

SEAWEEDS



The following are the eight steps in farming eucheuma seaweeds:

1. Selection of site
2. Acquisition of permit to farm
3. Preparation of required materials
4. Clearing and posting
5. Preparation of seedlings and planting
6. Building a farm house
7. Maintenance of planted seaweeds
8. Harvesting and drying

SELECTION OF SITE

Site selection is one of the most important factors in seaweed farming. In selecting the site, the following factors are to be considered:

1. The area should be free from pollution caused by floods, rivers, and such other sources of water pollution that would be detrimental to the growth of seaweeds. Furthermore, freshwater from rivers or creeks will decrease the salinity of seawater and its temperature thus causing to seaweeds. The temperature of the seawater should be between 27° and 30° Centigrade and the salinity should be maintained at 30 to 34 parts per thousand (PPT).
2. The area must be well-protected from tidal waves and strong winds coming from an open sea. There should be an island or coral reefs to act as barriers during low tide to cover the area in order to prevent destruction and/or disturbance of seaweeds planted. Wave action greatly affects the growth of seaweeds and usually destroys them.
3. There must be enough water current that will bring in food with a velocity of 20 to 40 meters per minute which can bend eel grasses to a 45 degree angle. Eucheuma seaweeds eat their food from water nutrients through tiny pores within their body and these nutrients are brought in by water current. Furthermore, eucheuma maintains cleanliness and freshness of seawater.
4. Local residents must be asked to determine whether there were wild eucheuma previously growing in the area which would be more advantageous to the project. In case no wild eucheuma were growing in the area test on some plants must be conducted to determine their growth rate. The test period should be from two (2) to six (6) weeks.

5. Sea bottom must be covered with some dead finger corals and coarser sand and should be rocky not muddy, with few vegetations preferably only of the species of brown, red and green algae.
6. The depthness of the water at lowest tide mark should be at least 1 1/2 to 3 feet (45 cm to 90 cm.) to the highest tide mark of at least 7 feet (210 cm.). It should be determined so that seaweeds will not be over exposed to sunlight and air during low tide but should be exposed to enough sunlight penetration during high tide.
7. Test plants of eucheuma seaweeds should be done in the proposed area. Weigh your seedlings first and tie them to corals. As recommended, seedlings should weigh from 150 to 200 grams from fresh branches. These will be placed in different parts of the proposed area with a distance of at least 10 meters apart. Every week, these test plants should be weighed until the sixth week to determine the average daily growth rate. If the daily growth rate is from 2.5% to 4%, then the area is suitable for commercial seaweed farming.

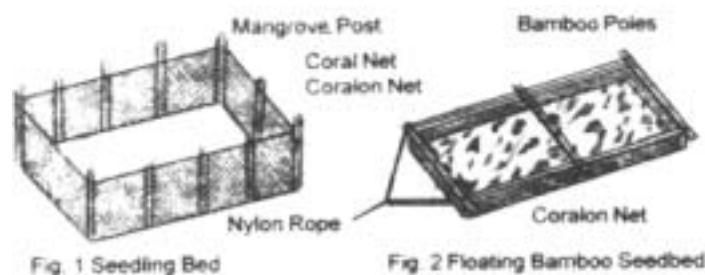
ACQUISITION OF PERMIT TO FARM

The proposed area must be surveyed by a geodetic engineer to determine the area's bearings and the exact size intended for the project. Once location bearing is determined including the total area in square meters, the applicant should acquire an official application form from the Bureau of Fisheries and Aquatic Resources (BFAR). He can then prepare all the necessary requirements as provided for by law. Guidelines promulgated by the (BFAR) must be followed to the fullest to avoid cancellation of the application. It should be noted that the application should be approved first before a permit is issued and before commercial farming commences.

PREPARATION OF REQUIRED MATERIALS

The following materials must be prepared based on a one hectare seaweeds farm:

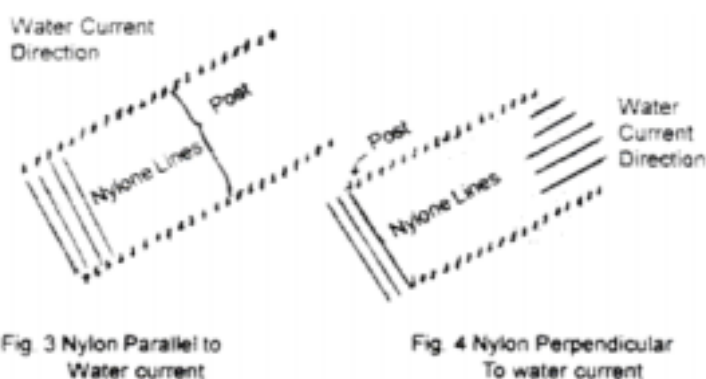
1. 1,200 mangrove posts measuring more or less 1 1/2 inches in diameter and 1 meter in length
2. 20 kilograms of nylon line number 150 to 200
3. 20 kilograms of plastic tie straw
4. one banca
5. 40,000 seedlings weighing from 150-200 grams each or a total equivalence of 6.000 kilograms
6. markers and signboard
7. seedling bed for at least 25 square meters or a floating bamboo seedbed.
8. 2 pointed iron or locally called "baras"
9. 2 bull hammer weighing 5 kilograms



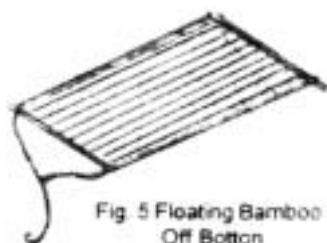
CLEARING AND POSTING

Clear the area of other species of seaweed, predators, big stones or corals, and other foreign materials that are destructive to seaweeds.

After clearing the area, measure the farm to the correct dimensions. Commence posting by using pointed iron bars or "baras". There will be two types of postings, either nylon lines will be parallel to the water current or perpendicular to the water current, as shown in Figure 3 and Figure 4, respectively. Either type of posting is applicable to monoline-bottom farming which is widely and commonly used because this is economical and well-protected. There is another common method of farming that is the off-bottom bamboo floating method as show in Figure 5. This method however, is not recommended because it is expensive compared to bottom method and also, this is destructive to fishermen's passage.



In posting, distances between posts holding one end of the nylon to the other, is one meter apart and with a side distance of at least five to 10 meters. Each post must be buried more or less six meters deep.



One problem in posting is the rocky sea bottom. To push the pointer iron bar use a heavy bull hammer. Then put the wooden post. Cover the total proposed area with posts before planting the seedlings.

SEEDLING PREPARATION AND PLANTING

Seedlings must come from a variety that has been proven to grow fast in the area. It must also come from the nearest source to avoid higher mortality and expenses when transporting to the area. However, a seedling bed should be prepared first before any transport of seedling to the area is done. The area will serve as a storing place of seaweed seedlings before planting.

The transport of seedlings is the most risky part of the process. There are factors to consider exposure to direct heat, wind over handling, and length of time off seawater. Seaweeds get their food from seawater brought in by water current so that once they are off the water for more than 12 hours and without pouring seawater into them in-between, seedlings will die. If the seedlings are placed in a container with inadequate ventilation, packed with too much pressure or there is an increase in temperature in the container, seaweed seedlings wilt die. Another factor is, when they are dipped in or wetted with fresh water or rain or any other liquid aside from seawater, they will die due to changes in salinity.

The manner of transporting seedlings commonly used and recommended are:

1. When the time required for transporting seedlings is eight (8) hours or less, then use a bamboo basket or wider bancas, covering them with cloth wet with seawater or any cotton made materials to avoid its exposure to sunlight and/or wind. In every one to two hours, wet them by pouring fresh seawater to maintain the temperature and the freshness of the seaweeds.
2. When the time required is more than eight hours but less than 36 hours, then use jute bags. Place the seedlings loosely inside the bags and dip it in seawater before loading them. While on transport, pour fresh seawater to the bag every three to four hours to maintain the temperature and the freshness of the seaweeds. It should be noted that these bags should be placed in cool, well covered and spacious portion of the boat, seeing to it that they are not placed one on top of the other.
3. When seedlings are transported for more than 36 hours, it is advisable that a plastic bag with corals and coarser sand inside is advisable. However, this type of transport is not recommended for commercial farming because it is expensive.

All transported seedlings should be placed immediately in the seedling bed. However, it is advisable that the seedlings are planted immediately to the area. Storing the seedlings in the seedling bed for more days will cause them to die especially that they are placed close to each other. Usually, minimum mortality on transported seedlings is 20 to 30 percent.

Split unsplit seedlings to desired weight and size. Tie the seedlings with straw and place them in a separate container in the area.

Common ways of tying seedlings to nylon lines:

1. Underwater, fastened a nylon line to the post. The planter will bring in the seedlings to the area and tie them to the nylon line. This procedure is advisable only when the tide is down and the current is not strong.
2. Or, place a nylon line between posts off the water and tie the seedlings to the line. After completely tying all the seedlings to line, place both ends of the nylon line to the opposite posts underwater. This way is good for all tidal positions except when raining or exposed to direct sunlight.
3. Or, tie the seedlings directly to the nylon line near the seedling bed but if there is already a house, then do it inside the farmhouse. Then bring the nylon lines to the area and tie the lines to the posts underwater.

It is common practice that seedlings are tied to nylon lines at a distance of eight to 12 inches apart. During the process of tying, seedlings must be covered from direct sunlight or rain. But it is advisable to submerge them in seawater most of the time.

In planting seedlings in a bamboo-raft follow the same procedure as in mono-line bottom method, only that nylon lines are tied to the bamboo rather than to the posts.

BUILDING A FARM HOUSE

After completely planting the area with seaweeds, a farm house should be built. It is advisable that a drying station is provided. This drying station in the house is necessary so that once seaweeds are harvested they can be dried right in the farm house.

MAINTENANCE OF THE AREA

Enough men must be employed with this project with a proportion of two to five men per hectare. They will have to clean the area daily. Dirt that cling to the seaweeds must be removed daily. Seaweed eating sea animals like sea urchins, starfishes and other predators, should be removed from the area. Inspection on seaweeds should be done on a daily basis.

At 45 days to a month old, branches of seaweeds start to fall off due to the water current. In order to save them from drifting away, a nylon net should be placed on two sides of the area that are perpendicular to the water current.

HARVESTING AND DRYING

Once seaweeds are 2 1/2 to 3 months old, start harvesting them. For economy, when harvesting, try to keep one fresh branch as your reserve seedling. However, if no fresh branch can be harvested and put aside, harvest all the seaweeds and replace with new ones. Always use a stainless knife when harvesting.

Use a wooden banca in harvesting seaweeds. Bring the harvest to the farm house drying station. To make it easier, use bamboo baskets. Usually, the time needed in fully drying seaweeds during sunny days is two to three days, while on cloudy days about five days.

If the space in the farm house is limited, then put the dried seaweeds into sacks and transport.

The initial planting is costly because seedlings are bought and much transportation cost is involved. However, in the succeeding plantings, the cost would be much lower because nylon lines will no longer be bought, so with the posts and seedlings plus the transport cost. Normally, posts should be changed every year and nylon line every two years.

PACKAGING

Fresh seaweeds, such as Caulerpa, Gracilaria and Codium which are intended for the local market are first thoroughly rinsed in clean seawater to remove mud and dirt. Sorting is also done to remove the weed species mixed with them. Packaging is an important post harvest activity which determines the shelf life of the seaweed.

Baskets made of bamboo are generally used as containers. The inner surface of each basket should be lined with gunny sack. Several layers of fresh or dried banana leaves or fresh seaweeds, such as Ulva or Sargassum should be placed over the bottom and along the sides of the basket. The basket is then filled with dean, fresh seaweeds. A topping of fresh seaweeds or banana leaves is then placed over the seaweeds, then the basket is finally covered with gunny sack which is secured by lacing it to the basket with tying materials.

Exposure to the sun or heat during transport should be avoided to Insure the freshness of the produce.

Seaweeds intended for food sold in local markets in dried form are first soaked in freshwater before consumption.

PRODUCTS FROM SEaweEDS

New products from seaweeds were developed by the Marine Bio-Organic Group of the University of the Philippines Marine Science Institute. Three of products are now being patented, while other seaweed-based food, fertilizer and personal-use products are now ready for commercialization.



1. **Seaweed-based air freshener gel (Seamoy).** This is a low-cost air freshener with a gel-like texture. It makes use of sweet floral scents that give a clean, fresh smell to rooms, cars, lockers' and cabinets.

Whole seaweeds are used in its manufacture (instead of polysaccharide extracts) making production cost low. Since the base allows a slow release of the essence, shelf life is prolonged. Unlike crystal air fresheners in the market, Seamoy can easily be divided into desired shapes and sizes for easier packing and use.

2. **Fruit-flavored candy-gels (fruity cubes).** These are jelly candies that are gummy-textured and come in different colors. Their flavors can be enjoyed by people of all ages. These are easy to manufacture and production cost is low. The polysaccharide used enhances the gummy texture better than gelatin.
3. **Pastilles (Euginto).** These are made from polysaccharides derived from seaweeds and local throat soothing substances. The manufacturing process is simple. The gummy texture is similar to that of imported pastilles. The materials used are locally available **and** the production cost is low.
4. **Menthol ointment (Ginhawa).** This is a non-greasy, soothing ointment that uses polysaccharides as a base for substances, such as menthol and camphor.

The polysaccharides used can replace the greater percentage of the usual compounds used as ointment bases. Thus, the formulation not only reduces the adverse effects between excipients, it also reduces possible allergic reactions of the user to the compounds. Production cost is similarly low.

5. **Seaweed-based fertilizer (Algro).** These are fertilizers that use the by-products of seaweeds processing. These fertilizers contain growth-promoting hormones and are fortified with nitrogen (N), phosphorous (P) and potassium (K) needed by plants.

The production process involves the use of pre-treatment wastes in agar/carrageenan production (or the slightly basic extract of old or enzyme-degraded brown seaweeds); waste that would otherwise be discarded. Water soluble, these fertilizers use only natural components that do not harm the soil.

6. **Suppository base.** This is a modification of the common suppository base formulations. It uses natural products, with carrageenan as the emulsifier and binder in place of gelatin. Once molded, it requires little refrigeration to retain its shape. It does not easily melt even at room temperature. Melting time at body temperature is comparable to that of gelatin suppositories.
7. **Skinless longganisa (Longsarap/Carraniza).** This is a high-fiber native sausage that contains refined and semi-refined carrageenan as a fat substitute. It allows the substitution of vegetable protein for an equal amount of pork meat. The product reduces the consumer's calorie intake and it is highly recommended for people on a low-fat diet.
8. **High-fiber pandesal (Pan de lusog/Pan de Carr).** This *pandesal* contains refined and semi-refined carrageenans that has a higher fiber content and longer shelf-life than ordinary pandesal. Its high fiber content is an aid to diabetic who wants to maintain a blood glucose level.
9. **Liquid soap/shampoo (Halimuyak/Humot).** This is a shampoo base prepared from biodegradable substances and seaweed polysaccharides. The seaweed polysaccharide as a viscosity enhancer that gives better body to the finished product.

By reducing the use of synthetic soap bases and using seaweeds instead, production cost is reduced. In addition, seaweed use poses no danger to the environment when disposed while providing the user with the usual cleansing effect of ordinary soap. The new products from seaweeds are the result of the transformation of research into useful, potentially profitable goods and commodities.

STEP INVOLVED IN GULAMAN MAKING



1. Select freshly harvested seaweeds gathered early in the morning or during low tide.



2. Wash the seaweeds with freshwater and drain thoroughly.



3. Spread the seaweeds into thin layers over wooden trays or in any clean container and dry under the sun for one week.
4. Resoak seaweeds in freshwater for 5-10 minutes. Dry again under the sun until the seaweeds turns dirty yellow.



5. Once the seaweeds are dried, bleach them with weak acids like vinegar until the color turns olive green.

A one-tenth kilo of dried seaweeds is either soaked in a solution of 3.5 liters of water and 90 ml of 0.1N sulfuric acid or soaked in a solution of half a liter water and 2.5 grams of commercial sodium thiosulfate.

6. Drain the bleached seaweeds and sun-dry until sufficiently dried (light brown in color)



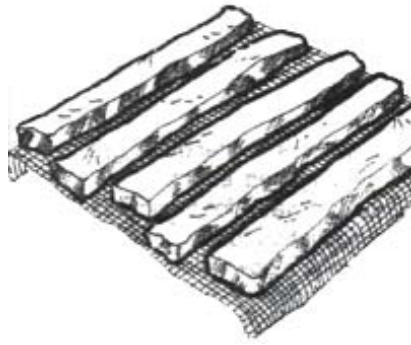
7. To the dried seaweeds, add 3-5 liters of water and a diluted solution of vinegar until slightly acidic to taste. Allow this to boil for 30 minutes to one hour while constantly stirring the solution. Boiling can be repeated until the solidification of the extracted agar is difficult to achieve.



8. After boiling, strain the seaweeds using ordinary cheesecloth. Separate the liquid portion from the plant residue.



9. After extraction, allow the filtered extract to cool and solidify. Once it is hard enough, cut into strips or to any desired form.
10. Pack the gulaman strips or bars into an ice box with dry ice or wrap them in cheesecloth with ice and salt, keep the bars intact for 2-3 days.



11. Thaw the gulaman bars by placing them on bamboo mattings or wire screen and allow them to dry at room temperature.
12. Finally, allow the extracted thawed agar to dry under the sun until the desired texture is obtained.
13. Cool the gulaman bars before packing and storing.

PICKLED SEaweEDS

Materials:

Eucheuma

Ingredients:

carrots
green and green pepper
garlic
ginger

Pickling solution:

1 cup vinegar
1 cup sugar
1 tsp salt

Procedures:

1. Soak eucheuma in fresh water overnight.
2. Drain and cut into desired length.
3. Blanch in lukewarm water for 5 minutes. Let it cool.
4. Boil the pickling solution for 5 minutes. Let it cool.
5. Mix all ingredients in a bowl except the pickling solution.
6. Pack in sterilized bottles
7. Pour the solution into filled bottles then seal completely.

References:

1. Seaweeds, An Industry Profile DA-AMAS
2. Produce Seaweeds and Earn Money DA-RFU IV
3. Steps involved in Gulaman Making DA-PCARRD, Feb. 1987

Sources:

1. Eucheuma Farming, 1989; Trono, G.C., Jr. and F.T. Greenfield Vol. 24 Nos. 3 and 5, 1999.
2. Handbook Guide, Seaweeds (Eucheuma) Farming 1990 Edition, Technology and Livelihood Resources Center.