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Seaweed culture

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Seaweed culture

The SEAFDEC Aquaculture Department recommends bottom monoline culture of the seaweed *Kappaphycus alvarezii* var. *tambalang*. Here's why.

Two methods are used to culture seaweeds in western Visayas, Philippines: bottom monoline and raft monoline. In the bottom monoline method, one row consists of two mangrove posts 76 cm long driven to the bottom 6-10 m apart. Monofilament lines (110 lbs test) are strung between these posts about 30 cm from the bottom. The average distance between rows is 0.5 m.

The raft method, on the other hand, consists of a floating 5x5 m bamboo raft anchored to the bottom by a polyethylene rope. Monofilament lines (110 lbs test) are strung across the bamboo raft at 20-30 cm intervals. On the average, a seaweed farmer owns two rafts. The raft monoline method is a variation of the floating raft method with nylon nets.

The average farm size is 580 m^2 in the bottom monoline method and 170 m^2 in the raft monoline method. Seaweed farms are located on shallow reef flats, 20-30 m from shore and 50-300 cm deep during lowest tide.

Seaweed cuttings weighing 150 g are tied to the monofilament lines at 16-20 cm intervals. Since farming areas are limited, cuttings are tied at closer intervals. This way reduces algal epiphytes but results in overcrowding and self-shading.

Extensive farming of seaweed is practiced in western Visayas. Stocking or seeding density is 921 kg/ha per crop in the bottom monoline method and 2488 kg/ha per crop in the raft monoline method. Seaweed farms can be extensive, semi-intensive, or intensive based on seeding rates of below 5000, 5000-10 000, and over 10 000 kg/ha per crop.

Seaweed culture starts at the onset of the dry season in October and lasts until June before the southwest monsoon. One culture period is about 90 days and there are two harvests in a year. To harvest the seaweeds, farmers pull up the bottom monolines, and pull the rafts to the shore. The plants are either hand picked whole or pruned. The harvested seaweeds are sun-dried from 1 to 5 days on dry coconut leaves, bamboo mats, old fish nets, fences, or most often, directly on the ground. Usually, seaweed

Table 1. Initial investment and annual depreciation for a 1-ha seaweed farm under extensive culture

	Bottom monoline method			Raft monoline method		
	Value (₱)	Economic life (yr)	Depreciation	Value (₱)	Economic life (yr)	Depreciation (₱)
Capital outlay						
Non-motorized banca	2 000	5	400	2 000	5	400
Monoline	8 345	2	4 173	18 529	2	9 265
Bamboo	2 448	2	1 224	6 824	2	3 412
Polyethylene rope	-	-	-	600	2	300
Tools	100	2	50	100	2	50
Total capital outlay	12 893		5 847	28 053		13 427
Working capital (one crop)						
Seedlings	6 143			16 595		
Plastic straw	4 050			6 300		
Hired labor	2 960			3 200		
Miscellaneous expenses	1 315			2 609		
Total working capital	14 468			28 704		
Total investment	27 361			56 757		

Table 2. Costs and returns of seaweed farming (peso/ha/crop)

	Unit cost (₱)	Bottom monoline method Quantity	Bottom monoline method Total cost (₱)	Raft monoline method Quantity	Raft monoline method Total cost (₱)
Returns	9.00	5862 kg dry	52 758	7647 kg-dry	68 823
Costs					
Cash costs					
Seedlings	6.67	921 kg	6 143	2488 kg	16 595
Plastic straw	45.00	90 kg	4 050	140 kg	6 300
Hired labor	40.00	74 man-day	2 960	80 man-day	3 200
Miscellaneous	10% of seed, straw, labor		1 315		2 609
Total cash costs			14 468		28 704
Non-cash costs					
Owner/family labor	40.00	52 man-day	2 080	176 man-day	7 040
Depreciation			2 923		6 713
Total non-cash costs			5 003		13 753
Total production cost			19 472		42 458
Operating income			38 290		40 119
Net farm income per crop			33 286		26 365
Annual net farm income (2 crops)			66 573		52 731

is sold immediately after drying. A few farmers store seaweed in sacks for 3 to 5 months to accumulate larger volumes, or to wait for higher market prices. Dried seaweed of about 45% moisture content is sold to local traders at ₱9/kg. The seaweed farmer's share of the export price is 42%.

Bottom monoline cultivation can yield 5.8 t/ha per crop (dry weight) whereas higher yields of 7.6 t/ha per crop (dry weight) can be obtained with the raft monoline as a result of the higher seeding rate. Specific growth rate of *Kappaphycus* is 2% per day with the bottom monoline and 1.24% per day with the raft monoline. In a *Eucheuma* pilot farm using nylon nets in Tapaan Island, Mindanao, production is 8.3 t/ha per month wet weight or 1.1 t/ha per month dry weight, and the average daily growth of *Eucheuma* is 2%.

The investment required is ₱27 400/ha for bottom monoline culture and ₱56 800/ha for the raft monoline (Table 1). These amounts cover capital outlay and working capital for one crop. Returns are higher by 30% in the raft monoline method (Table 2). Production cost per crop in the raft monoline method (₱42 500/ha per crop) is more than double that incurred in the bottom monoline (₱19 500/ha) because of the higher seeding rates that require more material and labor input. As a result, net farm income per crop from the bottom monoline method (₱33 300/ha) is higher by 26% than that derived from the raft monoline (₱26 365/ha).

Higher profit margin (ratio of net farm income to gross returns) is achieved with the bottom monoline (63%) than with the raft monoline (38%). This is because the proportion of non-cash costs, specifically owner or family labor and depreciation, to total production costs is 26% in the bottom monoline and 32% in the raft monoline. Non-cash costs decrease the profit margin.

The small-scale seaweed farms are mostly family-run enterprises. Owner and family labor account for 10% of production costs in the bottom monoline and 16% in the raft monoline.

Production is higher in the raft monoline (53 500 kg-fresh/ha per crop) than in bottom monoline (41 000 kg-fresh/ha per crop) because of higher seeding density. The average production cost with the raft monoline method is ₱5.55/kg, 67% higher than the ₱3.32/kg incurred with

the bottom monoline. The average production cost of the bottom monoline in northern Bohol was ₱2.71/kg in 1981. This increased to ₱4.29 - 6.22/kg in 1988. Higher production costs in the raft monoline resulted in lower return on investment (93%) and longer payback period (0.9 year) than in the bottom monoline (243%, 0.4 year). Sensitivity analysis showed that at equal seeding rates, the bottom monoline method is more profit-able.

The availability of seedlings and capital limit the small-scale production of seaweed. Seedlings are purchased from other seaweed farmers and the supply is not assured. The inputs used in a seaweed farm depends on whatever cash the farmers have on hand. Further problems include grazing on seaweeds by sea urchins and other herbivores, shading by epiphytes, and bad weather.

Seaweed farming is an attractive livelihood for fishermen and a high yielding investment. Demand for seaweed grows by about 10% per year, with the world supply coming mainly from developing countries. Through the bottom monoline culture, good drying, and sound post-harvest practices, higher production and profits are attainable.

Source: GPB Samonte, AQ Hurtado-Ponce, and RD Caturao. 1993. *Economic analysis of bottom line and raft monoline culture of Kappaphycus alvarezii var. tambalang in Western Visayas, Philippines.* **Aquaculture** 110:1-11.

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Learning the small-scale technology of Vietnam

Vuon, ao, chuong

The Vietnamese *vuon, ao, chuong* means garden-pond-livestock pen. This system, termed VAC, integrates the homelot, garden, livestock and fish pond. It has become a traditional approach to family food production in the rural regions of Vietnam after it was developed in the early 1980s to improve the diets of the rural poor.

The VAC system is family-managed, with practically all the labor coming from the household. VAC farms can be found under a variety of agro-ecological conditions, including irrigated lowlands, rain-fed uplands, and peri-urban areas.

About 85-90% of the rural families maintain a garden and a livestock pen, and 30-35% of these have fish ponds. In many villages, 50-80% of families have the full VAC system. About 30-60% of family incomes come from VAC, and a few derive all income from it.

Fruits commonly grown in the Vietnam lowlands include banana, orange, papaya, peach litchi, longan, and apple. In the suburbs, ornamental trees and flowers are planted as a main source of income. Vegetables grown include green onion, sweet potato, cress, tomato, cabbage, and water spinach. These perennial and annual crops provide year-round food to the house and products for the market.

Seaweed culture in the Philippines.