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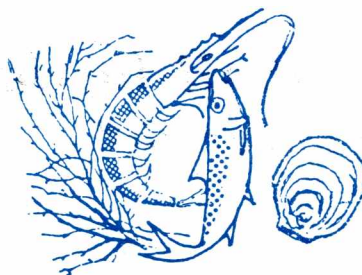
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AQUA FARM NEWS



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Small is beautiful

The Philippine Institute of Development Studies notes that the family used to be the biggest safety net in Philippine society. In times of sickness, the family provides the needed health care. At all times, it is the couch for social and economic needs and for the emotional bonds so typical of a Filipino family. However, due to massive poverty, most families at present are incapable of providing these safety nets. An official count in 1988 shows that 5.8 million families live below the poverty line. Assuming an average of 5 persons per family, half of the total population are really poor (Source: *Development Research News* Vol. X No. 4 July-Aug 1992).

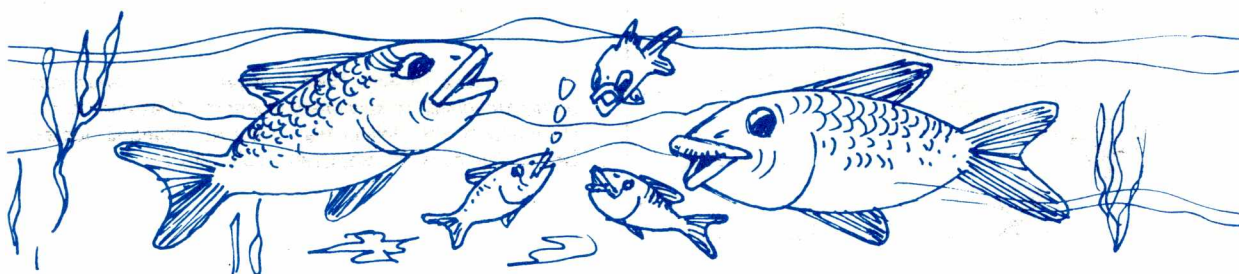
What could this half do?

The answer might be in small-scale technologies that families can adopt to augment income -- culture of fish and seaweeds, carp breeding and nursery, integrated farming, the so-called 'miracle holes,' and others. These are presented in this issue for was it not said that --

Universal prosperity is possible; its attainment is possible on the basis of the materialist philosophy of "enrich yourselves" and this is the road to peace. And for developing countries, intermediate technology is the answer ... Small is beautiful.

- EF Schumacher, 1973

(Small is beautiful: economics as if people mattered.
Harper and Row Publishers, Inc. New York. p. 25.)



The small-business entrepreneur

The experiences of 245 Filipino entrepreneurs indicate that careful preparations must be made before entering the small-business arena. Other than knowing the legal and managerial aspects, special qualities and traits are required of the entrepreneur: good physical health, high value placed on success, the thinking of a generalist, superior conceptuality, high self-confidence, perseverance, and imagination.

The entrepreneurs started their businesses when they were between 31 to 45 years of age. Most had previous employment experience and expertise in the trade, which helped them. They are self-reliant, and few hired consultants and other experts. They tapped their personal savings, and acquired loans from private commercial banks. They planned production capacities, marketing strategies, and organizational structures. They were strongly motivated by favorable return on their investments.

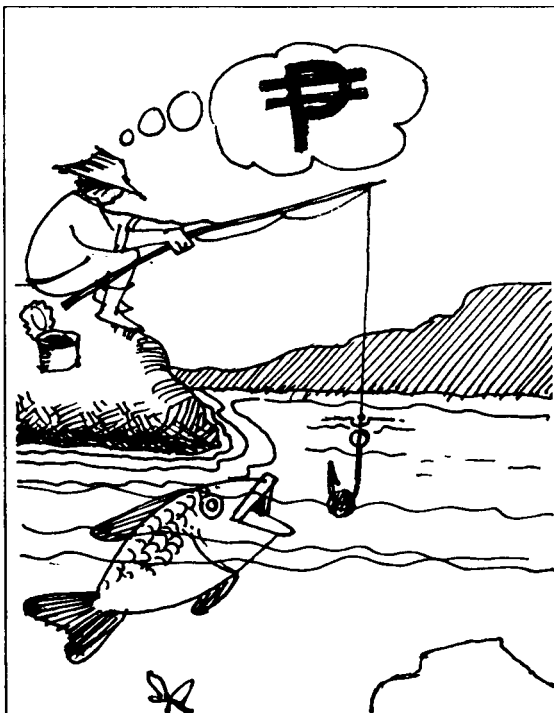
Operating the business resulted in some profits, but profitability could have been improved through increased financing and marketing. Many of the entrepreneurs failed to increase their capital and did not change their marketing strategies. Sales reached a quarter of a million pesos, but net earnings ratio to sales was only 13%. Growth rate of net earnings was only 19%. A majority decided not to plow back their earnings.

Problems threatening the stability of small business are the high cost of labor, high taxes, high interest rates in financing, competition from large business, shortage of raw materials, and burdensome government regulations. Stabilizing the small-business operation is a challenge. Majority of the entrepreneurs were required to use all personal resources. Many suffered from inflation which depleted their earnings. But the strength of small-business management lies in controls specifically related to cash sales, accounts receivable, production, inventory, budget, financial reporting, and personnel.

Majority of the entrepreneurs plan to continue their present small-business operations, and to remain closed private enterprises. However, they expressed limited plans to develop their product services further, to diversify or branch into other activities, or to expand their market area. They indicated very little appreciation for merging or combining with other groups, buying other existing businesses, or allowing interested investors to join them. The entrepreneurs indicated that the factors that could ensure success are proximity to customers, programmed activities, entrepreneurship and autonomy, production and motivation through people, and a loose-tight management control pendulum.

For the small business entrepreneurs to continue their businesses, it is strongly recommended that they individually undergo self analysis, and prepare a more comprehensive and integrated development program. Achieving this will ensure their meaningful participation in the country's economy.

Source: TA Sajo. 1985. *Prospects of small-business entrepreneurship in developing economy*. Presented at the University of the Philippines - Visayas Diamond Jubilee Lecture Series IV, 18 Sept. 1985, Iloilo City.



The Asian farmer

A typical Asian farmer lives with his wife and four children on a farm of approximately 1.5 ha and raises mainly rice. The family owns one or two work animals and raises several chickens and ducks. Land tenure and ownership or tenancy arrangements are variable. There may be several enterprises of varying importance:

- Wet rice, almost always present on farms in tropical Asia and often the principal feature of the farm;
- Multiple cropping of other annual crops with rice in the paddy fields;
- Permanent cultivation of annual or perennial crops, including staple roots and tubers on dry land (upland);
- A mixed garden around the farmstead where fruits, vegetables, and root crops are grown; and
- Livestock, cattle, or buffaloes kept mainly for work, and scavenging poultry and/or pigs.

In Asia as in Europe, there is a tendency for mixed gardening to occupy an increasing proportion of the total arable land on the farm. This can evolve into market gardening and the growing of vegetables for sale. This is seen as a response to increasing population density, particularly near urban areas.

Farming throughout the humid tropics is characterized by the neglect of livestock productivity. Most of the livestock in Southeast Asia are raised on small-scale farms rather than in commercial operations. Buffaloes and cattle are raised primarily as work animals although they are slaughtered when their working days are over. During the rice growing season, the buffaloes and cattle subsist on rough grass of poor quality; after harvest, they graze on straw in the paddy

fields. Cattle raising for dairy purposes is traditional in the Indian subcontinent but not in Southeast Asia, although there is now increasing interest in dairying among small-scale farmers in the latter region.

Fish culture, contrary to popular belief, is not at all widespread in tropical Asia. Farmers have captured wild fish from rice fields since time immemorial but it has been estimated that less than 1% of the irrigated ricefields in Southeast Asia are used to culture fish. Little has changed since this estimate. There are a few traditional aquaculture systems in tropical Asia, for example, the polyculture system for Indian major carps. However, until recently, this was not an example of integrated farming because it was extensive with no fertilizer or feed inputs. Overseas Chinese were largely responsible for importing integrated fish farming technology to Malaysia, Singapore, and Thailand, and perhaps Indonesia. There has been significant development of integrated crop-livestock-fish farming in tropical Asia over the past 20-30 years but it still probably involves less than 1% of the small-scale farmers in the region.

Chinese farmers in Malaysia and elsewhere are involved in more intensive cultivation of crops and livestock and sometimes fish. The livestock, mainly pigs, are well integrated into the farming system -- they are fed mainly cassava and crop residues such as waste vegetables and rice by-products and their manure is applied either to crops or to fishponds. However, most small-scale farming in Asia may be characterized as settled agriculture with plant crops dominant and not integrated with livestock or fish.

Source: P Edwards, RSV Pullin, JA Gartner. 1988. *Research and education for the development of integrated crop-livestock-fish farming systems in the tropics*. International Center for Living Aquatic Resources Management. Manila, Philippines. p. 9-10.

Culture of short-cycle species in seasonal ponds and ditches

Seasonal ponds, ditches and road-side canals that are formed from the excavation for house or road construction, and ponds dug for household uses or irrigation can be used for aquaculture of short-cycle species such as the silver barb (*Puntius gonionotus*) or Nile tilapia (*Oreochromis niloticus*). Even 80-100 m² ditches as shallow as 70-80 cm can be used for culture of these species, and so can ponds that retain water for only 3-4 months. On-farm agricultural wastes and by-products can be used as inputs. The culture practice is simple and requires very low labor input. Hence, it can be undertaken by women and children to produce fish for household consumption and for market. Landless farmers can also benefit from this technology -- they can culture fish in common property road-side ditches.

Pond preparation

Trees on pond embankment are trimmed. Ponds should be cleared of submerged and floating weeds as they utilize nutrients and ob-

struct penetration of sunlight into the water, resulting in low production of fish food organisms. Apply lime (25 g/m²) to lower acidity if necessary.

Fertilization

For good production of food organisms (plankton), the ponds have to be fertilized with organic manures or chemical fertilizers. Cattle dung (100 g/m²), chicken manure (50 g/m²), or urea (2 g/m²) and triple superphosphate (5 g/m²) is applied once every two weeks. Organic manure is heaped in the pond corners while chemical fertilizers are dissolved in water and spread in the pond.

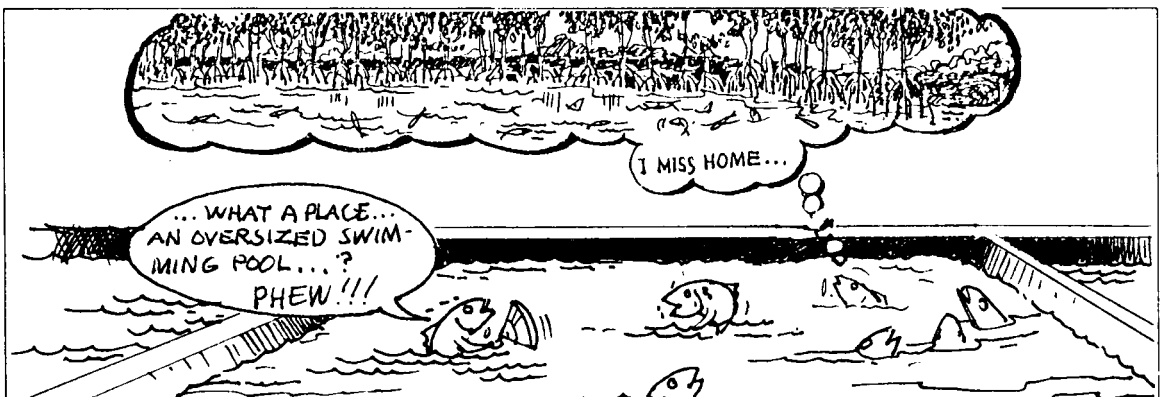
Stocking

Depending on the farmer's choice, Nile tilapia (2 fingerlings/m²) or silver barb (3 fingerlings/2 m²) can be stocked in the pond. If the pond retains water for more than 6 months, several fish can be stocked in addition to silver barb -- 3 fingerlings/40 m² of catla or silver carp and 2 fingerlings/40 m² of common carp. This will increase total fish production.

Healthy fingerlings should be procured from a reliable hatchery or supplier. It is better to stock the 3-5 g size, as these would reach table size early -- an important consideration in ponds that retain water for only 3-4 months.

Feeding

For good production, supplementary feeds should be given to the stock. Kitchen waste,



duck weeds, *kangkong*, sweet potato, tender terrestrial grasses, rice bran or wheat bran can be given. Feeding should be done once or twice a day, and the amount adjusted to the size of fish.

Pond management

Green water indicates good production of plankton. Clear pond water indicates lack of fish food. To test this, dip an arm in the water halfway to the elbow. If the hand can be seen, the water is clear and it is necessary to increase fertilization. If the hand can not be seen, there is sufficient plankton. If the hand can not be seen when it is dipped just under the surface of deep-green pond water, there is a plankton bloom. Blooms deplete oxygen in pond water, especially at night and during cloudy days, and can result in mortality of stock. Stop feeding and fertilization until the water color becomes lighter.

Tilapia breeds in pond and the overpopulation results in poor growth due to competition for food. Tilapia fry that school along the banks of ponds can be removed with a scoop net and either sold or used as feed.

Harvesting

Fish can be harvested as soon as they reach table size or when the water level in the pond goes below 40-50 cm. Harvesting can be done for family consumption a little at a time or for marketing at one time. A total of 75-100 kg fish can be harvested from a 500-m² pond in 5-6 months.

Disease

When the temperature goes down to 20°C and below during November-January, silver barb becomes susceptible to ulcerative syndrome, a disease that starts as red spots on the fish and later become wounds. When infection is seen, apply lime to ponds at a rate of 25 g/m².

Source: International Institute for Rural Reconstruction and International Center for Living Aquatic Resources Management. 1992. *Farmer-proven integrated agriculture-aquaculture: a technology information kit*.

Miracle holes

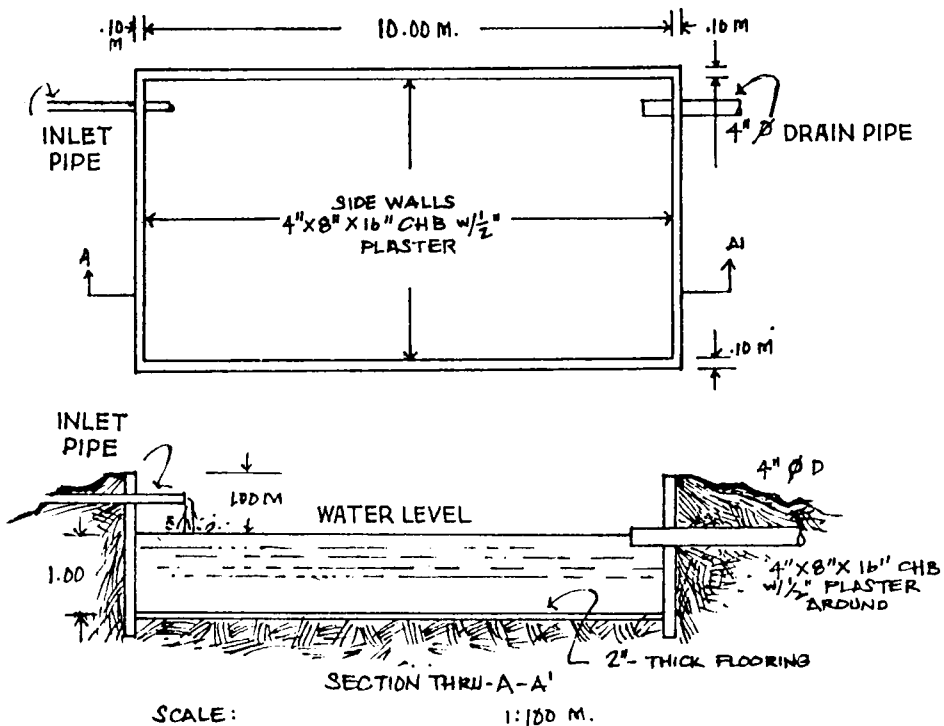
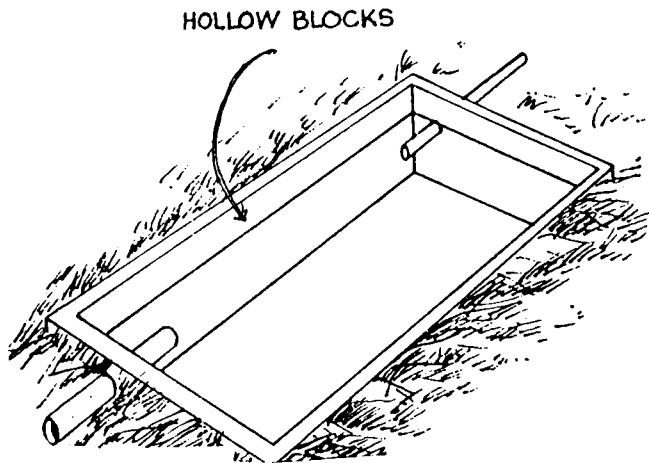
Fishermen in the coastal areas of Taloto, Tagbilaran City practice a unique method of fish capture called "miracle hole." They select areas in the mangrove swamps where natural channels allow entry of seawater. Twigs or thickets are placed at the mouth of the channels. Fish fry can pass through, but once they are grown, the thickets or twigs block their exit. Thus, fishermen can easily harvest the fish. This practice has encouraged fishermen to conserve the mangroves.

The first "miracle hole" was built in 1955 by Nasario D. Arat, a fisherman who perfected the technique by studying his coastal zone. His legacy is an environmentally sound indigenous technology that is sustainable for many generations. Last July, during the 1992 National Science and Technology Month, Arat was given a special (posthumous) award by the Department of Science and Technology Region 7 in recognition of his pioneering efforts. His son, Eliseo, received the award.

Source: Release of the Department of Science and Technology - Region VII. Undated.



A backyard fishpond design



The backyard fishpond can be of two types:

- The dug-out excavated type made by digging the soil of the desired area at least 1-1.5 m deep. The soil removed is utilized to build perimeter dikes 2 m high from the base to the top. It is provided with a water pipe 3-in in dia. to serve as overflow.
- The dug-out concrete type (shown above) follows the same principle, except that the wall is made of 4" x 8" x 16" concrete hollow blocks. The bottom of the pond is filled with gravel and planted with aquatic plants like tape grass, water lily, kangkong, and parrot's feather.

Source: Department of Agriculture and Natural Resources. 1972. *Backyard and community fishponds*. Intramuros, Manila. 11 pp.

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 m² in the bottom monoline method and 170 m² 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 (P)	Economic life (yr)	Depreciation	Value (P)	Economic life (yr)	Depreciation (P)
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 (P)	Bottom monoline method		Raft monoline method	
		Quantity	Total cost (P)	Quantity	Total cost (P)
Returns	9.00	5862 kg dry	52 758	7647 kg-dry	68 823
Costs					
<i>Cash costs</i>					
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
<i>Non-cash costs</i>					
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 P9/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 P27 400/ha for bottom monoline culture and P56 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 (P42 500/ha per

crop) is more than double that incurred in the bottom monoline (P19 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 (P33 300/ha) is higher by 26% than that derived from the raft monoline (P26 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 P5.55/kg, 67% higher than the P3.32/kg incurred with

the bottom monoline. The average production cost of the bottom monoline in northern Bohol was P2.71/kg in 1981. This increased to P4.29 - 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.

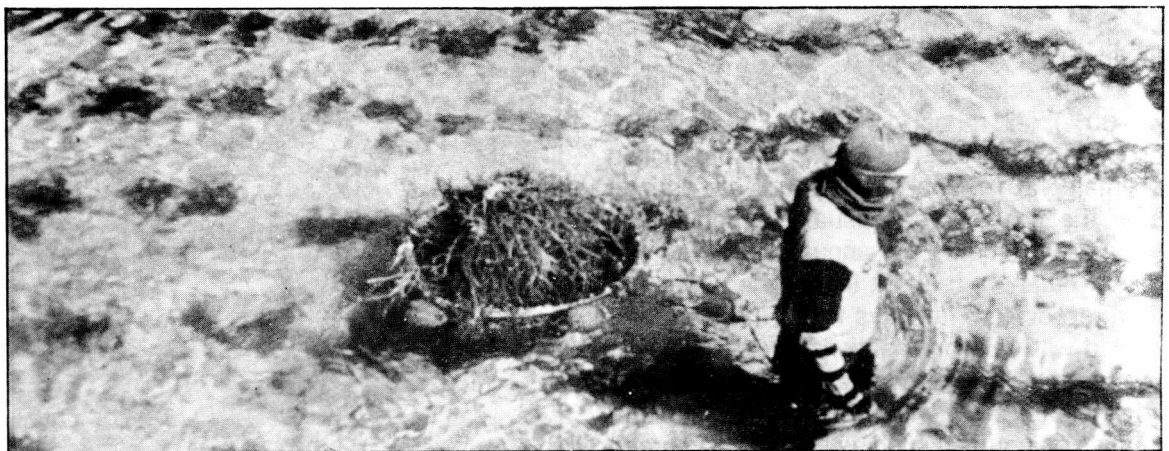
The availability of seedlings and capital limit the small-scale production of seaweed. Seedlings are purchased from other seaweed farmers and the supply is not assured. The inputs used in a seaweed farm depends on whatever cash the farmers have on hand. Further problems include grazing on seaweeds by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

This paper won for SEAFDEC/AQD the second prize in the Best Paper Competition (Socioeconomics category) in the 1992 National Research Symposium of the Department of Agriculture. - Ed.

Seaweed culture in the Philippines.



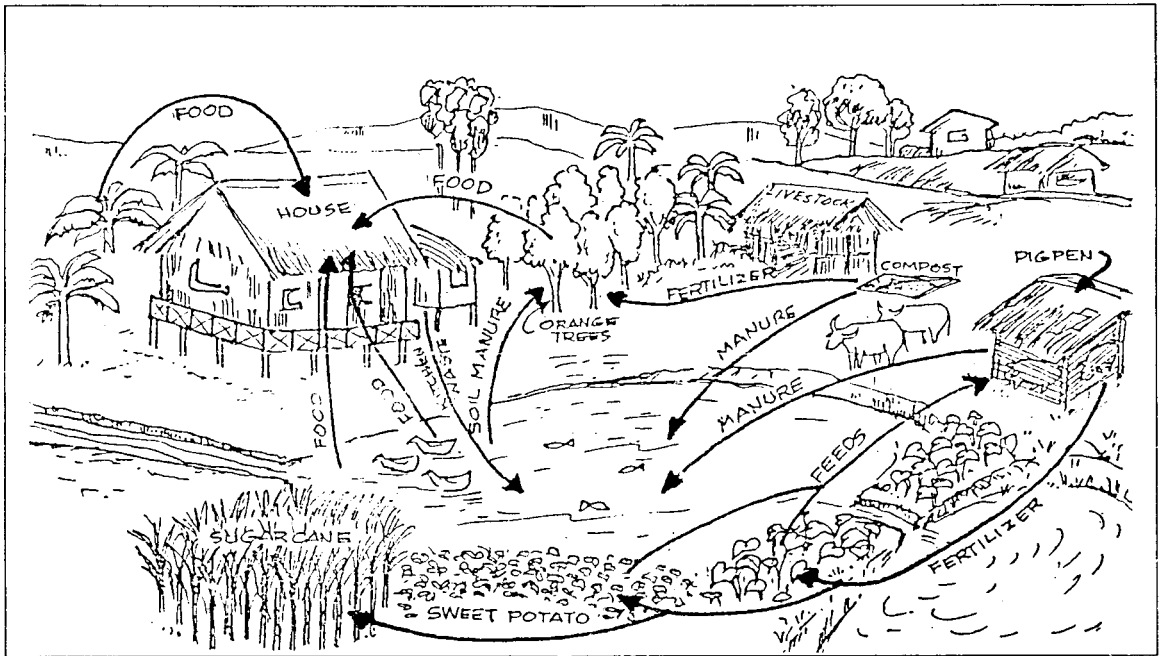
Vuon, ao, chuong

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.



The integrated farming system in Vietnam: The garden has an area of 200-300 m² with fruit trees and vegetables. Livestock are raised on farm products or by-products. Livestock manure and pond mud are used as fertilizer. The pond is stocked with many species of fish.

Most families keep a variety of animals on the farm, including one or more water buffaloes and cattle, one or more pigs, and several ducks and chickens. The livestock pens are constructed at the corner of the garden close to the pond. The large ruminant animals are allowed to graze, or are fed farm by-products. The swine and poultry are usually fed kitchen wastes, as well as cassava, rice bran, sweet potato, banana trunks, and water hyacinth. Livestock manure is used as fertilizer for the ponds.

Families have ponds 50-400 m² with a depth of 1-1.2 m. They are stocked with 1-2 fingerlings/m² of silver carp (25-35%), grass carp (2-5%), hybrid common carp (10-15%), rohu (20-30%), and mrigal (15-25%). Harvest is continuous throughout the year with production estimated at 1-5 t/ha-yr. The ponds are drained after the final harvest (usually in January or February). Pond mud is annually removed and used to manure the fruit trees. The ponds are then kept dry for a few days, limed, manured, and refilled with rain or irrigation water. Domestic washings and kitchen wastes may be channeled into the pond along with some livestock manure. Leaves of legumes such as peanuts and green

beans are also used as fertilizer in ponds. Pond water is used for irrigating the garden, especially the vegetables.

Source: International Institute for Rural Reconstruction and International Center for Living Aquatic Resources Management. 1992. *Farmer-proven integrated agriculture-aquaculture: a technology information kit.*



Carp breeding using wheat fields off season

About 300,000 ha of wheat fields around Jabalpur, Madhya Pradesh become rainfed ponds (*havelis*) from July to October. Rainwater is impounded in these fields (with dikes about 1 m high) until the onset of winter when they are drained, plowed, and the wheat is sown. For a period of 3-4 months, the field can be used for seed production of common carp.

For a 0.4 ha field, the following procedures could be followed:

- Select a field near the road but away from flood-prone zone. Check the dikes and put meshed screens on the inlets and outlets.
- Spray an emulsion of 20 liters diesel and 7 kg of cheap washing soap on the water surface to kill predatory aquatic insects as soon as about 60-80 cm of water has accumulated in the field.
- After spraying, release 4 healthy and fully ripe females with 4 males, each weighing about 1 kg. A fully ripe, healthy female has a swollen abdomen and a reddish genital region. Males ooze milt with gentle pressure on the abdomen. Provide 2-3 kg of *Hydrilla* or *Eichornia* at 3 or 4 places in the field.

The fish breed within 24-48 h of stocking, or may take a day or two more if they are not fully ripe. The eggs are laid on the weeds and hatch within 48-72 h. Harvesting of fry can be done after 15-20 days; the yield is about 100,000 fry 25-30 mm in size. If the field is manured with 2,000 kg cowdung and the fry are given an artificial feed made of groundnut oil cake and rice bran (1:1 by weight), about 20,000 fingerlings 40-60 mm in size may be harvested.

Source: International Institute for Rural Reconstruction and International Center for Living and Aquatic Resources Management. 1992. *Farmer-proven integrated agriculture-aquaculture: an information kit*.

Nursery system for carps

A nursery is a facility where fish fry can grow. Efficient fish culture requires special nurseries for growing fry prior to stocking in grow-out ponds. The ideal size of a nursery is 200-500 m² with a depth of 1.0-1.5 m.

Pond preparation

- Remove all aquatic weeds (Day 1).
- Drain and dry the pond (Day 2).
- Apply 5-6 kg lime to release nutrients and kill harmful organisms in the pond (Day 16).
- Apply fertilizer 3 days after lime application and 7-10 days before stocking. Refill water if necessary (Day 19).

The test for the growth of natural food (plankton) is simple. Dip an arm in the water up to the elbow. If the hand can not be seen, the plankton is probably sufficient.

Stocking

Stock 60,000-70,000 larvae (4-5 days old) or older fry. The stock should be of the same age and size, vigorous, and released in the morning or late afternoon (Day 30). Seed of common carp are available in January-March, silver carp in February-August, rohu and mrigal in April-July, catla in May-July, grass carp in May-August, and silver barb in March-May.

Before the larvae or fry are released into

A 15-min video program on **Breeding carps for the farm** is available from SEAFDEC/AQD. Old price: P450 US\$40
New price: P200 US\$15

See page 16 for the address.

the nursery, it is important that the temperature inside the transport bag is the same as that of pond water. Place the unopened bags in the pond for 10-15 min. Open slowly and introduce small quantities of pond water to equalize the temperature. The fry are then allowed to swim into the pond.

Feeding

It is often difficult to maintain a high level of natural food for growing fry and supplementary feeds become necessary (Day 31). A mixture of finely powdered oil cake (soya beans, mustard, etc.), rice or wheat bran, and fish meal in the ratio of 5:4:1 can be supplied to fry daily.

Care of fry or fingerlings

Check the pond daily and see if there is an excess of green algae, then stop application of supplementary feeds. Increase feed if fish growth is not good. Remove frogs, snakes, and other predators from the pond.

Harvest and transport

Harvest the fry or fingerlings with a net either in the morning or late afternoon and keep them in enclosures (*hapa*) or cistern at least 3-4 h before transport (Day 60).

It is important that fingerlings are conditioned before transport. They must have time to empty their guts before being packed in high densities, so that the transport water is not polluted by excreta. Clean water from a well should be used for conditioning the fingerlings.

Transport the fry or fingerlings in oxygenated plastic bags. About 5 liters of water and 15 liters of oxygen is placed in each bag of 20 liters capacity. Density of fish (30- mm size) during transport:

Species	Fry per liter
Rohu	50
Bighead carp	50
Catla	33
Silver carp	60

Source: International Institute for Rural Reconstruction and International Center for Living and Aquatic Resources Management. 1992. *Farmer-proven integrated agriculture-aquaculture: an information kit*.

Boom or bust indices of the family farm

The farm budget, monthly cash flow, and other economic considerations are important to the family business. Here is how the farm's economic potential and performance are analyzed:

The farm budget

First, make a **cost sheet**

- List the things that are required for you to do business.
- Write down how much is needed, the price, and the amount paid.
- Add all amounts paid to find out the total costs.

Second, make an **income sheet**

- List all the products from the business that can be sold.
- Write down how much is sold, at what price, and the amount received.
- Add all amounts received to find out the total income.

Third, work out your **balance or profit sheet**

- Write down the total income received from the business.
- Write down the total costs that were required in doing the business.
- Subtract the total amount paid from the total amount received from the sales of the business.

The monthly cash flow

First, work out your **cash outflow**

- Note down the activities of the business that required money. Write down the costs involved.
- Record on the calendar the activities that needed money and the amounts paid during each month.
- Add all money required to do business each month to get the total monthly cash outflow.

Second, work out your **cash inflows**

- Note down the products sold and the money

received from these sales.

- Add all the money received from the sales of the products of the business each month to get the total monthly cash inflow.

Third, compute the **cash netflow**

- The monthly cash netflow is computed by subtracting the monthly cash outflow from the monthly cash inflow.

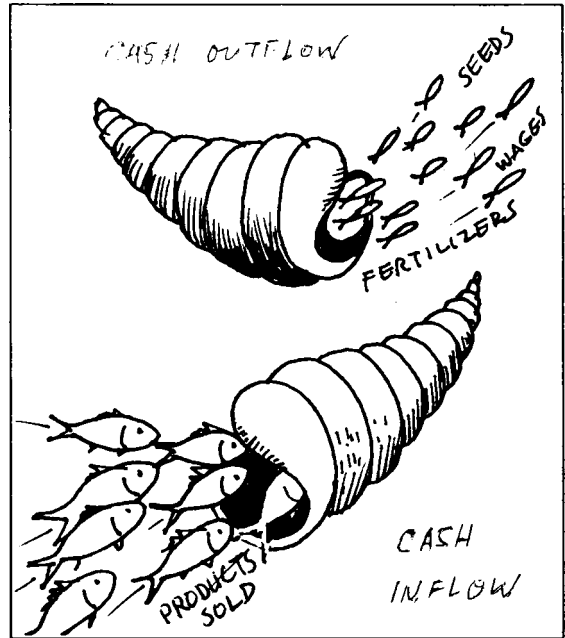
A negative cash netflow during the first few months of business means that the farmer spends money to buy and pay for things that are required. When he starts getting cash inflows but has a negative netflow, more money is required to pay for the business than what is received from the sales of his products. When there are cash inflows and outflows in a particular month, a positive netflow means that the farmer receives more money from the sales of his products than he needs to pay for the farm expenses that particular month.

Opportunity costs

The farmer may have several alternative uses for his resources such as labor, land or cash capital. He must know whether using his resources for a particular business would give him better income than investing in others. The opportunity cost is the value of the best use of a particular resource. A new technology is worth adopting if the income earned from the use of the farmer's resources are greater than the opportunity costs of what could have been earned from other activities.

Equity and income distribution

Is the new technology or business going to place significant demand for the labor and time of family members? Who will meet such labor demand? What is the opportunity cost of additional labor hours in terms of leisure, children's schooling, and house work by women? A farmer's



wife may have to spend more time in the farm - feeding the fish with rice bran and cleaning the dikes instead of cooking at home for the family. Children may also have to help in the farm chores and spend less time studying.

Risks and markets

Is the produce meant for household and local consumption or for export? How diversified will the farm operations become when a new component technology is adopted? Will it increase or reduce risks of crop failure? Will the products of the new technology be subject to price uncertainty because of an unstable market? How sensitive is the net return to changes in input costs and output prices?

Source: International Institute for Rural Reconstruction and International Center for Living Aquatic Resources Management. 1992. *Farmer-proven integrated agriculture - aquaculture: a technology information kit*.



Farm-made aquafeeds

The bulk of aquaculture production of fish and crustaceans in Asia is from semi-intensive ponds. The majority of these ponds, particularly those for freshwater non-carnivorous fishes (which account for over 80% of the total fish production in Asia) depend upon the use of farm-made feeds. Some intensive systems, notably cage culture of marine fishes and some carnivorous freshwater fishes (e.g., snakehead and catfish) also use farm-made feeds. Only about 10% of Asian fish production and 50% of shrimp production is based on commercial feeds.

There is an increasing tendency for farmers to utilize commercial feeds as nutritionally complete diets in semi-intensive systems. However, nutrition and feeding of fish and crustaceans in semi-intensive ponds are complex and poorly understood. Little or no information is available on dietary requirements of the cultured species in such ponds. It is difficult to quantify the contribution of natural food organisms in the

Farm-made feeds are pellets, crumbles, flakes, or wet feeds consisting of artificial and natural feed-stuffs, produced for the exclusive use of a particular farm and not for commercial sale or profit.



overall nutrition of pond-raised fish or crustaceans.

Farm-made feeds make use of locally available agricultural products and wastes of agro-processing industries that would otherwise have little or limited use within the community. The use of wastes in farm-made feeds has significant environmental advantages. However, commercial and, to a lesser extent, farm-made feeds require expensive animal protein sources. Hence, there is a need to identify and utilize alternative protein sources that are both inexpensive and sustainable. Although farm-made feeds are cheaper than commercial aquafeeds, production costs can still be reduced with appropriate feed management techniques. Some farmers who initially use farm-made aquafeeds shift to the more convenient commercial feeds.

The FAO Expert Consultative Meeting on Farm-made Aquafeeds, held on 13-20 December 1992 in Thailand, recorded for the first time the scale and importance of farm-made aquafeeds in the Asia-Pacific region. The meeting recommended the following:

- The information and technology on farm-made aquafeeds should be widely disseminated to governments, international agencies, and potential donors to: (1) alert them to the importance of these feeds to small-scale aquaculture and the need for technical support; and (2) persuade donors that future aid concerning feed development should concentrate on farm-made feeds. Public sector funding should primarily assist small-scale farmers, not feed manufacturers.

- The approach towards research and extension of farm-made feeds should be "bottom-up" rather than "top-down." Pre-conceived ideas should not be forced on farmers but it should be demonstrated that: (1) farmers' existing practices can be improved without compromising environmental quality; and (2) the improvements can lead to greater profits.

- Simple and cheap methods of increasing the nutritional value of feeds for fishes and crustaceans should be developed, with particular reference to digestibility, removal of toxic substances, and palatability.

- Simple and cheap machinery for the

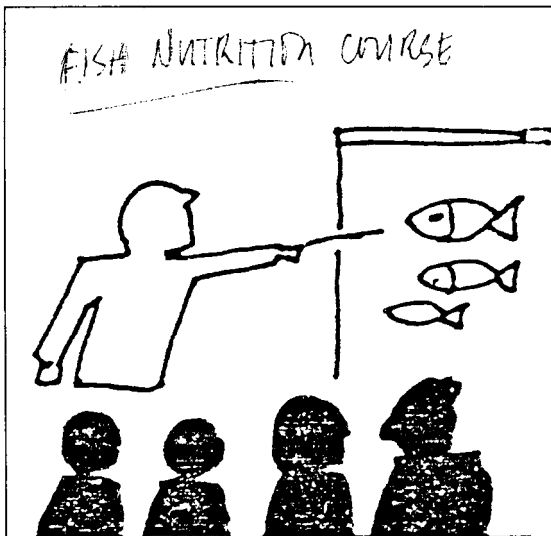
production of farm-made feeds and techniques for on-farm processing and storage should be developed and improved, with funding provided when necessary.

- Feed advisers should formulate feeds taking into account: (1) locally available ingredients; (2) nutritional requirements of farmed species; (3) minimal use of vitamin premixes, binders, and other expensive ingredients; (4) the contribution of natural food in semi-intensive farming systems; and (5) overall quality.

- Feeding strategy should be improved through research and development in: (1) feeding frequency; (2) methods of feed presentation; (3) two-component systems (i.e., alternation of different feeds or feeding rates); (4) reduction of feed wastage; (5) farmer-friendly sensory methods of assessment of ingredient quality; and (6) biomass assessment of farmed species.

- Village-level training can be designed in the local language to teach farmers simple formulation, ingredient choice, feed processing, storage, and on-farm feed management. Instructional videos and simple booklets in the local languages can complement the training course.

Source: Report of SEAFDEC/AQD Scientist RM Coloso regarding his attendance to the FAO Expert Consultative Meeting on Farm-made Aquafeeds; 13-20 December 1992; Bangkok, Thailand.



Feeding fish without fouling the environment

Fishes excrete ammonia as a waste product of protein breakdown. Ammonia is a toxic pollutant in aquatic systems without plants. The only effective ways to reduce ammonia output are to:

- 1) balance the protein and energy in the diets;
- 2) ensure that the protein in the diet is highly digestible; or
- 3) balance the amino acids.

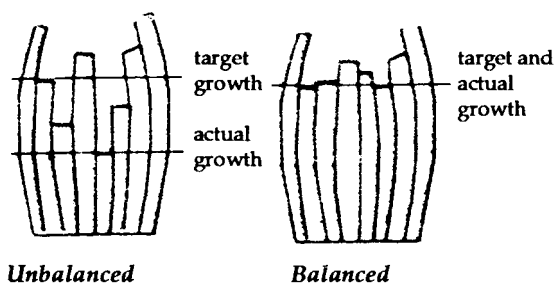
Protein is composed of sequences of 22 different amino acids. Ten of these cannot be made by the fish and have to be provided in the diet; they are termed essential amino acids. Fishes require the same 10 essential amino acids as humans do, but in different proportions.

Fishes use amino acids for protein building only up to the level of the first limiting essential amino acid (see figure next page). The excess amino acids, those out of balance, will be used for energy and excreted. The ammonia output from the fish farm thus increases.

Protein produces lean muscle tissue. It is essential that the amino acids are balanced and supported by the correct level of digestible energy. Fish oil is the preferred energy source for salmon and trout, providing about twice the energy per gram of protein or carbohydrate.

The protein content declaration on a bag of feeds is of limited value because it gives no indication of quality or digestibility. A diet can be formulated with what appears to be a satisfactory protein level, but if the digestibility is poor, and the amino acids are not balanced, then growth will be poor and ammonia output high. Feed manufacturers are beginning to provide more useful information, such as digestible energy, digestible protein, and a list of ingredients (e.g., fish meals, fish oils, soya proteins, cereals, cereal by-products, vitamins, minerals, pigments, antioxidants and stabilizers, binding agents). Such data are still of limited use for determining the nutritional quality of the feed if the sources of ingredients and the processing parameters are not known. Sources of ingredients are kept confidential because companies spend a lot of time and money locating and evaluating

Amino acid supply and balance



raw materials from factories around the world and are unwilling to give away information to competitors. The open declaration on feed labels does give assurance that the manufacturers are not using unacceptable raw materials.

The best way to achieve a diet with a well-balanced amino acid profile is to use fish meals from various sources. Fish meals are purchased from many countries and formulated into fish feeds that give the amino acid profile specified by the nutritionist. At least three fish meals are commonly included in commercial rations.

There is very little nutritional value in the vegetable matter suitable for low-pollution feeds for salmon and trout. Vegetable ingredients are usually lower in protein than fish meals and

generally have unbalanced amino acid profiles. High levels of plant ingredients tend to increase the biological oxygen demand and the output of suspended solids from the farm. However, low levels provide cost-effective sources of some amino acids and are essential for the physical quality of the product.

In order to produce economical, environmentally friendly, nutrient-dense feeds, manufacturers must use nutrient-dense raw materials. For fishes, this means fish meals with highly digestible protein. However, given the finite quantity of wild fish stocks, it is essential that alternative protein sources are found to replace fish meal as the main protein source.

The most likely replacement for fish meal would be an upgraded vegetable protein. Upgrading would involve concentrating the protein component and removing most of the carbohydrate. This would only become economically feasible when the price of fish meal increases significantly. The vegetable source would also have to be readily available in large quantities.

Development of a suitable raw material and the technology to upgrade it economically is not likely in the short term, and dependence on fish meal will continue for some time yet.

Source: *Fish Farmer*, January-February 1991.

Publications and video tapes

Nutrition and Feeding of *Penaeus monodon* by FP Pascual. 1989. 24 pp.
Old price: P80 US\$28
New price: P40 US\$15

Feeding Prawns for Grow-out Culture
by FP Pascual and RV Rivera. 1989.
21 pp.
Old price: P30 US\$28
New price: P15 US\$14

Prawn Feed Preparation. 14 min.
Old price: P210 US\$20
New price: P100 US\$15

Proximate Analysis. 21 min.
Old price: P630 US\$60
New price: P300 US\$30.

Available from the SEAFDEC Aquaculture Department. The Department is also preparing an extension manual on *Feeds and feeding of fishes and tiger shrimp*. This will be available in late 1993.

For more information, contact:
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Aquaculture Clinic

QUERY The concern for preserving the environment for the future generation has pushed government and non-government organizations to rehabilitate our mangrove forests. Would restoring a mangrove forest to its former glory preclude making a living out of it?

REPLY SEAFDEC/AQD Scientist Jurgenne Primavera notes that mangroves and aquaculture ecosystems are not entirely incompatible. As long as culture systems imitate natural ecosystem functions, they require less resource inputs and produce less harmful ecological effects. Examples of environment-friendly aquaculture systems in mangrove areas are:

- fish cage culture
- mollusc culture - oyster, mussel, clams, cockles
- *amatong* - rocks or branches placed in excavations in the intertidal area to provide shelter for groupers and other fishes which are then harvested regularly
- seaweed culture - *Gracilaria*, *Caulerpa*
- crab fattening
- Indonesian *tumpang sari* - a combination of fisheries, forestry, aquaculture, or agriculture.

The mangrove forests can also be reforested and managed as a plantation. Ms. Primavera noted that the mangrove reforestation undertaken by the families in Barangay Buswang in Kalibo, Aklan (northern Panay, Philippines) will in the future demonstrate the profitability of leaving or keeping the mangroves intact.

A community effort

The fishing families of Barangay Buswang, Kalibo each planted two hectares of mangroves near the mouth of Aklan River. The P562,000 Buswang Mangrove Contract Reforestation Project is undertaken by the Municipality of Kalibo and is funded by the Overseas Economic Cooperation Fund of the Government of Japan. It aims to reestablish the vanishing mangroves in 50 hectares of river mouth. The deforestation was due to siltation, firewood gathering, and expansion of communities.

The reforestation effort is ecologically beneficial because mangroves prevent soil erosion, act as buffer zone or coastal zone stabilizer, and serve as nursery and breeding grounds of aquatic animals and plants. People can benefit

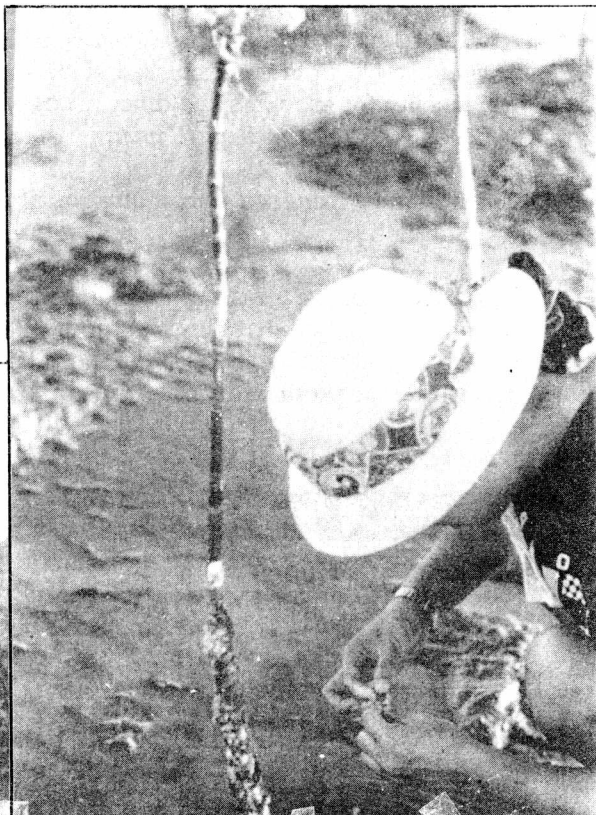
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from a well-managed mangrove forest, which is the source of many products like timber, firewood, charcoal, pulp and paper, tannins and dyes, nipa sap and shingles, oil, medicine, resin, tea, and livestock fodder.

The mangrove species planted at the project site are *bakawan babae* (*Rhizophora mucronata*), *bakawan lalake* (*Rhizophora apiculata*) and *nipa* (*Nypa fruticans*). The seedlings were obtained from Dungon, Numancia, and New Washington all in Aklan province and planted 1.5 m apart. Of the 50 ha contracted, 45 ha were planted the *bakawan* species, and the remaining 5 ha with *nipa*. Early this year, the planted mangroves flowered for the first time. The *bakawan* grew 1.6 m high, with trunk diameter of 4.5 cm; the *nipa* reached 0.5 m height.

The project was implemented in 1990 and will eventually be turned over to the KASAME or the Kalibo Save the Mangrove Association. KASAME will be awarded a 25-year forest land management agreement by the Department of Environment and Natural Resources.

The 50-ha reforestation effort is a small but significant dent in the estimated 300,000 ha of mangroves destroyed in the Philippines since 1920.



JH Primavera

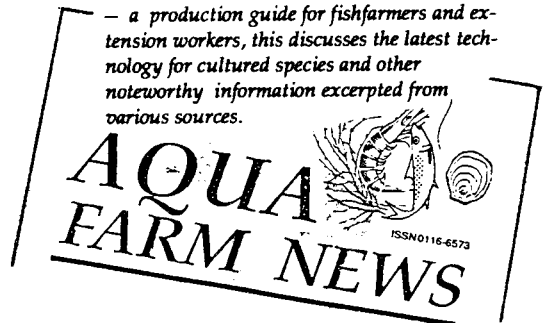
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For more information, contact: TRAINING AND INFORMATION DIVISION,
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IN THIS ISSUE

Vol. XI, No. 1, January-February 1993

Small is beautiful, p.1

The small-business entrepreneur, p. 2

The Asian farmer, p.3

Culture of short-cycle species, p. 4

Miracle hole, p. 5

Backyard pond design, p. 6

Seaweed culture, p. 7

Voun, ao, chung, p. 9

Carp breeding, p. 11

Carp nursery, p. 11

Boom or bust indices, p. 12

On-farm feeds, p. 14

Feeding for the environment, p. 15

SEAFDEC/AQD News, p.19

AFN is a production guide for fishfarmers and extension workers that discusses the latest technology for cultured species and other noteworthy information excerpted from various sources.

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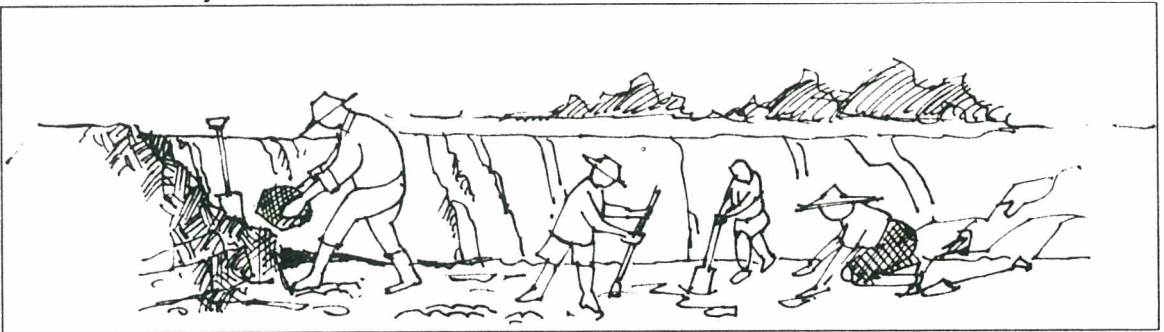
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by E. Ledesma



Better life through aquaculture