Aquaponics in Haiti

Aquaponics … an affordable and sustainable agricultural option for Haiti and other developing countries.

By April Perry and Shelia Rittgers

Our interest in aquaponics began with our interest in working in Haiti. On our first church medical mission trip to Haiti in June 2001, we discussed the possibility of building an aquaponics project in a remote mountain village where we had previously built a medical clinic. We had been introduced to the concept of aquaponics from a friend prior to our leaving for the trip. There is already lots of aquaculture in Haiti and, consequently, our friend wondered if aquaponics might be something which could help meet some of the needs for the people of Haiti.

While visiting the village of Fondwa and talking with the community leaders, they expressed a strong interest in investigating the possibility of building an aquaponics project there. As we discussed what it would take to do that, it became clear that a prototype built in the US would need to be the first step. We were asked if our farm might be a potential site for the prototype. Not having any idea how that decision would change our lives, we enthusiasticly answered “yes”.

Upon arriving back in the US, we formed a small task force to evaluate what needed to be done to make the Haiti project come to fruition. Our plan was a relatively simple one in structure. We would build a prototype in the US, experiment with it over a period of time (hopefully a year or so), evaluate what needed to be done to adapt the system to Haiti and then build a system in Haiti. Our timeline was to get a system in Haiti within two years. We had $5000 given to us by a local non- profit as start-up money for this project.

We read all we could about aquaponics. Some of the initial research on the possibilities for aquaponics came from the McMurtrey group at North Carolina State University, right here in our back yard. We also contacted S & S AquaFarms, West Plains, MO (Web Site: http://www.townsqr.com/snsaqua/) and ordered their start up manual.

The US Prototype

Within 6 weeks after returning from Haiti, we arranged a work day and invited all interested parities to a greenhouse building day. Organization was the key to making the best use of all the volunteer labor. We had coordinators for each of the following components: growing beds, irrigation system, greenhouse structure and support (food, drinks, logistics). The day started early and we had about 35 people come to help us out. Before the day was over, we had 6 growing-beds built, the irrigation systems assembled for all of the growing-beds and the greenhouse structure 75% completed. It took the better part of three additional weekends to complete the greenhouse, get the plastic sheeting on the outside, fill the growing-beds with gravel and get the plumbing hooked up. We initially started with a 500-gallon stock feeding pond and 4 growing-beds. We used the S&S system as our model and followed their instructions to the letter. Our final greenhouse was 20’ x 30’, housing 6 growing-beds and a 500 gallon fish pond.

We started with 50 goldfish to get the system go-

ing and quickly added 75 tilapia fingerlings. We still have a few of the original goldfish living in the pond. The first winter brought challenges of how to heat the greenhouse adequately and keep the fish warm. We solved this by initially using small electric heaters, ultimately converting to free standing kerosene heaters, which is what is currently in use. We wrap our fish pond (tank) in fiberglass wall insulation when the first frost comes. We use three inch thick Styrofoam to make a cover for the tank which is placed on at night to hold in the heat. We use a thermostatically controlled quick-plug electric heater in the pond to keep it at about 70° F. Ambient temperature in the greenhouse ranges from 55-65° F during the winter months. Our first crops were lettuce seedlings, collards, and mustard greens

In November, 2001, we wrote a grant for continuation of the project and were awarded $14,000 from the *International Hunger Fund of the Presbyterian Church, USA*. This allowed us to complete the greenhouse with permanent polycarbonate walls and build the prototype in Fondwa, Haiti.

Over the winter of 2001 we refined our system of pumping and draining, settling on running the system 4-6 times a day for about one hour, each time utilizing standard electric timers. The float-triggered sump pumps allow the system to cycle based on the amount of water in the fish pond and then return. Three beds are drained by gravity directly back into the fish pond and three are drained into a return tank which uses another sump pump to return the water to the large fish pond, thus allowing the force of the pumping action to aerate the water as it is pumped back to the fish pond. Our tilapia did well and, fortunately, we have not had a major fish kill in two years.

Top: Various crops in the US prototype growing-bed.

Middle: Shelia Rittgers, project co-manager at the prototype greenhouse in Durham, NC

Bottom: Tilapia in the US prototype system.

In February, 2002, we brought two aid workers from Fondwa to the US for 4 days to look at the prototype, to further discuss the project and to help us think about the designs required in Haiti. We were unable to bring Haitian project leaders to the US due to difficulties in their obtaining a visitor's visa to enter the US. The aid workers made a videotape of the project to show to the local leaders. They were able to narrate the video in Haitian Kreyol. This proved to be an invaluable teaching tool for the local farmers who would later be involved in the project.

During our annual mission trip in May, 2002, we again discussed where we were with the

project in the US and began planning for the Haitian prototype. The local farmers remained enthusiastic and interested in the project.

Over the following summer, which neared our first year in operation, we began to think of how we could adapt this system, heavily dependant on electricity, to Haiti. In the remote mountain community of Fondwa, there is no electricity available at all. While we now knew that the concept of growing fish and plants together in a soil-less environment would work, we faced two major problems... first, how could we adapt this system to not be dependant on electricity and, secondly, would it work in Haiti? The second question was as important as the first. We had shown that two amateurs could make aquaponics work (Shelia is a pediatric clinical social worker and April is an advance practice nurse (both hobby gardeners). We were sure that the relative simplicity of the system could be used in Haiti with some education of the local nationals we were working with. But we needed to overcome these two issues to adapt the system to Haiti and have a chance at success with aquaponics there.

A Haitian farmer working a steep hillside.

The Need in Haiti

Fondwa, Haiti, is located in the southern peninsula of Haiti about a 2 hours drive from the capital city of Port au Prince. The residents there are subsistence farmers who work an average of 1-2 acres on steep mountainside plots. Much of Haiti in general has been deforested by the peasants and the wood used as fuel. Consequently, the topsoil has eroded significantly making even simple farming difficult at best.

The people of Haiti live difficult lives. While those in more rural communities fare a little better than those in urban environments (due to the lack of diseases of over population such as TB, diarrheal-based disease and infections), still 75% of the Haitian population exhibits moderate or severe protein calorie malnutrition. Thirty percent of the children under 5 years of age die of infections or starvation. The lack of food is part of the problem but, even in areas where food is available either through farming or markets, the peasants lack income to purchase food for themselves and their families. The average income in Haiti is less than $360 US per year and over half of the population makes less than $60 US per year.

The need for a good source of protein as well as calories in the form of vegetables is great. This is the most essential need in Haiti and was what attracted us to aquaponics as a potential solution to the need for food in Haiti. Calories were important and available to some degree, but there was no real consistent protein source available either for farming or in the markets.

Tilapia are farmed in aquaculture by local missionaries in various areas of the country. They are well tolerated and liked by the Haitian nationals. Often they are harvested at about ¾ lb. because that is about how much it would take to feed a family and, more importantly, because that is about all they are able to afford for a meal.

The Fondwa Prototype

We kept the local community leaders apprised of our progress on the US prototype regularly as people made trips to Fondwa. Because they have no phones or other means of communication with the outside world, we had to rely on hand delivered letters to keep them informed. The farmers in Fondwa remained very interested in aquaponics. During our annual mission trip to Haiti in May 2002, we met with them again and discussed with them what we had done over the last year. We worked with the local peasant organization, Association of Peasants of Fondwa (APF), to identify a potential community leader who would be willing to operate the Haitian prototype when we were ready to implement

it.

At this point, we still had to overcome the electricity problem. We looked into several options, which included solar powered pumps, battery powered pumps and manual pumps. The first two were problematic due to the issues of expense along with maintenance, breakage and repair. In a remote area where one must hike 1.5 miles down a rocky road to get to the valley, the chances of having things repaired easily were pretty much nil.

A manual pumping system seemed to be the only solution. And it turned out to be a pretty simple one at that. We looked into a variety of manual pumps and settled on a simple manual bilge pump. The one we picked we found online at Boatersworld.com. It was a simple diaphragm-based pump leaving no real parts to break.

The manual pump assembly in the fish tank in the US prototype.

The *Whale Gusher Urchin* pump is the ideal manual bilge and waste water pump for small to medium sized applications and was just what we needed. The compact design is perfect for confined spaces and the smooth, easy action pumps up to 11 gallons per minute. The lightweight and durable housing has feet for convenient mounting to solid surfaces and the dual-sized nozzles allow for connection to both 1" and 1-1/2" hoses. In addition it was cheap (less than $40).

Having decided on the type of pump we wanted to try, we set up a prototype of the Haitian model in our greenhouse. Our plans were to use one of our growing-beds to test the Haitian prototype to see what problems existed with it here in the States and try to work them out before installing it in Haiti. With the help of our father, Jim Perry, a retired engineer, we rigged up a very basic manual pumping system to provide the pumping action through the irrigation system. Additionally, he designed a recirculating system for the pump which allowed us to recirculate the water from the fish pond back into it with pumping action providing aeration to the pond periodically. It was an ingenious design. Since there would not be the force of the electric pump returning the water to the fish pond (this is accomplished through gravity drain) we could aerate the water using the manual pump.

In January, 2003, we bought a 100 gallon stock watering container from a local farm supply store and set up a small fish pond with one growing-bed as our Fondwa prototype. We put 20 tilapia fingerlings in the pond and placed a gravity drain pipe from the drain in the growing bed to the fish pond. We planted lettuce, collards and green beans in the first crop and we began using the hand pump system to irrigate the growing-bed. We wanted to see what it was like to pump with it so we could know first hand what the Haitians would need to go through to operate the system.

The hand pump had specs of pumping 11 gallons per minute. It took about 10 minutes of hand pumping to flood the bed. We soon learned that it took less pumping to flood the bed if we closed off the ball valve which was located on the growing-bed drain to allow the water to stay in the bed during the pumping. This also served the secondary purpose of saving our middle-age rotator cuffs. The only change we needed to make initially was to place a 2 foot length of PVC pipe over the handle, extending the pump handle length to make the pumping action easier.

Given the fact that we worked during the day, we were only able to pump the beds 2-3 times during

the week and 3-4 times on the weekend. Even though this wasn't as much as we wanted to water the beds, within one week we had little lettuce and collard seedlings. We were elated. Over the next 2 months we hand pumped the system each day and soon had lettuce to harvest. It was now the spring of 2003 and now felt we were ready to begin to plan for the installation of the Fondwa prototype.

Aquaponics in Haiti

As we began to plan for the installation of the first Haitian aquaponics system in the summer of 2003, we looked at design plans for the system and asked the local community leaders to identify a site which would house the system. They decided to place it at the home of the farmer who would operate the prototype. We had visited the site on our previous trip in May, 2003. We determined where the beds would have to go in relationship to the fish pond to allow for gravity drainage of the irrigation water back into the fish pond. We left Smith Noncent, the Haitian project leader, with a list of materials which he would procure and have at the site by the time the building team arrived in early June.

Given the site size and location, our plans were to build a two bed system with a fish pond to start with. Two of our committee members, John and Elizabeth VanBruggen, had agreed to spend a month in Fondwa getting the system built and running. Shelia and I were planning to return to Haiti 6 weeks after they finished to evaluate the system and identify what problems needed addressing before they became real concerns.

John and Elizabeth traveled to Haiti in early June, only two months before their wedding. We had arranged to have a translator working with them during the entire building process as Smith did not speak English. Even with that, some things got lost in translation. The beds were built on the ground, made out of concrete blocks on a concrete slab. They were waterproofed with smoothed out concrete. The fish pond was located below the grade of the growing-beds on a small hill just below to allow for gravity drainage of the beds.

Top: John VanBruggen (left), a committee member and the person who traveled to Haiti to build the Fondwa prototype, along with his Haitian translator, Thomas, (right).

Bottom: The newly-sprouted lettuce and tomato seedlings in the aquaponic system in Haiti

The pond was made out of a concrete slab with 4 rows of concrete blocks comprising the sides. It was also waterproofed as above. The drain pipes were built into the beds prior to the cement drying as was the drainage pipes leading from the growing-beds to the fish pond.

Building the system went relatively well given the nature of working in Haiti. Things in general took longer to accomplish than one might reasonably expect but, given the overall remoteness of the site and the difficulty with transport of materials to the site along with the language issues, we were pleased that they got the system built, fish in the pond and seeds planted the week before they left. We did send some seeds which we had procured from the University of Hawaii, hybrids needing a tropical environment (tomatoes and lettuce). But the Haitian project manager used the seeds he

had available to him locally as well. We were just trying out the tropical hybrid seeds to see how they grew. We utilized a local missionary who works with tilapia aquaculture in the next valley to supply the initial 100 fingerlings for the system.

All of the materials needed to build the system were available in Haiti with the exception of the pumps which our team brought. They brought one manual pump to use to pump water from the fish pond into the growing beds and a spare in the event of problems with the main pump. The on-site building team adapted some of the design elements of the system given what was available in Haiti. For example, instead of using a ball valve to control the amount of water flow out of the growing-beds into to fish pond, they used a simple water faucet. The one thing which we wish had gotten done but did not was that the beds were not lined with 3 mil black plastic. We are concerned that chemicals in the cement which lined the growing beds might leech into the plant system and affect it negatively somehow. We will need to wait and see how that plays out.

When we returned to Haiti in mid-August, six weeks after the installation team had left, we were pleased to see that all the fish were still alive and well. In addition, we were thrilled to see many tomato and lettuce seedlings. Smith had been pumping the system 3-4 times daily. The only problem he had was one that, given endless time to anticipate, we would never have identified. He only had tilapia fry which were about one inch in length when he got them. Within the first week, he had many frogs jumping into the fish pond. He was worried that the frogs might eat the fry since they were so small so he removed the frogs and placed some remaining screening over the fish pond to prevent the frogs from returning.

Haiti aquaponics fish pond and Fa-Fa, a translator and guide

Izsmith (Smith) Noncent (left), the Haitian farmer who operates the aquaponic system.

Aside from this minor problem, the system in Haiti seems to be working great. We will receive updates from the project manager as often as we have teams going to the area—every few months or so. To date, there have been no major problems with getting the plants and fish to grow. As time goes by, we anticipate working more closely with the local aquaculture missionary to have Smith learn the nuances of tilapia breeding so that they can harvest the fish and have others breeding to keep the supply of tilapia constant in the system.

In order to assist in making the system sustainable, we agreed that Smith will give 50% of the initial profits of the marketing of the vegetables and fish to a fund to build another system in the valley. Twenty five percentof the profits will go to the APF and he will keep 25%. When a second sys-

tem is built with this equity, he will keep all of the profits made from the sale of the food and fish and the same agreement will be put in place with the second aquaponics system operator.

The Future of Aquaponics in Haiti

Our plans are to observe the project in Fondwa for about a year and see if the interest can be sustained in the work needed to maintain the project, as well as evaluate whether the system can be useful for growing vegetables for consumption and marketing. At that time, we will consider setting-up another system in the valley with an interested farmer. In reviewing our finances for this project with Smith, we believe that we can build a second aquaponics system comprised of a fish pond and 2-3 growing beds (about what the yard of the average Haitian home can handle) for about $1500 US. It seems like a reasonable price given the instability of the Haitian economy where the local currency, the Haitian Gourde, has devalued about 75% in the last 18 months.

In addition, through our website, http://www.lukesmission.org, we have made contacts with at least two other agencies who are interested in building aquaponic systems in their areas. Funded through another PCUSA Hunger Fund grant, we are working with Bridges Farms, located in St. Michel in the northern part of the country, to build a 6 bed system which should be completed by the first of the year, 2004. This system is located on a large plantation with access to generator electrical power and will be powered electrically. The goal is to set up a prototype with the intent of evaluating the potential for doing aquaponics commercially on this large agricultural plantation. Aquaponics has the potential for providing employment to the local population as well as providing inexpensive produce for consumption.

As a part of the same grant, we are also working with Hope Ministries located just outside of Port au Prince to build a system there, sometime in the summer of 2004.

Finally, we have been approached by a pastor from Nodola, Zambia, who is very interested in starting an aquaponics project on his complex in Zambia. We have submitted grant applications to try to secure funding for this project on the African continent.

Above Left: The John Van Bruggen Memorial Greenhouse for Aquaponics, Durham, NC, (see note) was dedicated on September 21, 2003.

Above: Some of the many successful crops grown in the US prototype aquaponic system.

Locally, in the US prototype in Durham, North Carolina, we recorded the poundage of cucumbers and tomatoes which we grew this year. Based on standards set by Virginia State University, we

achieved 6 times the average yield by weight per vine of cucumbers grown in the traditional manner. This gives much more credence to the statement by Dr. Sanders at NCSU that aquaponics can provide food for a family of 5 in an area about the size of a parking space.

We dedicated the John Van Bruggen Memorial Greenhouse for Aquaponics (see note) on September 21, 2003, only three months after returning from Haiti.

We see a great potential for aquaponics to fill the void seen in many third world countries where adequate protein sources and vegetables are not available for consumption due to droughts, poor farming techniques and other effects of cultural poverty causing a chronically malnourished population. In addition, the potential for providing food for marketing, thus increasing income and sense of self reliance, is also great for this technology. The Fondwa Haiti prototype has clearly shown that the technology can be used in areas where only the most basic of supplies are available and where no reliable source of electricity is present.

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Shelia Rittgers is a clinical social worker at the Duke Children's Health Care Center. She has also traveled to Haiti a number of times. She serves as vice chairman of the board of directors and Aquaponics Coordinator for Luke's Mission, Inc.

NOTE: Our greenhouse is named in honor John B. VanBruggen, the father of John O. VanBruggen, who assisted us in building and running both the US and Haiti aquaponics projects. He and his wife Elizabeth are integral parts of this project. John Sr. lived his life in service to others and was very interested in mission opportunities for him and others.