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Annual Results

SW97-025

Sustainable Culture of the Edible Red Seaweed *Gracilaria parvispora* Abbott in Traditional Hawaiian Fishponds

Location:
University of Arizona, Tucson,
and Molokai, Hawaii

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OBJECTIVES

The project goal is to eliminate roadblocks to ogo production, so that production reaches 500 to 1,000 kg/week with 20 to 40 community participants by project end. Specific objectives are:

1. Establish methods to break dormancy of sporelings.
2. Establish methods for cage culture.
3. Design and test seaweed cleaning machine.
4. Disseminate information.

ABSTRACT

We have introduced a community-based form of ogo culture on Molokai. The working partner operates a hatchery which distributes spore-coated rocks to potential growers. They plant patches of ogo on Molokai's extensive south reef, which is public domain. They harvest their patches periodically and sell their ogo to Ke Kua'aina, which multiplies the harvest three to five fold in floating cages, then cleans and markets the ogo in Honolulu.

Research has shown that ammonia is the controlling factor for growth of ogo on the reef. Sixteen individuals or families are now part of the growers' network, harvesting patches located at nutrient-rich hot-spots on the reef. Sales are approximately 1,600 kg/month valued at approximately \$12,000/month, almost all of which is paid directly to growers or to limu handlers working at the central cooperative. Molokai ogo has captured a significant portion of the fresh ogo market in Hawaii; it is the only source of native, long ogo.

As we have attempted to expand the number of community participants, we found that only 15 percent of sites which were planted on the reef actually developed harvestable crops. Therefore, we have conducted research to determine the factors controlling growth on the reef, so we can predict where productive patches can be established. Three laboratory-scale experiments and two field studies have been conducted on factors controlling ogo growth. The most informative has been a field experiment conducted at six sites on the reef at three different seasons of the year (October, 1997; March, 1998 and June, 1998). The sites are areas from which growers harvest ogo. We placed out ten to 20 test rocks inoculated with spores and measured ogo production on each rock over 21 days during each experiment. We also measured water quality factors at seven day intervals during each experiment. The water quality factors were: salinity, water motion, temperature, nitrate, ammonia and phosphate content. The study has produced a striking finding: biomass production is strongly correlated with ammonia ($r = 0.91$, $P < 0.001$), but not with any other water quality factor ($P > 0.05$). Both biomass production and ammonia were skewed towards low values.

Based on these results we are surveying the reef for ammonia "hot-spots" at which we can locate productive ogo patches. Most of the reef is low in nutrients, but hot-spots occur where land run-off brings in nutrients. These spots include areas with shoreline housing developments, shrimp farms and cattle grazing. The amount of ammonia needed to stimulate ogo growth is very low—140 parts per billion ammonia was the highest level measured on the reef (well below drinking water standards). Ogo patches established near ammonia hot-spots can help in controlling nutrient inflow onto the reef as well as providing a cash crop for residents.

One journal article has been published in *Aquaculture* and one has been submitted. A 'Ohana Growers Network is established to train and recruit community members, working through the Limited Resources Aquaculture Program (LRAP), funded by the Queen Liliuokalani Children's Center on Molokai. The LRAP program will be the primary means by which we expand the program.

ECONOMIC ANALYSIS

Ke Kua'aina pays \$6.60 per kg to growers and sells its harvest for \$7.15 per kg. Growers make from \$50 to \$1,200 per month. Ke Kua'aina currently markets 1,500 to 1,700 kg/month for a gross income of approximately \$12,000 per month, almost all of which is disbursed to the community through direct payment to growers or salaries to ogo workers who maintain cages and clean and market ogo (Ke Kua'aina is a non-profit organization which does not charge overhead to the project; its administrative costs are supported by the Schroll Trust, and endowment fund to benefit native Hawaiians on Molokai).

POTENTIAL BENEFITS

The coastal residents are attempting to demonstrate the economic value of the south reef for sustainable agriculture and aquaculture, partly as a means to resist pressure for urban development. The project has been the first economic success of the dispersed aquaculture efforts utilizing the fishponds. Molokai is currently the *only* source of native, long ogo in Hawaii and it has captured a large portion of the total ogo market, which is also supplied by tank culturists working with a *Gracilaria* species imported from Florida. The culture method emphasizes community participation and sustainable methods that enhance the supply of ogo on the reef for everyone, as the ogo spreads by spores to other locations. Ogo culture also helps control nutrient levels on the reef and does not require chemical fertilization of patches. We believe this project will become a model for sustainable aquaculture development in Hawaii and the Pacific.

FARMER ADOPTION AND DIRECT IMPACT

The coastal residents who participate are mainly fishermen and other subsistence-level users of the reef resources. They have readily adopted to this form of aquaculture as it involves harvesting from the open reef. They are protective of their ogo patches and there has been some friction between growers over who can plant in good locations, as the entire reef is in public domain. In general, growers harvest from an area in front of their own property. As the program expands, the growers network will need to develop ground rules on participation. Control can be exerted through the cooperative which markets ogo, as it is impractical for individual growers to ship their own product to buyers in Honolulu.

PRODUCER INVOLVEMENT

Sixteen outside growers, plus five to ten hourly employees at Ke Kua'aina, are involved in ogo production. Participation at workshops and training sessions has ranged from 20 to 40.

FUTURE RECOMMENDATIONS OR NEW HYPOTHESES

The project is advancing on schedule. Now that ammonia has been identified as a limiting factor, a decision is required whether to introduce methods to fertilize the crop, or to concentrate production at the fertile hot-spots, as discussed above. This will be a community decision, but so far the strong inclination is not to introduce additional outside nutrients to the reef, since that would not be compatible with the oligotrophic nature of the reef. There are sufficient spots where nutrients enter the reef from human land-use practices to expand ogo production on Molokai and elsewhere in Hawaii and the Pacific. The cage cultures are fertilized once a week on land and the nutrients are recycled through a ditch system prior to discharge. Ke Kua'aina now plans to add other aquaculture components to the system, including a shrimp hatchery to produce specific-pathogen-free larvae, utilizing the ogo hatchery facilities, and mullet culture in floating ogo cages.

This summary was prepared by the project coordinator for the 1999 reporting cycle.