# Developments In Seaweed Farming In Southeast Asia

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## Abstract

During the last thirty years, seaweed farming has progressed in the region comprising the Association of Southeast Asian Nations (ASEAN). Farm production reached a high of 146,500 mt of dried seaweeds in 1997 from an initial harvest of 500 mt in 1973. In 1997, the ASEAN region produced about 90% of the world's production of carrageenophyte seaweed, providing raw materials for the US$350 million world carrageenan market. Two species of carrageenophytes, *Kappaphycus alvarezii* (=*Eucheuma cottonii*) and *Eucheuma denticulatum* (=*Eucheuma spinosum*), constitute the base of the seaweed industry in the region. *K. alvarezii* is predominantly farmed in the Philippines and Malaysia while *E. denticulatum* is dominant in Indonesia. Vegetative propagation is still applied in all farmed species of carrageenophytes, while the monoline method remains the most popular method of farming. Non-traditional farming areas have been established in central and northern Philippines and in Sabah, Malaysia. The culture technology has been developed for *Gracilaria* sp.; however, no up-to-date reports on production are available. Seaweed farming has become one of the most important sources of livelihood for at least 100,000 coastal families in Southeast Asia, contributing apparently to the reduction of blast and cyanide fishing and to the relative improvement of peace and order in seaweed farming areas.

## Introduction

The seaweed industry in Southeast Asia was first recognized in the Philippines in the mid-1960s when there was an unprecedented commercial harvest of the red algae *Eucheuma.* Initially, no attempts were made to farm seaweed. From a harvest of 415 mt in 1969 from wild natural growth, seaweed production increased to 1,240 mt in 1996. In the early 1970s, the Philippines first commercial seaweed farming was introduced in Sulu Sea in southern Philippines, but later on, it was adopted in many areas of the southern and central Philippines, particularly in the Sulu archipelago.

The expansion of farming carrageenophyte algae led to the introduction of *Eucheuma* farming in Indonesia. *Eucheuma spinosum* (=*E. denticulatum*) was introduced in Bali, Indonesia in 1978 and, in 1985, seedlings of *E. cottonii* (=*Kappaphycus alvarezii*) were brought to Bali from the Philippines. During the last thirty years, the seaweed industry has progressed in the ASEAN region. The ASEAN region produced about 90% of the world's production of carrageenophyte seaweeds providing raw materials for the US$350 million world carrageenan market. The regular cropping system now provides a reliable and sustainable environment-friendly alternative livelihood to coastal communities in the Philippines, Indonesia, and Malaysia. Farm production reached a high of 146,500 mt of dried seaweeds in 1997 from an initial harvest of 500 mt in 1973. Two species of carrageenophytes – *K. alvarezii* and

*E. denticulatum* constitute the base of the seaweed industry in the region. *K. alvarezii* is predominantly farmed in the Philippines and Malaysia while *E. denticulatum* is dominant in Indonesia. Vegetative propagation is still applied in all farmed species of carrageenophytes while the monoline method remains the most popular method of fanning. Non-traditional farming areas are developed in central and northern Philippines and in Sabah, Malaysia. The culture technology has been developed for *Gracilaria* sp.; however, no up-to-date reports on production are available.

## Commercial Cultivation and Production of Seaweeds

### *Carrageenophytes*

Two species of carrageenophytes, *K. alvarezii* and *E. denticulatum* are produced commercially through farming, thus constituting the base of the multi-million seaweed industry in Southeast Asia. In spite of the negative effects of the El Nino weather phenomenon that hit the *Eucheuma* farms in Southeast Asia and tsunamis that devastated the western Sitangkai in the Sulu archipelago in 1998, which is considered one of the biggest seaweed farming areas in the Philippines, the region has produced about 90% of the world's production of carrageenophytes, equivalent to a total of 144,225 mt. In the same year, Philippine seaweed production reached a total of 109,225 mt followed by Indonesia with 29,000 mt and Malaysia with 6,000 mt. The majority of production from the Philippines and Malaysia is *K. alvarezii* while the production from Indonesia is more of *E. denticulatum.* Presently, there are over ten strains of carrageenophytes farmed. The giant "tambalang" strain of *K. alvarezii* is farmed in southern Philippines. The search for a disease-tolerant strain led to the introduction of the "sacol" variety in the central and recently in the northern Philippines.

### *Agarophytes and Caulerpa*

Among the agarophytes for the processing of agar are several species of *Gracilaria* and *Gelidiella.* A large portion of the raw material are cultured in ponds while the rest are still harvested from wild stocks. Pond and open-lagoon culture is followed in *Caulerpa lentillefera* farming. In spite of their huge economic potential and the availability of culture technology, no up-to-date information is available on the culture and production of these seaweed species.

## Economic Importance

### *Beneficiaries*

Due to the increased demand for *Eucheuma* raw material and the opportunities to earn higher income, seaweed farming has become the most important means of livelihood among coastal and island communities. Non-traditional farming areas are utilized for the mariculture of the two commercially important carrageenophytes. More than 100,000 coastal and island families in the Philippines, Indonesia, and Malaysia are presently engaged in seaweed cultivation An area of more than ten thousand hectares has been estimated for the mariculture of these carrageenophytes.

### *Average annual income per family*

A family normally cultivates an area of a quarter to one half of a hectare. This area can accommodate 500 monolines of 10 m length and a distance of half meter between lines. Two hundred and fifty lines can be harvested monthly, with a 60-day growth cycle producing a net harvest of 12,500 kg fresh seaweeds. At a farm gate price of P20 per kg (US$0.50), a family earns an average gross annual income of P320,000 (US$8,000). An initial investment of P40,000 (US$1,000) is required.

## Farming Methods

Vegetative propagation is still widely applied in all farmed species of carrageenophytes. From the original net method introduced by Dr. Maxwel Doty, the farmers have introduced innovations of farming to suit the condition of the farming site. The most popular is the monoline method of farming. Floating monoline method is utilized in deeper areas, while bottom monoline farming is generally used in shallow reef flats and coastal waters. Other farming methods include stake and net, bamboo raft, suspended rope and line with float, and broadcast. These methods are utilized for both *K. alvarezii* and *E. denticulatum.*

### *Polyculture potential*

A polyculture system to integrate seaweed farming with other marine fauna like abalone, giant clams, sea cucumber and fish is also fast developing in the region. However, this polyculture potential remains to be developed and utilized. To maximize the production of resources per unit area, a research and development program should be initiated to focus on these aspects of seaweed polyculture.

## Ecological Importance

The experience during the last thirty years of seaweed farming has shown a substantial regeneration and rehabilitation of the marine environment where the seaweed farms are located. In most ASEAN countries, particularly the Philippines, coral reef areas have been reported to be degraded, over-exploited, destroyed and virtually turned into ocean deserts. Destructive fishing activities such as dynamite and cyanide fishing are prevalent. With the introduction of seaweed farming in some areas, the seas became more alive and productive. For example, the establishment of MCPI Corporation's Ocean Farming Research Center in the Danajon Reef in central Philippines appeared to have restored the ecological balance in the area, resulting in a significant increase in the daily catch of abalones, sea cucumbers, sea urchins, mollusks, and fishes by local fishermen. Farmed seaweed beds in the area likewise attract various marine food organisms and could provide shelter to fish, mollusks, and other marine life. Hence, seaweed beds have become a new sanctuary and breeding ground for many marine organisms, consequently regenerating the reef and increasing the farmers' harvest from the reef.

Several concerns for potential disturbance and pollution of the reef ecosystem have been raised however. One of these is increased pollution in the farm area. But, the fact is seaweeds should not be farmed in polluted water since they require a clean environment and relatively strong water current to assure the flow of nutrients that nourish the plants. Likewise, farmers regularly clean the farm beds of foreign materials and guard them to ward off trespassers, dynamite fishers, cyanide sprayers and shell collectors. These practices may contribute to ecological stability and sustained productivity of the reef.

## Recommendation

Seaweed farming is an important economic activity that provides not only an alternative livelihood for coastal communities but also promotes ecological regeneration. Both government and private sectors in ASEAN countries should therefore cooperate and encourage the development and advancement of farming, post harvest activity/processing and product applications of seaweeds.

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