Lessons Learned from Cement Ring Aquaponics Systems in Northern Thailand

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[Editor's Note: Scott Breaden has lived in Northern Thailand for eight years. He came here with a rich background in crosscultural ministry, project management, and development in Australasia and Africa. For the past six years, he has enjoyed experimenting with backyard gardening and aquaponics in Chiang Mai, where he lives with his wife and son.]

The Beginning

Around five years ago, after reading online about aquaponics, a friend wanted to try a small-scale system in his urban backyard (a rental property) in Chiang Mai. I had some experience working with a larger system and was interested in trying a small-scale, low-cost system that would be portable and that could be used as a demonstration/training model. Unlike today, in which a great deal of information can be found online (especially in the form of YouTube videos), very little free information was available on the design, setup, and maintenance of small-scale systems. So everything we did during that first build-out was experimental.

Materials

Here in Northern Thailand, many backyard cement industries make cement rings (either 80 cm or 1 meter in diameter, and 40 cm high). These hollow rings are stacked on top of each either to form in-ground septic tanks, or stacked on top of each other to make above-ground water storage and water filters. The bottom rings have a cement base and are commonly used for raised garden beds, ornamental ponds, and raising frogs and/or catfish. In addition to the cement rings, blue PVC pipes and fittings of many sizes are common and cheap. Small 220-volt aquarium pumps are also easily available (in the city at least) and are commonly used for fountains and in small water features for homes, restaurants and gardens. Ideal medium (such as uniform round rocks around 1-2 cm in diameter) is harder to find, but normal crushed rock for use in concrete is cheap and easily available.

Putting it together (Figure 1)

After materials had been collected (we used 1 m cement rings with floors, a small pump, gravel of 0.5-0.75 cm diameter, and PVC fittings), our system was assembled in less than three hours and was test run without fish the next day, after the cement had dried. Then we stocked the system with 30 cheap and readily-available catfish fry (people growing catfish alone in cement rings in Northern Thailand sometimes stock up to 50 per ring). Locally, catfish are usually raised in cement rings in low quality water, so there was a low risk of having fish die if we made mistakes.

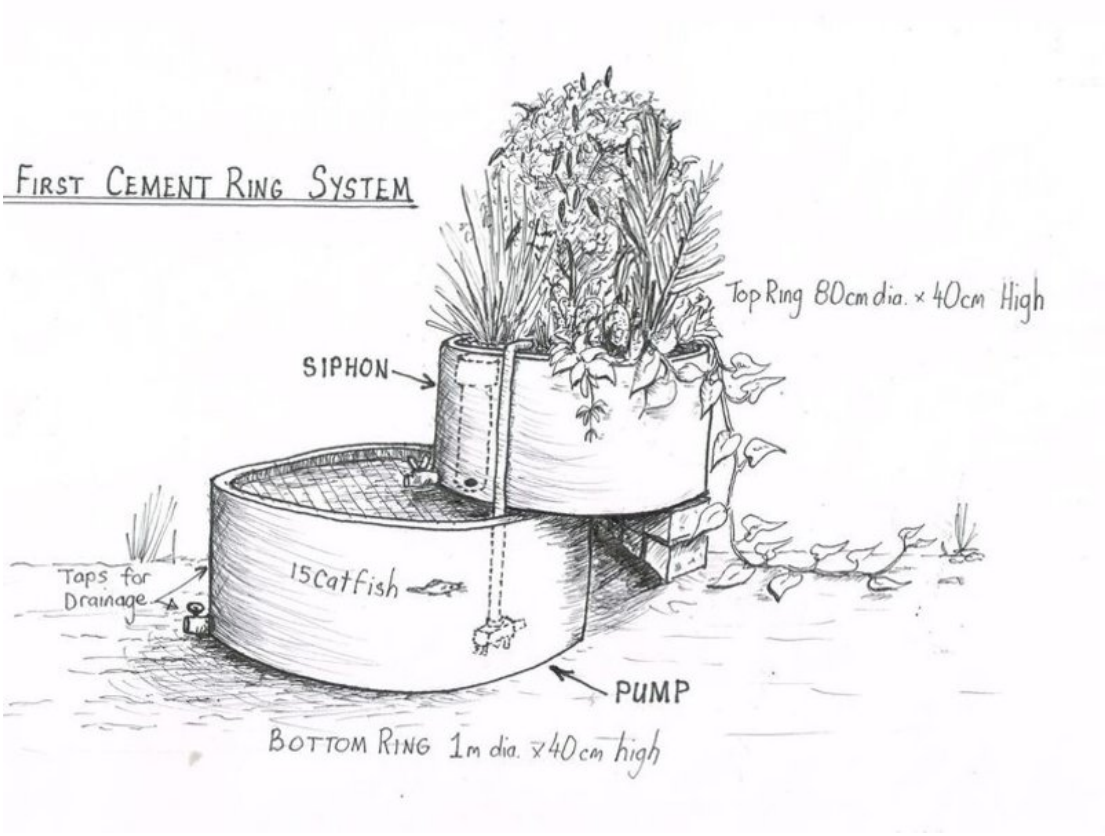

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Figure 1. Scott's first cement ring system. Illustrated by Scott.

It took more than a month to get the plants growing well. While the fish were still fingerlings, our system was easy to manage, but as the fish grew bigger, the small aquarium pump struggled with too many fish waste solids and needed daily cleaning. *[Editors' Note: as mentioned in the previous article, the build-up of fish excrement and solids can reduce the water flow and cause problems in aquaponics systems]*. We tried many things to keep the flow rate high and the pump clean (homemade filters, for example), but the cheap pump remained the weak link in the system. The small system worked well, although it would be a stretch to say that it was easy to operate. But it met our goals at the time of: 1) being cheap (under $ 40 USD) and 2) demonstrating that the principles of aquaponics could work on a small-scale.

Lessons Learned (Figure 2)

With the cement rings, pipes are easy to add and changes in design are straightforward. However, the rings are very heavy and difficult to move or rearrange, as I found when my friend moved countries and I moved the system to my own backyard. I did not like the idea of checking/cleaning the pump daily, so I changed the design and added an extra ring to act as a sump tank, which helped to collect the solids and keep the pump clean. As a result, I only needed to check and clean the pump once a month (Figure 2). I also stocked it with 15 catfish instead of the 30 that I started with initially, and I planted many perennials and waterloving plants to help in the water filtration process. The final system made a very good Thai herb garden, with perennial plantings of lemongrass (*Cymbopogon citratus*), birds eye chilies (*Capsicum frutescens*), basil (*Ocimum basilicum*), pandanas (*Pandanus amaryllifolius*), ginger (*Zingiber officinale*), galangal (*Alpinia galanga*), edible ferns (*Diplazium esculentum*), and morning glory (*Impomoea aquatica*). During the cool season, I also grew tomatoes, lettuce, bok choi, strawberries, and other leafy greens. Overall, the system didn't really produce large quantities of fish or food, but for me there was benefit even in producing a small amount of fresh, chemical-free food. I found this aspect was also the greatest point of interest to neighbors and visitors.

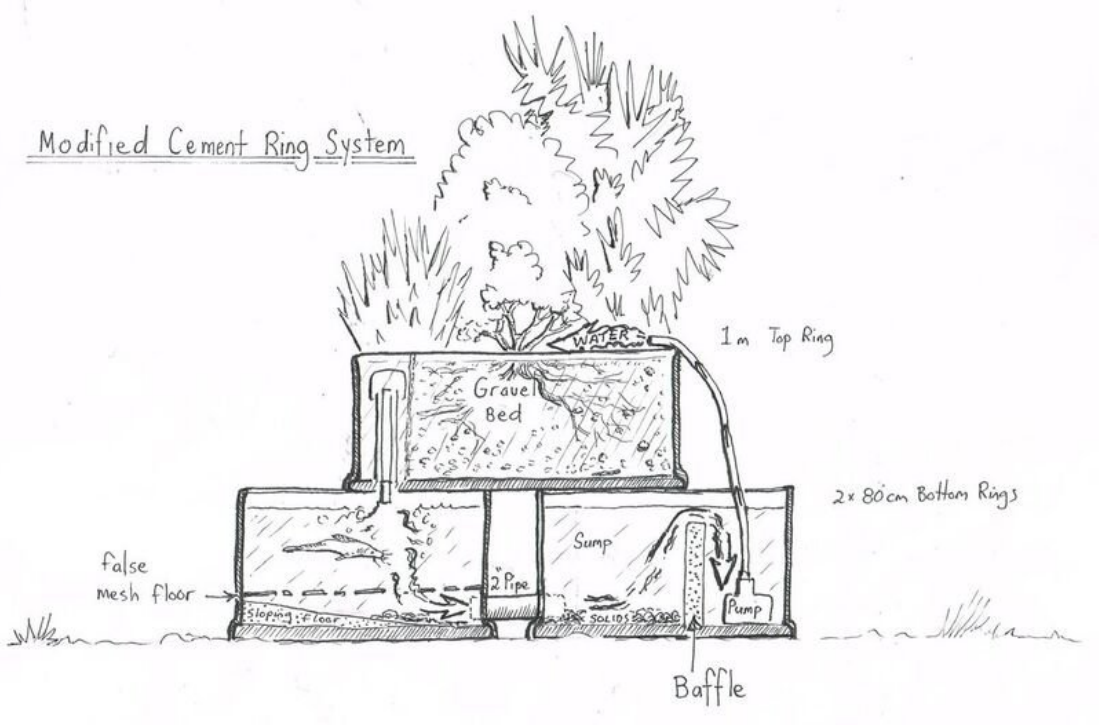

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Figure 2. Scott's modified cement ring system.

Looking Back

Today, if someone were to ask me to help build a small system on their urban rental property, would I use cement rings? The easy answer is yes, but I would not use the large 1 m rings. Today more options exist in terms of materials and designs (see Figure 3 for a prototype that I would like to try sometime). Something lighter and more easily moveable (than the 1 m rings) is generally more appropriate for an urban setting. I think a larger cement ring design could be appropriate for rural areas, since many people in rural areas (at least in Northern Thailand) know how to join the cement rings together and add PVC pipes. Four or five people could drop in and give a hand to lift or shift the rings without any trouble. Also, the issue of weight and permanence would not be as much of a problem in a rural setting as in an urban area. And finally, many rural people in Northern Thailand have had experience with raising catfish in cement rings, so adding the pump and gravel bed would just be adding to an already existing system.

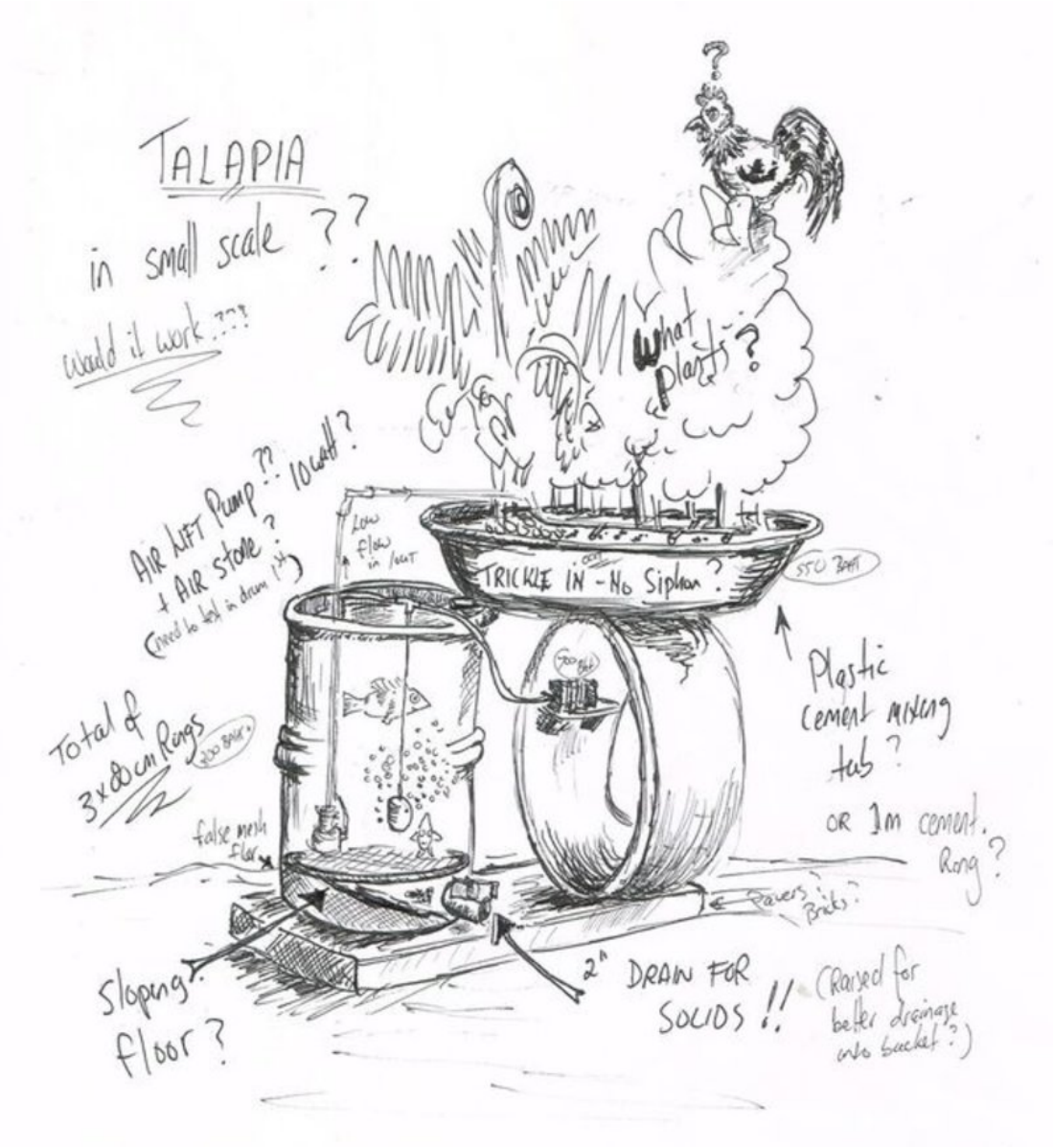

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Figure 3. Plans for a future prototype aquaponics system. Both illustrated by Scott.

The Bigger Picture

I personally think that small aquaponics systems are more difficult to run than larger systems (larger than 1000 L), and I warn people that things can go wrong quickly in these small systems. But a small system like the one I have outlined is great to show people the principles and parts of an aquaponics system (i.e. it demonstrates how various siphons, pumps, etc. work, and shows the relationship between fish, nitrifying bacteria and healthy plants; it can also make a very nice water feature on a property). But a small system doesn't necessarily model food production, because it isn't big enough to show how to produce larger quantities (or support larger projects such as large childrens' homes) of either vegetables or marketable fish.

A larger scale system has additional challenges. Besides keeping the fish-vegetable system running in equilibrium, someone running a large scale system also needs to source and store seeds; germinate and transplant vegetables; and harvest, process, and market the fish and produce. The complexity of all these parts working together is more easily appreciated when seeing a larger system. However, for home consumers, a small system is a great starting place for learning the principles of food and fish production, and it can easily be ramped up.

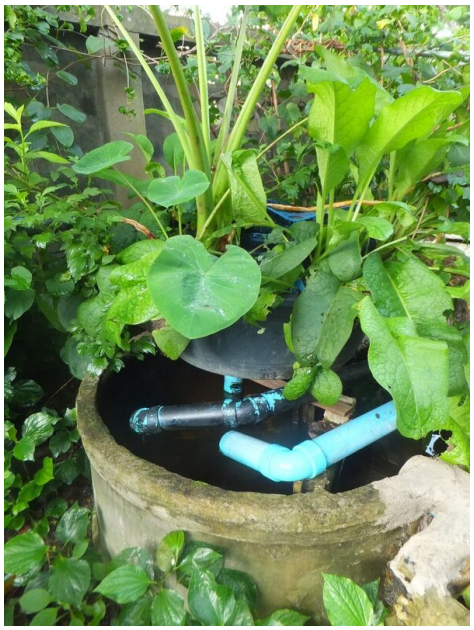
When I made my own backyard aquaponics system, I constantly thought about how I could make it simpler and how I could make it work in the cheapest, easiest manner. I came from a background in large-scale extensive agriculture, with no experience or knowledge of highly intensive smallscale systems. Over time, each of my aquaponics systems have become more complex, and this increase in complexity has been rewarded with a better product or more produce. I have also found that the more energy and time I put into improving the design, the more satisfaction I get from managing it.

I now have the capacity to produce food for my own family in a satisfying way. I am no longer afraid of producing food intensively; I enjoy the complexity of the system and see it as a positive attribute, because it opens doors to learning and to new ways of

doing things. With aquaponics, you can start simple, and as your knowledge increases (about best practices and how to best maintain the system), you can grow and expand your system in many different ways, being rewarded for your creativity (i.e. thought/ design is rewarded with tangible outputs).

As an unforeseen side benefit of creating this system, I have met many people, and have built relationships with people I would not have known otherwise, which has made life so much richer and deeper. My aquaponics system has been a great talking point with my neighbors, all of whom value healthy food and see my system as a source of love/care in the way it provides good, healthy food to the family.

Photos of Scott's backyard aquaponics systems. Photo credit: Scott Breaden.



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