

Is aquaponics viable in the Pacific Islands?

Fish and vegetable production by aquaponics is grabbing more attention these days among SPC member countries and territories in the Pacific Islands. Because there is not yet much of a track record of experience with aquaponics under our own local conditions, it can be difficult for people not familiar with the subject to separate fact from fad and make sound decisions about it. SPC convened a meeting of experts and representatives of interested Pacific Island countries and territories in October 2013 that aimed to collate experiences to date and find out whether aquaponics can indeed move from a nice idea to an actual industry in the insular Pacific.

But first, what is aquaponics? Here's the short answer: it's a polyculture system in which three groups of organisms — fish, vegetables and nitrifying bacteria — are grown in water that is re-circulated in an enclosed tank system (see Fig. 1). Fish excrete nitrogenous waste (mainly as ammonia), but plants need nitrogenous compounds (mainly nitrate) as their fertiliser. Nitrifying bacteria provide the link between fish and plants, by converting ammonia from the fish into nitrate for the plants. This makes aquaponics a pro-biotic system where “friendly” bacteria are encouraged.

This sounds deceptively simple and appealing. So much so, that aquaponics is creating a lot of interest in the Pacific, particularly in places where traditional soil-based agriculture or fish farming is difficult. Imagine the advantages for many Pacific Island locations of a soil-less agriculture system that is unaffected by sea-level rise, drought, and salty or sandy soil conditions; conserves fresh water and nutrients by recirculating them; and grows crops intensively in a small land area.

Balanced against these advantages, however, is the sizeable cost for the materials to build an aquaponics system, followed by an ongoing need for reliable electricity and fish food to operate it. The system needs daily checks and adjustments to keep everything running well and to rapidly fix any breakdowns.

Because of the increasing interest but lack of information about Pacific Island aquaponics, SPC's Aquaculture Section in 2013 convened a regional Aquaponics Expert Consultation in Cook Islands to gather information to answer several questions: Can aquaponic food production systems be viable in a Pacific Islands context? What should be the best form or size of such systems, in order to be successful? What gaps in knowledge need to be filled to take aquaponics to the next level?

Hosted by the aquaponics public-private partnership of Te Raurau o Te Kaingavai and Ministry of Marine Resources at Titikaveka on Rarotonga, the meeting first focused upon purely commercial approaches to aquaponics. We heard from economist John Hambrey, engaged by the New Zealand Ministry of Foreign

Affairs and Trade to review the current status of the global aquaponics industry, that large industrial-scale aquaponics ventures are not very common. Those that do exist (there are three in Hawaii) were founded not purely to make money, but rather to make “sustainable food”. They succeed as businesses only by clever niche marketing that allows them to sell the products at a high price. Their founders chose aquaponics not because it is the most cost-effective production method, but because it conforms to their personal philosophy about how food ought to be grown in the future. A major consideration here is the pesticide- and chemical-free nature of aquaponics food products. Aquaponicists simply cannot treat plant pests with anything toxic, because to do so would harm the fish and the nitrifying bacteria.

In addition to selling vegetables and fish, many of the bigger ventures depend heavily upon income from selling start-up equipment and offering training to those getting started in aquaponics. However, there are lately signs of a backlash by customers against aquaponics experts whose main business is selling aquaponics gadgets — it is not easy to be commercially successful by purchasing any of the expensive off-the-shelf systems. In fact, it is difficult to think of any equipment for a backyard aquaponics system that cannot be purchased locally from a regular hardware store or scavenged.

Investment in large-scale commercial aquaponics needs to be weighed against hydroponics, which is the obvious alternative soil-less agriculture system. Hydroponics produces only plants (a monoculture), so it does not have the complication and added risks of a polyculture system with fish, bacteria, biofilters, and so on. A decade or so ago, hydroponics was risky and speculative. But now it is a mature and well understood technology that works quite well, daily tasks are largely automated, and it is big business.

To the committed aquaponicist however, hydroponics is “antibiotic”, while aquaponics is pro-biotic. Hydroponicists usually use pesticides to control bugs, and supply plant nutrients as industrial chemical mixes. At regular intervals, all water must be dumped from the hydroponic system so that everything can be carefully

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sterilised with antiseptic before the system is re-filled. Aquaponicists also claim that the quality and taste of their vegetables is superior to those grown by hydroponics, and the shelf life is longer.

But aquaponics needs more time, more skills and dedication, and more frequent management interventions, to maintain the balance of culture conditions. The interdependency of fish, plants and bacteria greatly limits options for pest and disease management. Aquaponics systems are more complicated and require more investment, and operational costs are high (mainly for energy and labour). Aquaponics has a lot more variables than hydroponics, and therefore has more risks.

This type of hard-headed economic analysis is not deterring people from engaging in aquaponics, however. It appears that the increasing amount of interest in aquaponics is not being driven purely by money. Just as for hydroponics, clearly aquaponics is an industry whose time will come. But right now, finding the rationale for aquaponics requires considering other factors.

What is the relevance of aquaponics to the Pacific? There was much discussion about this among the meeting participants. Before getting started in aquaponics, you

have to know WHY you are doing it. Only then can you decide what to do, and whether it is worth it. This is very much a personal decision. Whether or not aquaponics is the best method to meet your objective will vary from place to place.

In some Pacific locations, we don't have water or soil. If you live in a "desert" environment, like on an atoll, aquaponics is an easier way of growing plants than trying to make compost and build up soil in sandy or salty conditions. Where all else fails, there is a place for aquaponics. You can even grow plants in outer space by aquaponics.

The notion of "food miles", or considering the distance that your food has traveled when shopping, is becoming increasingly relevant. Already the Pacific has chefs who prefer to buy local rather than from the continental Pacific rim, and who don't mind paying extra for a smaller carbon footprint plus added freshness. This is niche marketing that commands a high price. A premium for locally-grown produce is a competitive advantage that Pacific aquaponics should pursue.

But remember, the key to such marketing is this: Don't start with aquaponics. Start with the market. Then ask yourself — does the local market make aquaponics

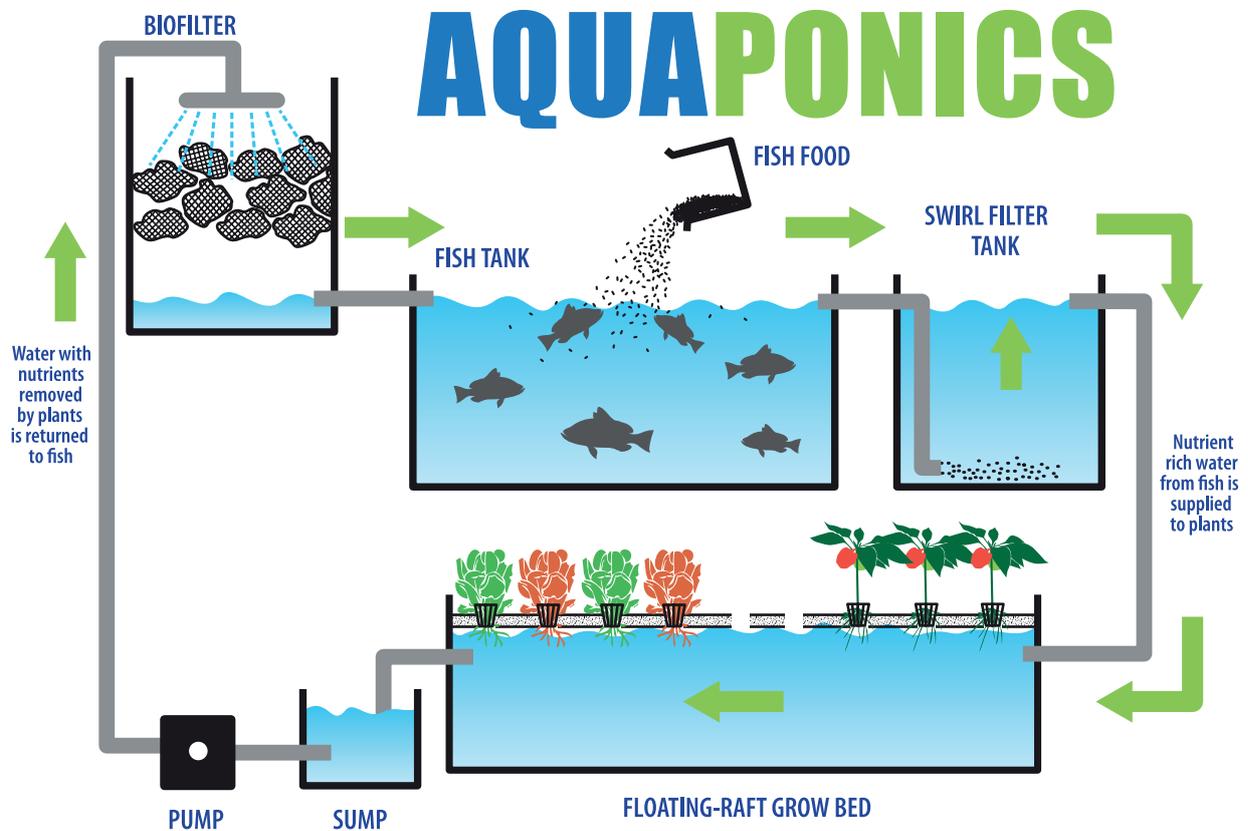


Figure 1. Schematic diagram of a typical aquaponics system

attractive? Do your sums *before* you head off to the hardware store!

While food miles and the lack of water and soil are both valid commercial drivers for Pacific aquaponics, by themselves they do not explain the fact that most aquaponics systems are small-scale systems in urban areas. Such aquaponics farms, run by backyard urban farmers, cannot hope to compete on price with industrialised organic agriculture, yet they are being established. Why?

The answer is that “backyard” is not the same as “commercial”. There are other reasons to be an urban farmer aside from making a profit. Aquaponics can be fun and satisfying. The goal can be saving money (rather than earning money) and better health. Larry and Patty Yonashiro shared with the meeting their post-retirement experiences of becoming backyard urban farmers growing pak choi in a very sandy and infertile part of Molokai, Hawaii. They feel that this is the way good food ought to be produced. They are determined to demonstrate the economic, social and nutritional benefits of “growing local” through urban networks of backyard farmers, each specialising in particular crops and trading amongst themselves.

Then there are non-monetary benefits, such as food safety, which extend beyond money to networking, community empowerment, and revival of past traditions. Recent Hawaiian experiences in places like Waimanalo were shared by Leina’ala Bright, whose approach to aquaponics is from a standpoint of maintaining community links and preserving traditional knowledge about Hawaiian medicinal plants. The benefits of backyard aquaponics to the 50+ participating households in Waimanalo are more than just nutritional. There are community, spiritual and wellness benefits. Backyard aquaponics is an absorbing pastime with tangible social benefits. It increases social ties and restores self-esteem — vital factors that lead away

from the path to crime and drugs in urban settings. These findings tie in with the documented experiences of urban agriculture and community garden projects in places like New York City, where participation has been linked to a lessening of aggressive and anti-social behavior.

Schools are finding that an aquaponics system is a wonderful hands-on learning tool. It is a self-contained microcosm to demonstrate the water and nutrient cycling principles of natural ecosystems, in addition to fish husbandry and plant cropping. Learning institutions in Hawaii, American Samoa, French Polynesia and Fiji have already established demonstration aquaponics systems for educational purposes.

Leina’ala Bright’s own specialisation is growing traditional medicinal plants, such as *kōkō’ōlāu* (*Bidens pilosa*) for treatment of diabetes, through aquaponics. She has demonstrated increased effectiveness of some medicines when produced by aquaponics. Her advice is to not worry about aquaponics being a business. Just do it! Small-scale aquaponics can be very rewarding, and the benefits cannot all be measured in terms of money.

There is no universal answer to the question “Is aquaponics worth doing?” First decide what your objective is. Then, and only then, consider aquaponics, simply as one of a range of options that might help you reach that objective. It will never be a magical solution to all problems of food security in the Pacific. But aquaponics seems sure to have an increasingly important role.

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Figure 2.

Participants at the aquaponics meeting at Te Raurau o Te Kaingavai are guided by Brad Fox (third from right) and Leina’ala Bright (fourth from right) of University of Hawaii in the construction of a “barrel-ponics” system. This type of aquaponic system is not even “backyard” scale, it is “backdoor” scale!

