

Preface

“Nature has all the answers. What was your question?”

— Howard T. Odum, noted ecologist

The aquaponics epiphany

The rain was a gift. I had set aside that entire Saturday in early April to do yard work, but instead was searching for something to do inside. As it happened, my then 14-year-old son also had no plans, and my husband and daughter were out of town. Hmm. What to do? Clearly something together would be best, but where was the overlap in our current interests? Then it hit me. I remembered my longtime buddy at AeroGrow, John, had been for trying for months to get me to come over to see his basement aquaponic system. Fish and crawdads growing plants in a basement might be interesting. The added bonus of seeing their new baby chicks sealed the deal. We got in the car and drove off without realizing that our lives were about to be changed forever.

The AeroGarden.



AeroGrow International, Inc.

I admit I was skeptical. John and I were both part of the original founding team at AeroGrow, the makers of the AeroGarden. The AeroGarden is a small, countertop-sized hydroponic garden about the size of a toaster oven. It grew plants year-round, indoors, without dirt or weeds. It was the first product that really took hydroponics out from its hiding place in closets and basements and brought it to the mass markets and the Average Joes. John and I were the only gardeners of the five original founders, and later on the executive team. We often felt that we had an unspoken, but profound, responsibility to the gardening world. Why? We wanted to not only make sure that this very special product got to market, but that it made it in a way that got gardeners excited. “They are ruining our system!” we often secretly complained, behind a closed door in one or the other of our offices, or on a walk if it got really bad. But by working together as a united, “green” front, we generally prevailed and managed to launch a product of which we are both extremely proud.

We were born within hours of being one year apart in age and were often teased for being more like sister and brother than co-workers. I love him like family, but like any siblings we have marked differences in our personalities that sometimes caused misunderstandings and battles. John is a dreamer, an inventor, a “ready, fire, aim” kind of guy. I am more studied, measured and skeptical. I need proof. John had been trying to convince me for months that he really was growing plants with just the water from fish, but I figured that this was just another one of his wild dreams.

So, with this as background, you can see why I was dubious when I approached his home that rainy Saturday. I had occasionally heard of aquaponics over the years through the hydroponic trade magazines. But I had always dismissed it as more of a desire by the environmental fringe to change the fundamentals of hydroponic growing than a viable reality. While I am not a scientist by education or title, I know a lot about growing plants. I am a longtime traditional dirt gardener with experience spanning four yards over four states. I joined AeroGrow in 2003 and soon set up and managed the Grow Lab and Plant Nursery. We developed the hydroponic plant nutrients, a pH-buffering system and other seed-kit technologies that are the basis for several of the patents that list me among the inventors. I then became the Director of Plant Products and assumed the responsibilities for the rest of the seed kit product line. By the time I left AeroGrow in October

of 2009 I was the VP of Marketing and Product Development. Why did I leave such an interesting job? In part, it was time to move on. AeroGrow had become a very different place than the company I had joined so many years ago. The main reason, however, was to pursue what had become a true passion — aquaponics.

When my son and I walked into the basement of John's rural ranch house, we were greeted with the sounds of baby chicks scratching on their newspaper-lined flooring and water flowing among the grow beds. The room was well lit and warm from the plant growing lights. The air smelled moist and fresh. The plants I saw were healthy and huge and the fish were active and obviously hungry as John tossed in a handful of food. He was excited to show us his setup and to debunk my skepticism. He was right. Aquaponics works!

When I saw that basement setup, I was immediately convinced that aquaponics was going to become a very important growing technology. I concluded that it solves the problem of expensive, and often unsafe, chemical fertilizers in hydroponics. It solves the problem of waste removal in aquaculture. It solves the problem of excess water use in traditional agriculture. And for the backyard gardener, it solves the problems of weeds, under- and over-watering, fertilizing and back strain.

Since that rainy April day, I've dedicated my life to learning all I can about aquaponics and spreading the word about this amazing way to grow plants. In December 2009, I started the Aquaponic Gardening Blog (aquaponicgardeningblog.com) to write about my personal journey through aquaponics. Topics have ranged from practical advice on seed starting and grow bed depth to musings about organic certification and visits with fellow aquaponic addicts. In January 2010, I started the Aquaponic Gardening Community site (aquaponicscommunity.com). It has become a thriving meeting place for worldwide, round-the-clock conversations about aquaponics. This community, and other aquaponics communities and forum sites around the world, are an incredible source of shared learning and support for this burgeoning new growing technique and industry. Without online communities I wouldn't be writing this book.

Because it was unrealistic to think that I could live off of blogging and running a niche community, that winter my husband and I also started a company called The Aquaponic Source (theaquaponicsource.com). It brings

aquaponics education, community and products together under one roof. We have designed an aquaponics system called AquaBundance and have many ideas for future products. I teach, I speak and I have produced a video called *Aquaponics Explained*. My goal is to spread the word about aquaponics to any willing audience and to take it from an obscure gardening technique with just a few converts into a worldwide movement.

About this book

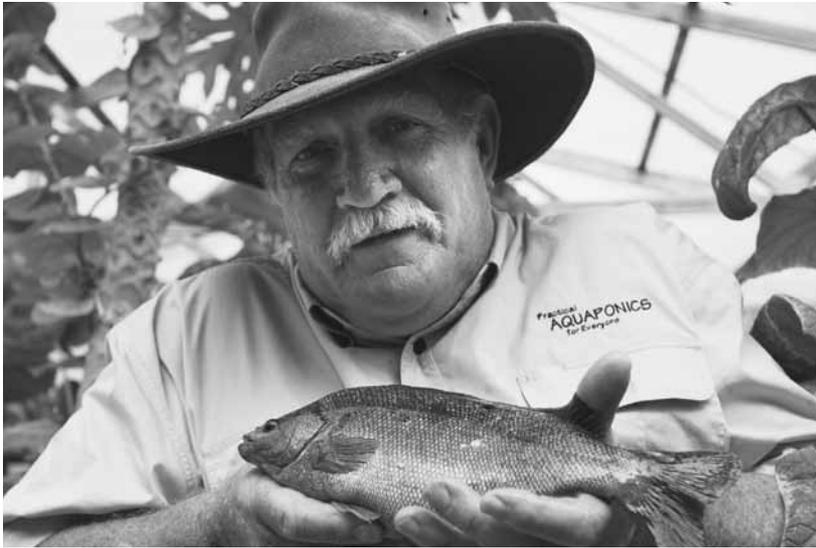
Home-scale aquaponic gardeners have evolved from the early tinkerers setting up systems in their backyards and basements. They learned from the academic work that was going on in North Carolina and the Virgin Islands, and then focused on making systems that were simpler and cheaper to build and operate. They wanted systems that could grow a wide variety of crops, not just salad greens and tilapia. They wanted to use recycled materials and off-the-shelf parts. They wanted the least amount of monitoring and fuss possible.

They found each other, and started talking online.

Probably one of the earliest examples was in West Plains, Missouri, in the early 1990s. Tom and Paula Speraneo created a successful media-based aquaponics farm called S&S AquaFarm and subsequently wrote a guide for others to follow what they had learned. More importantly, they also started an email list to start a worldwide conversation about aquaponic gardening.

In the early 2000's Joel Malcom, an engineer from Perth, Australia started looking into aquaponics and found very little published information, but he did find the Speraneo's list-serv. He started experimenting with his own backyard system, wrote a book about his experience called *Backyard Aquaponics*, and founded a company by the same name. Now Joel also runs the world's largest aquaponics forum site and is the publisher of *Backyard Aquaponics Magazine*, in addition to his very successful aquaponics systems and supplies business.

At the same time that Joel started his aquaponics adventure, fellow Australian Murray Hallam heard about aquaponics, and Joel, and struck up a relationship with him. Although Murray also had an aquaponic system business on the other side of the country, the two men collaborated and learned from each other. Murray's company, Practical Aquaponics, also sells aquaponic systems and supplies and he also runs a large forum site. Murray



Ecofilms Australia

*Murray Hallam, President
of Practical Aquaponics.*

is now probably best known worldwide for his entertaining educational Aquaponic video series.

In large part due to the efforts of these two men, home-based or backyard aquaponics has quickly become an accepted part of the Australian gardening scene. But these efforts have certainly been fostered by the match between aquaponics and some particulars of the Australian environment. Most of Australia enjoys year-round growing conditions. This enables aquaponic systems to be set up unprotected, without fear of winter freezing and bacteria die-off. Australia has also been experiencing one of their worst droughts in recorded history so the water-conserving benefit of aquaponics is especially appealing there. Finally, in the recent devastating floods in Queensland, aquaponics again proved to be uniquely adapted to Australia. While grocery store produce aisles were picked over, aquaponic gardeners were picking fresh veggies from their raised grow beds.

Back in North America, aquaponics took a different, two-pronged path. First, university efforts in the Virgin Islands, and to a lesser extent in a few other places, were targeting commercial applications that weren't appropriate for the backyard gardener. The other efforts were largely led by folks like Travis Hughey (Barrel-ponics®) and Will Allen (Growing Power), whose aquaponic designs were created with an eye toward solving urban or

third-world food problems rather than an optimal growing experience for a North American backyard gardener.

In October 2010, after six months of learning about aquaponics and all its benefits, and spending many, many hours on the Backyard Aquaponics forum, I quit my job at AeroGrow to focus on building an industry around backyard aquaponics, American style. Since that time, I have started a blog, a company and a community site, all focused on what I refer to as “aquaponic gardening” — media-based aquaponics for growing vegetables and fish at home in a variety of climates.

One of the things I’ve learned since starting these endeavors is that while aquaponics excites more and more people every day, those people are not finding the reliable information they need to get started and grow successfully. Forums and community sites are tremendous, critical resources but you need a lot of time and patience to wade through the thousands of accumulated posts and often chatty or acrimonious exchanges. You also need to be able to separate the wheat from the chaff, the good information from the bad. This is not always easy in a new technology where the information providers are usually everyday folks growing a huge variety of fish and plants under a huge variety of conditions. Where do the universal truths lie?

One day I got this message in my Aquaponic Gardening Community inbox:

“We need something that people who are starting up could hang onto. I realize that there is no set way but I think what we need to do is tell the new people what we do and does it work. I consider myself educated but I am not an engineer or a lot of other things and I need advice. I don’t need arguments over which advice is correct. As I get older I find I need less complicated explanations.”

I decided it was time to write this book.

What this book is, and isn’t, about

My aim for this book is to provide a comprehensive guide for successful home aquaponic gardening. With it, you now have all the information you need in order to grow using aquaponic techniques. You have guidelines on how you can create your own system, or how to shop intelligently for a system kit. You will know how to start your system, when to add fish, how

many to add, and how to take care of them. You will know the same for the plants. You will have a precise set of guidelines for monitoring and maintaining your system.

I started the process of writing this book in 2009 when I began to write the Aquaponic Gardening Blog, and wrote a series of articles for *Backyard Aquaponics*, *Growing Edge* and *Urban Garden* magazines. I wrote the real backbone, however, in November 2010, when I created a set of Aquaponic Gardening Rules of Thumb in collaboration with Australian Dr. Wilson Lennard.

Dr. Lennard earned one of the few PhDs in aquaponics in the world in 2006. After that he designed, constructed and managed Minnamurra Aquaponics, Australia's first truly commercial-scale aquaponic system. Dr. Lennard writes extensively on aquaponics for both scientific and trade journals, and currently consults worldwide through his company, Aquaponic Solutions.

The guidelines Dr. Lennard and I developed have also been reviewed and endorsed by Murray Hallam of Practical Aquaponics and vetted by the Aquaponic Gardening Community and my blog community. While there are exceptions to almost every Rule, I can guarantee you that if you follow them as they are written you will have a successful aquaponic gardening experience.

These Rules are now available through my website, community site and blog, and are reprinted in the back of this book. You will find that at the end of each chapter, I have also listed the subset of the Rules that were detailed in that particular chapter.

Media-based aquaponics

This book is entirely focused on media-based systems, with a brief discussion of vertical and hybrid systems. Why media-based and not raft or nutrient film technique (NFT)? For two reasons: solids filtration and planting flexibility.

In a raft system (also known as deep-water culture or DWC), the plants are started in a media cube, then that cube



Green Acre Organic Farm

Green Acre Organics farm, Brooksville, Florida, owned and operated by Tonya Penick and Gina Cavaliero.

is anchored into a hole in a floating board (typically Styrofoam) or “raft”. This raft is then placed in a channel of oxygenated fish-waste water and the plant roots grow directly into that water. This system works well, until the solid fish waste starts accumulating on the plant roots and starves them of oxygen. To get around this problem, raft-based systems typically include some or all of the following additional filtering components: a mineralization tank, a degassing tank and a clarifying tank. While the addition of these three components enables you to stock your aquaponics system with more fish, the extra cost and complication of adding these to your aquaponics setup just does not make sense for a backyard gardener. Plus, a filtration system means that you need to clean out the filtrate on a daily basis and dispose of it outside the system. I’m not crazy about this for two reasons. First, who needs one more thing to clean in their lives? Second, why remove valuable sources of plant nutrient from the system if it just isn’t necessary?

In a media-based system the grow bed becomes the filtration system for all the waste products. If a media system is constructed, stocked and operated as instructed in this book, the only solids removal that will need to be done will be a monthly shot of high-pressure water through your pipes and pump to knock lose any solid waste buildup inside. Otherwise there is no regular cleanout of the grow beds or fish tanks. Ever.

The second reason why media systems are more appropriate for home gardening is that there is almost no limit to the types of plants you can grow

in these systems. Raft and NFT systems have lower levels of nutrients because of the solids removal and they pose logistical constraints around a set of holes arranged on a fixed grid on a floating raft. These both conspire to limit the types of plants that grow best to smaller, nitrogen-loving plants like salad greens and herbs.

In contrast, a media-based system can grow absolutely anything that doesn’t require an acidic soil (blueberries, for example, don’t do well in any aquaponic system). I know a woman in Florida who has grown a banana tree. Murray Hallam has grown papaya trees.

Frog and zucchini.



I have grown 25-foot tomato plants, ground cherries, peppers, cucumbers, strawberries, celery, broccoli ... as well as salad greens and herbs. Backyard gardeners do not want to be limited in what they can grow.

How this book is structured

I want you to think of aquaponic gardening as a technology platform, like your personal computer. We will be talking about a variety of hardware options, such as grow beds, fish tanks and plumbing components. We will also be talking about the possible software, or living, options you have for your system, i.e., the fish and the plants. By the end of this book you will be able to configure your own, customized aquaponic system based on the combination of options that make the most sense for your gardening and food growing goals. Best of all, I assure you that even though you will be creating your own customized system, it will work, and work well, if you follow the Rules of Thumbs that are woven throughout the book. No matter how you configure your system, the underlying Rules remain the same.

The chapters in this book are arranged in logical, chronological order for building a system. I recommend reading them in the order they appear in, and reading them all. Because aquaponics is an integrated ecosystem, every component needs to be present and in balance with all the other components. Unless you teach yourself how they all work together, you risk doing something that adversely affects that balance.

The members of the Aquaponic Gardening Community are present throughout this book, either explicitly or implicitly. Each chapter after the introduction is started by an experienced, or sometimes not so experienced, aquaponic gardener from the site, answering the question “What does aquaponics mean to you?” I hope you find their insights and passions as inspiring as I did.