# Aquaponics for Developing Countries

**By Travis Hughey**

Some people would say that aquaponics is a bit too complicated for application in a developing country. In it's current form here in the United States, that would probably be true considering that we have reasonably reliable grid electricity that allows us a lot of flexibility in design.

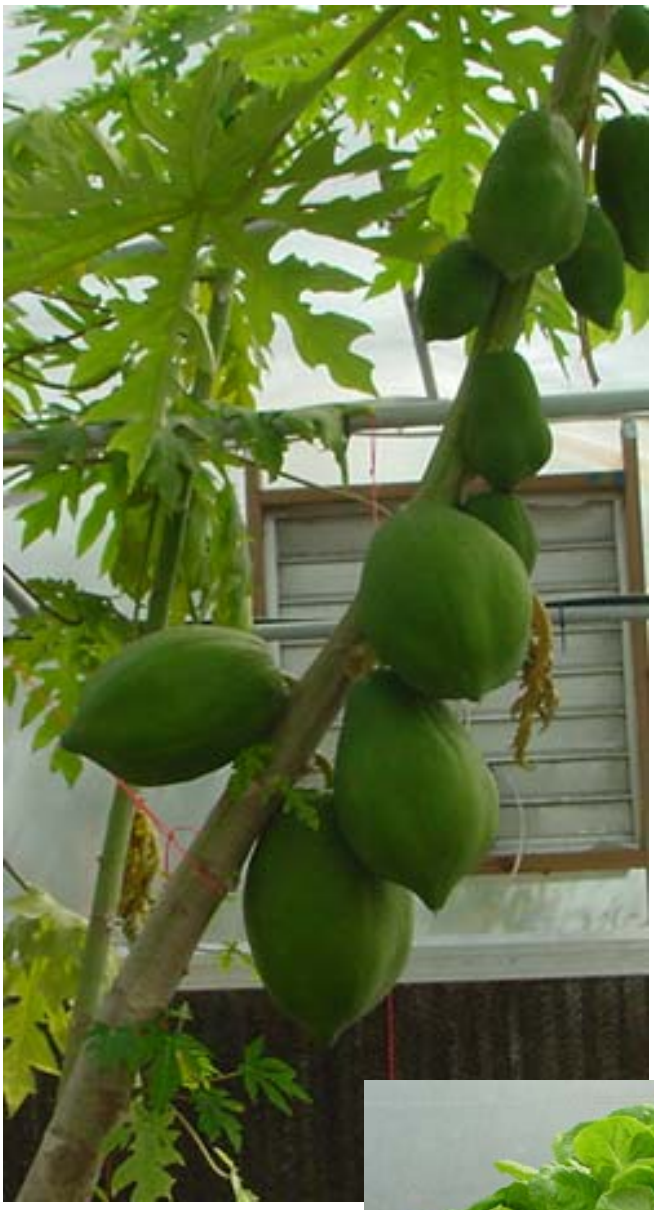
What if there was no electricity to operate pumps, float switches, timers, etc.? Trips I've made to Africa over the past few years, combined with my obsession with aquaponics got me to thinking about how to do this in a remote setting with few resources and no reliable grid power. I am convinced it can be done. My observation in Africa is that there is lots of maize and cassava but not that much in the way of greens or protein. It is an interesting phenomenon to see malnutrition in places where there appears to be lots of food. It would be a huge nutritional benefit to have fresh greens and fish protein in places where these things are now scarce. It would also be a blessing to be able to grow vegetables throughout the year, even during the dry season.

My inspiration to develop a low-tech aquaponic system started when my wife and I attended a conference hosted by Charlie Johnson of Aquaculture International in Bryson City, NC in 2003. There we saw a presentation given by a man named Frank McNeely. He was from St. Louis, MO and was doing aquaponics in a series of salvaged bathtubs. His creativity got me to thinking of how to build my system using plastic barrel halves as grow beds. I had ordered the S&S (S&S AquaFarms, West Plaines, Missouri) manual and had read it through. With just enough information and inspiration to be dangerous, it was time for the perspiration part of the program.




*Left: The "Float Valve" designed by Travis Hugley. Middle: The small aquaponic system upon completion Right: The small aquaponic system with a variety of vegetables growing.*

Later that year we built our first system and got started on this adventure. It is an S&S-based design with a few of my own modifications to make it easier to maintain and less expensive to build. The following year I was asked to give a presentation of this system at the Aquaculture International conference as well as a presentation of a small system I designed for demonstration purposes in orphanages and such in developing countries.



Doing aquaponics in a developing country would require simplicity, reliability and freedom from the need for grid power as well as the need to control the flood and drain parameters of the system. This is where the "Flood Valve" comes into the equation.

The "Flood Valve" is an invention I came up with to address this problem. There are many schemes to control the flow of water in aquaponic systems. Those that involve electricity are out of the question in this scenario since it is not always available.

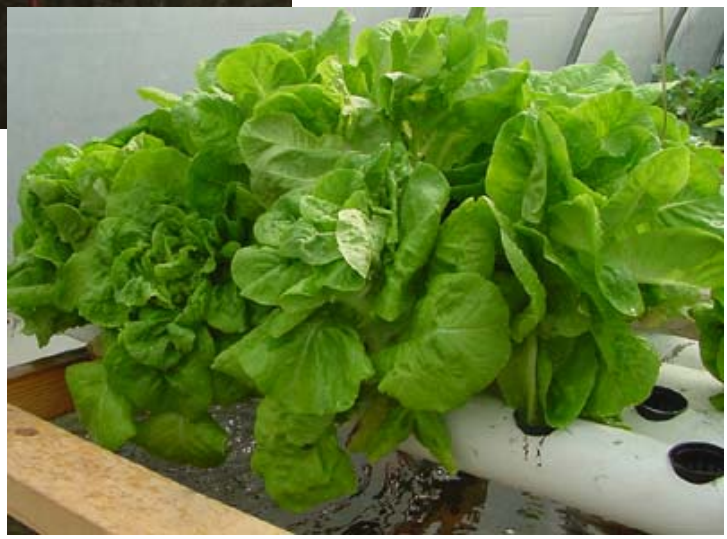
Yes, there is solar, but it is many times too expensive for the average subsistence farmer to afford. Siphons are another possibility but tend to be limited in low-flow situations encountered with minimal flow rates. A system appropriate for developing countries must be adaptable to many situations.

My "Flood Valve" can utilize any kind of pump whether it is electric, gas or wind driven (or whatever source one chooses). The only requirement is to pump the water from the fish tank to the "Flood Valve." It will work with flow rates lower than 100 gallons per hour.

Here's how it works. Water is pumped to the "Flood Valve" which has a standard toilet valve installed with an extension on the overflow pipe. On the side of the tank there is a small adjustable siphon that, when the water gets to the set height, starts to fill a counterweight with a small hole in the bottom.

As the siphon fills the counterweight, it eventually gets heavy enough to pull open the flapper on the flush valve and dumps the flood tank to the grow beds. As the water drains from the flood tank, the siphon breaks and the counterweight starts to empty. As it gets light enough, the flapper closes and the tank begins filling again. The flood volume is adjusted by the height of the small si-





*Papayas and lettuce grown in the small aquaponic system shown on previous page.*

phon and the cycle time is adjusted by the water flow. Excess water is redirected from the pump back through a spray nozzle to aerate the fish tank.

This system only requires one pump and no timers, float valves, etc. The pump runs continuously so there is no start and stop. There are, however, limitations on how deep the flood tank can be when using a rubber flapper since the water pressure can get too great for the flapper to lift without tearing (thanks to Paul Range for this info).


*Travis' greenhouse with a variety of plants grown from the waste of tilapia. Travis hopes to build a larger version of this prototype in Kenya next year.*



The small system I built has 12 sq. ft. of grow beds with overflow protection designed in and self-starting siphons to completely evacuate the grow beds. It is built using three 55 gal. plastic drums and various parts found at any hardware store.

The pump is externally mounted. I have operated it on as little as 60 watts with a fountain pump but I am currently using a March marine type magnetic drive A/C pump which is working much better. I prefer these pumps for their reliability and ease of repair/rebuild. The fish tank is a 55 gal. plastic drum laid on its side and is working quite well. I have grown cucumbers, beans, radishes, lettuce, tomatoes, strawberries and papaya in this system to date. It has been in operation for a little over a year now and I am quite pleased with its performance. It has needed very little maintenance and has proven to be quite reliable.

I am currently working on a larger version that will be built in Kenya, hopefully next year, with appropriate design modifications. We will be using wind to operate the pump, as it is a very reliable power source there.

I will be working on a manual on how to build this system in the near future with complete details and dimensions.

***About the Author:*** *Travis Hughey is an aquaponics enthusiast who is currently developing aquaponic systems for use in developing countries. He can be reached by email at: aquaponic70@yahoo.com.*