Developing the cottonii (Kappaphycus alvarezii) cultivation industry in the Fiji Islands

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Abstract

A commercially successful cottonii seaweed [Kappaphycus alvarezii var. tambalang (Doty) Doty] cultivation industry has been established in Fiji. At the beginning of December 1997, the Fisheries Division of the Ministry of Agriculture, Fisheries, Forest and ALTA established a three-year development programme to obtain commercial volumes (1,000 t y⁻¹) and establish a relationship with a commercial partner which would then take over purchasing once commercial volumes were established. The project was funded solely by the government’s Commodity Development Fund, established to promote alternative commodities to sugarcane, the nation’s primary export crop. The project has met the expectations of the government to improve the socioeconomic situation of coastal villagers and improve the coastal environment. At the end of 2000, 80 t mo⁻¹ were produced and purchased by FMC BioPolymer. Annual volumes are scheduled to increase to 3,000 t by 2005.

Introduction

Since independence in 1972, the Fijian economy has relied on only a few primary industries such as tourism and sugar. Realizing the importance of diversifying the economy, the Ministry of Agriculture, Fisheries and Forestry created the Commodity Development Fund (CDF) in 1997 to provide the financial means to develop more crops and marine products for export. Included in this were aquaculture projects such as pearl farming and K. alvarezii cultivation.

Kappaphycus alvarezii cultivation had, however, been attempted previously in Fiji. K. alvarezii was originally introduced in 1975 (Luxton et al., 1987; Prakash, 1990) from the Philippines for research purposes by two academics at the University of the South Pacific. A viable culture was established at Telau Island near the capital city of Suva (Prakash, 1990). This was followed by a survey undertaken in cooperation between the Fiji Fisheries Division and Coast Biological Ltd. of New Zealand, which led to importation of K. alvarezii from Tonga in 1984 (Luxton et al., 1987; Prakash, 1990). The seedstock was Filipino in origin but had arrived in Fiji from introduction and cultivation or research projects in Hawaii, Kiribati, Samoa and finally Tonga. These introductions had taken place during the 1970s and early 1980s. Coast Biological withdrew in 1988 for political reasons, namely the coup of 1987, and also because of poor weather, unfavourable NZ$ exchange rates, trade bans between New Zealand and Fiji, and farmers leaving seaweed farming for quick cash during a short-lived sea cucumber fishery boom (Prakash, 1990).

In 1989, a private company, Seaweed (South Pacific) Ltd. was created to develop supplies in the northern part of the country using a plantation method (Prakash, 1990). This failed shortly thereafter primarily because a typhoon destroyed the farms, but also because of inherent flaws in the business and operations model. For example, the project proponents moved farmers 5 km offshore and constructed stilt houses for them to live and
work on, similar to the farm houses found in the Sulu Archipelago of the southern Philippines. This was done without consideration of Fijian traditional culture and their communal activities, meetings and obligations to the village.

In addition, with development support by Fiji Fisheries Division, purchasing/marketing provided by the National Marketing Authority and liaisons between the FAO/South Pacific Aquaculture Development Project and the New Zealand Government, seaweed was purchased from individual farmers and sold to FMC Corporation in 1988 and 1989 (Prakash, 1990). However, this collapsed in 1993 for two reasons. First, the marketing agent was unable to ship enough monthly volume to cover overhead costs and secondly, the Fisheries Division was unable to provide adequate technical support to increase volumes.

Senior fisheries officers of the Fisheries Division studied the past failures and it was discovered that four important components were necessary to achieve a successful cultivation industry:

1. government support
2. a guaranteed market
3. adequate funding to operate the programme until commercial volumes were achieved
4. competent project design, management and execution.

The fourth component includes the use of trained field technicians and understanding the barriers to entry into seaweed farming by the coastal villagers and a plan to lower those barriers.

Government support was adequate, with funding through the Ministry of Agriculture, Fisheries and Forestry in excess of US$ 1.5 million over a three-year period. FMC BioPolymer assured a market. The key was assuring good project design, planning and execution. Fortunately, a few exceptionally qualified individuals at the Fisheries Division provided the competent project management. FMC BioPolymer also provided technical support and training of field technicians during cultivation development.

During the previous cultivation attempts, seasonal production and environmental data were recorded. This information indicated that good growth occurs during the south-easterly trade winds during April to December. Growth slows in January to March with elevated water temperatures and a change in the wind patterns (Prakash, 1990). The current development project took this into account in designing the development plan.

Materials & Methods

Fisheries Division realized that to develop a successful cultivation industry, several key factors were necessary in the project plan:

1. excellent site selection to assure that the chances of success in the villages selected were great and subsequently the investment of time, effort and materials was justified
2. a clear understanding of the barriers to entry of villagers into seaweed farming and how to lower those barriers
3. suitable seedstock (quantity, morphology and acclimation)
4. constant technical support to the villages to encourage farmers as they expanded farms to commercial size (6 km of line)
5. regular purchasing at an attractive price to the farmers in order to assure constant positive cash flow to the villagers as well as promoting seaweed farming as a viable alternative to other livelihoods such as copra growing and collecting and fishing. An attractive price is defined as that required for the income per unit effort of seaweed farming to be higher than other alternative livelihoods, in this case, producing copra or fishing. In addition, other factors such as initial capital cost and enjoyment of the work must also be considered.

From these considerations the following step-by-step development plan was created:

1. Site selection
2. Seed stock procurement
3. Pilot farm development
4. Promotion and training
5. Maintenance
6. Post harvest handling training
7. Purchasing

In addition, barriers to entry were also identified. These barriers were primarily farm equipment and materials and some or all of the following materials were supplied to farmers: 4 m wooden boats, 15 hp outboard motors, farm material (lines and tie-tie) and drying platforms. Potential farmers signed a contract with the Fisheries Division that stipulated the conditions upon which the materials were received. Basically, the farmer would own the materials once they had produced 20 t. However, if the farmer did not meet his/her supply obligations, the materials were seized by Fisheries Division and redistributed to another potential farmer. The original farmer could try again after a certain period of time.

Materials were repossessed from about 60% of the farmers and redistributed to new farmers. It is important to note that the primary author, who has been involved with seaweed farming development in five countries representing a variety of cultures and politico-socioeconomic conditions, assumes a 70% failure rate when introducing seaweed farming as a new livelihood. Because of this, it is important to triple the effort to meet production targets. In addition, it should be kept in mind that once a certain farmer production base is obtained, for example 80 t mo⁻¹, there is usually enough momentum to sustain farming. From that point, farmer numbers and production will increase as villagers set aside their doubts and suspicions of the new livelihood because of positive testimony from friends and relatives and being able to observe actual farming. This is assuming, of course, that interested villagers have access to farm materials and capital.

Another barrier to entry was education about seaweed farming and the Fisheries Division provided technical support to villages to address this.

The standard off-bottom farm method was promoted (Trono, 1992) using 7–10 m long, 3.5 mm braided line, spaced 0.5 m apart and deployed in 100 line blocks. One-hundred gram propagules were attached every 20 cm using conventional tie-tie. The target farm size was 6 km, so 6–8.5 blocks were required depending on the length of the line. Farms of this size can produce over one t per month.

Results & Discussion

In late 1997, a site survey and site selection programme was conducted. The villages of Kiuva, Nakobo and Karoko (Fig. 1) were chosen because they had met the environmental, politico-socioeconomic, logistic and demographic criteria. In addition, they had a previous history of seaweed farming, so less technical training would be required. Shortly after the survey, seedstock was gathered in Ono-I-Lau, Ogea, Lakeba and Taveuni Islands (Fig. 1) where it had been growing in the wild since abandonment of farming in the early 1990s.

Seedbanks were established in Kiuva, Nakoba and Motoriki (Fig. 1) during the first three months of 1998 and farming was promoted in eastern Viti Levu, northeastern and southeastern Vanua Levu, Taveuni, the Lau group and other areas. By October 1998, there were about 150 farmers (Fig. 2). In November and December 1998, disaster struck as seawater at temperatures in excess of

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Figure 1. Wild seedstock, seedbanks and initial cultivation sites of the Fiji Fisheries Division’s *Kappaphycus alvarezii* development project.
31°C quickly moved through the farm areas. The rapid increase in temperature killed over 70% of the plants, leading to a rapid decrease in farmed lines (Fig. 2).

In January of 1999, the project managers put all their efforts into recovering from this disaster and returning to target farmer, line and production levels. By March 1999, the project was back on track (Fig. 2).

In addition to the increased water temperatures, other environmental problems encountered were herbivory (primarily by siganid fish), storm weather/large waves, pest weeds, including epiphytes, and incessant rainfall, even on the drier parts of the country, that hindered drying. The latter was an effect of the La Niña phenomenon and created moisture and salt content problems. In addition, politico-socioeconomic problems were encountered. There are numerous examples:

1. In some villages, people left seaweed farming for more lucrative opportunities.
2. In one area, farmers abandoned seaweed farming for a few months as part of a traditional mourning practice for a deceased chief. The mourning required a ban on use of coastal resources. Unlike fishing or collecting of marine products, seaweed farms need constant attention so when they are left for months, plants fall off lines and stakes and lines are lost. Plants also become very large in diameter, making them difficult to dry.
3. During the election campaign in the first half of 1999, the opposition, which eventually won the election, criticized the standing party for establishing the Commodity Development Fund, charging that it resulted in waste and fraud. Though this criticism was a political move with few and questionable supporting facts, it did paint the CDF in a negative light and funding to the seaweed project was threatened for two to three months leading up to the election. The constant negative publicity also lowered the morale of the Fisheries Division staff operating the seaweed cultivation program. This criticism dissipated after the election and the threat disappeared.
4. The coup attempt crisis in May–July 2000, left seaweed farming a low priority and created trade bans with New Zealand and Australia making it difficult to receive farm material and trans-ship seaweed. In combination, this decreased the government’s budget, making it difficult to purchase seaweed from farmers on a regular basis.

However, all these problems were overcome or dealt with in other ways and subsequent to the first quarter of 1999, farmer numbers, farm lines and production continued to increase (Fig. 2). Production in 1998 was 20 t, in 1999 240 t and in 2000 420 t. Now the purchasing and export is privatized through agreement with the Ministry of Agriculture, Fisheries and Forestry and plans to increase volumes to 3,000 t y⁻¹ by 2005 are underway. At that volume, about US$ 750,000 to $ 1.25 million per year will be flowing into coastal villages throughout Fiji. Given that the CDF development budget for seaweed was US$ 1.5 million over three years, the project will certainly have been deemed a success.

With privatization and the desire among FMC BioPolymer and the Fijian Government to increase annual production volumes substantially, Fisheries Division will continue to play the development role. In addition to technical training in cultivation
and post-harvest handling, as well decreasing barriers to entry, efforts to train farmers in personal finance and farm economics are beginning. This knowledge is deemed necessary in Fiji given the higher operating costs of most Fijian farms compared to the world average. Farmers must become business persons and manage their operating costs appropriately.

**Conclusion**

The history of establishing a successful seaweed cultivation industry in Fiji has been one of making mistakes, learning from those mistakes and moving on. The authors believed that given the success of *K. alvarezi* cultivation in the Philippines, Indonesia and a few other countries, it could certainly work in Fiji. However, it was important to design the project to address the native culture and mores as well as to consider the barriers to entry. Since the inception of the project, *K. alvarezi* volumes have continued to increase, even in the face of substantial problems. This success is attributed to the soundness of the development plan and the management skills of key Fisheries Officers overseeing the seaweed project.

It is hoped that the neighbouring countries of Samoa, Tonga, Vanuatu, Solomon Islands and Taveuni will follow Fiji’s successful example, and that the political and financial support can be raised to create *K. alvarezi* cultivation industry projects in those countries as well.

**References**

