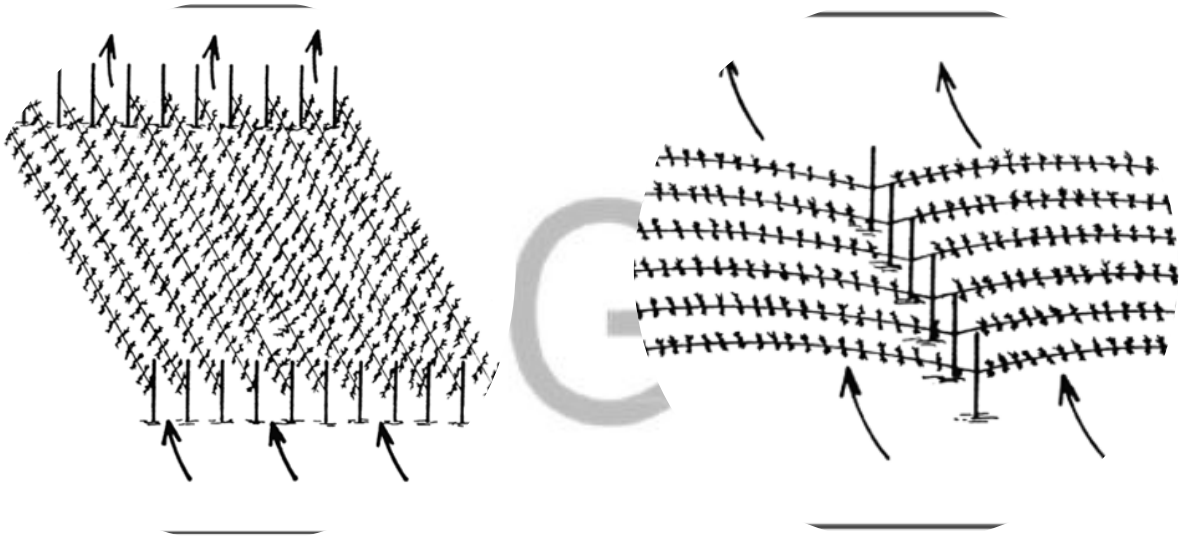
- A white sandy bottom with the presence of a limited amount of natural seaweed, is probably the best place to cultivate *Eucheuma*. If the bottom is covered with seagrass, *Kappaphycus*/*Eucheuma* will not grow very well. This is because other seaweeds might compete, absorbing the nutrients from the water leaving your *Kappaphycus*/*Eucheuma* plants starving. In this situation, plants might be covered with unwanted seaweeds and as a result, silt will quickly deposit on them.
- A sea bottom with hard coral formations and coral heads is not a good site to establish your farm. In such areas it is difficult to secure your stakes. In addition, plant eating fish generally live and aggregate around coral heads. From here, they move out from time to time to graze on your seaweed. As a result, they damage your plants.
- A muddy sea bottom, is also not advisable for your farming site because silt or mud will cover the plants reducing the seaweed growth and some extra work will be necessary to shake and keep clean your plants. Also, murky water will limit the amount of sunlight that is supposed to reach your plants.

Water Movement

- Moderate water movement is mostly preferred to strong water current . If the water current is too strong, it can

damage plants and even wash away planted lines by pulling down the stakes. It will also slow down work as it is difficult work in areas with strong swift current.

- However, be sure that there is a constant exchange of ocean water as the one you have with the changing of the tides and sufficient water movement as the one created by waves. This will bring the necessary nutrients to the plants for a healthy growth.
- As for any type of farming, the supply of nutrients is an essential factor for growing your crops. This applies to seaweed cultivation too. Therefore, remember to consider water movement as an important factor for seaweed growth while selecting the area for farms.
- The farm must be placed in such a direction that the water current flows into the farm and not against it as shown in the drawing.



A) The water current flows into the farm and not against.

B) Seaweed farm that set against water current. Strong water current can bend or even break the lines.

Sunlight

- *Eucheuma* requires sufficient sunlight for growth (photosynthesis). Sunlight is used by *Eucheuma* as a source of energy for its growth and to manufacture carbohydrates like carrageenan, the commercially valuable substance inside the seaweed. Thus, it is essential to have plenty of sunlight.
- Clear seawater allows sunlight to penetrate more easily to the plants. This is why when seaweed is planted close to the sea surface, it grows faster and healthier compared to that planted close to the sea bottom or in deep water.

Water Temperature

- Water temperature ranging form 25°C to 30°C is best for growing *Kappaphycus*/*Eucheuma*. In shallow waters near the beach, the water temperature can become quite high especially during a sunny day. Such an area is not suitable

for planting seaweed. The high-water temperature will kill the seaweeds.

- So, set farm away from the lowest tide mark (spring low tide limit). A good area is between the spring low tide limit and the reef edge or an area which does not dry up during these big low tides occurring during full or new moon.

Water Depth

- At least knee-deep water at spring low tide (0.5 meter) is the minimum water depth required to cultivate *Kappaphycus*/*Eucheuma*. In shallower waters seaweed can still grow, but it might be exposed to direct sunlight and wind.
- As soon as seaweed is exposed to sun and wind, the tender tips of the plants are destroyed and if exposed for a long time (2 to 3 hours), the whitening of the branches can be seen.
- This will indicate that part of the seaweed has been killed. Eventually branches will break and drift away from the whitened area.
- So, it is important to consider the water depth while selecting the area of cultivation.

Water Pollution

- Because *Kappaphycus*/*Eucheuma* prefers clear water and plenty of sunlight, even turbid water (muddy) will not sustain good seaweed growth.
- Chemical pollution will kill the seaweed as in the case of most marine plants and animals.

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