

Aquaponic Gardening: A Step-by-Step Guide to Raising Vegetables and Fish Together

by

Sylvia Bernstein



SYLVIA BERNSTEIN

AQUAPONIC GARDENING

A STEP-BY-STEP GUIDE TO RAISING VEGETABLES and FISH TOGETHER



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Synopsis

Aquaponics is a revolutionary system for growing plants by fertilizing them with the waste water from fish in a sustainable closed system. A combination of aquaculture and hydroponics, aquaponic gardening is an amazingly productive way to grow organic vegetables, greens, herbs, and fruits, while providing the added benefits of fresh fish as a safe, healthy source of protein. On a larger scale, it is a key solution to mitigating food insecurity, climate change, groundwater pollution, and the impacts of overfishing on our oceans. Aquaponic Gardening is the definitive do-it-yourself home manual, focused on giving you all the tools you need to create your own aquaponic system and enjoy healthy, safe, fresh, and delicious food all year round. Starting with an overview of the theory, benefits, and potential of aquaponics, the book goes on to explain:— System location considerations and hardware components—The living elements—fish, plants, bacteria, and worms—Putting it all together—starting and maintaining a healthy system. Aquaponics systems are completely organic. They are four to six times more productive and use ninety percent less water than conventional gardens. Other advantages include no weeds, fewer pests, and no watering, fertilizing, bending, digging, or heavy lifting—in fact, there really is no downside! Anyone interested in taking the next step towards self-sufficiency will be fascinated by this practical, accessible, and well-illustrated guide. Sylvia Bernstein is the president and founder of The Aquaponic Source. An internationally recognized expert on aquaponic gardening, Sylvia speaks, writes, and blogs extensively about this revolutionary technique.

Sort review

This isn't just another book for dummies; this is a comprehensive handbook on how to grow real food...so meticulously documented, that failure is not an option. --Jeff Edwards - President, Progressive Gardening Trade Association (PGTA) I have always wanted to put my money where my mouth is and figure out how to do sustainable aquaculture in the context of my home garden. Finally I've got the book to help me do it. --Paul Greenberg - Best Selling Author, Four Fish: The Future of the Last Wild Food This is a delightful book to read! ... I've been involved with hydroponics and aquaculture for 30 years and still learned from reading this very thorough how-to book. --Henry A. Robitaille, PhD - Former General Manager, The Land Exhibit, Epcot Center Learning how to garden through the creation of a completely balanced ecosystem is now clearly understandable, even to inexperienced gardeners. -- Michael C. Metallo, President and CEO, National Gardening Association Sylvia Bernstein has provided the "aquapons of the world" with a clear, impassioned, and elegant "Bible" to spread the good news about aquaponics. -- James J. Godsil, co-founder Sweet Water Organics Sweet Water Foundation Aquaponic Gardening is an excellent primer for anyone considering home-scale aquaculture. Whatever your location or methods, the information should prove invaluable. Fish are within reach! --Peter

Bane, Publisher of Permaculture Activist magazine
About the Author
Sylvia Bernstein is the president and founder of The Aquaponic Source and the co-Founder and former Vice Chairman of the Aquaponics Association. She also manages AquaponicsCommunity.com, the largest US-based online forum site dedicated to aquaponic gardening. An experienced speaker and internationally recognized expert on aquaponic gardening, Sylvia writes and blogs on the subject for the Aquaponic Gardening Blog, Maximum Yield Magazine and more. Her inspiration is a large, thriving aquaponic setup in her backyard greenhouse in Boulder, CO powered by tilapia, catfish, bluegill and other creatures that swim. Excerpt. © Reprinted by permission. All rights reserved.

Section 1 An introduction to aquaponics
"Here's to the crazy ones. The misfits. The rebels. The troublemakers. The round pegs in the square holes. The ones who see things differently. They're not fond of rules. And they have no respect for the status quo. You can quote them, disagree with them, glorify or vilify them. About the only thing you can't do is ignore them. Because they change things. They push the human race forward. And while some may see them as the crazy ones, we see genius. Because the people who are crazy enough to think they can change the world, are the ones who do." — Apple Inc.

After breakfast Luna, my nine-year-old Tibetan terrier, runs to the door that leads to the back deck whenever I approach it. She knows that soon we need to go feed the fish. After several false alarms, the moment finally arrives when I open the door. She races down the stairs, banks around the corner and skids to a stop in front of the greenhouse. When I finally join her, I open the door and we are both momentarily overwhelmed by the sights, smells and sounds that greet us every morning. The winter aquaponic garden in my greenhouse is alive in a way that the cold, still outside garden can't possibly aspire to. The warm, moist air smells slightly like freshly turned earth after a spring rain. The sound of flowing water tells of life and energy. The vibrant green plants in various stages and sizes are bursting with promise and productivity. A ladybug flies by. But the best part is the fish. I glance down at Luna, who The author and her dog. Benjamin Rasmussen has pulled herself up on the rim of my 300-gallon stock tank with her front paws to peer at the community within. She never tires of watching them, forever hopeful that someday, if they get just close enough, and she is just fast enough, just maybe...

Welcome to aquaponic gardening. With this book I hope to take you on a journey through an entirely different way of gardening. You will learn how to grow plants in rocks using only fish waste as the fertilizer source and bacteria and worms as the bridge between barren toxicity and harmonious fertility. It sounds simple, and in many ways it is, but it can also have a profound effect on your ability to feed yourself and those around you. With this technique you will learn how to grow edible fish to supplement your family's diet with safe protein you raised yourself. You will learn to grow fruits, vegetables and greens using less than a tenth of the water and without the weeds of a traditional soil garden. And you will be able to grow food anywhere, without the restrictions of soil and sunlight. Aquaponic gardening is a fascinating and enjoyable hobby, but fair warning — it can be very addictive. Yes, it is a healthy addiction, like yoga or salads, but an addiction nonetheless. For some, this means expanding from time to time to keep "the itch scratched." I've seen systems start with a 30-gallon aquarium

and one small bed, then become 300 gallons and four beds. Pretty soon the addicts are raising bass and trout in a newly converted backyard pool. My personal experience has been a tale of expansion as well. I started with a 70-gallon pond liner from Home Depot. When that sprung a leak (I didn't puncture it, I swear), I replaced it with a 120-gallon version — the fish were getting bigger and needed more room, right? Now I'm up to 120 tilapia and assorted goldfish in five tanks — four 60-gallon and one 300-gallon. Sad but true. Save yourself while you still can.

Chapter 1: What is Aquaponics

So what is this crazy, addictive gardening technique? Here is one attempt at a definition: Aquaponics is the cultivation of fish and plants together in a constructed, recirculating ecosystem utilizing natural bacterial cycles to convert fish waste to plant nutrients. This is an environmentally friendly, natural food-growing method that harnesses the best attributes of aquaculture and hydroponics without the need to discard any water or filtrate or add chemical fertilizers.— Aquaponic Gardening Community, November 2010

The above was the result of a month-long online effort to define this thing called aquaponics. It is an excellent starting point for describing what it is that separates aquaponics from any other growing system available today. Let's look under the hood at the individual components of this definition:

- "cultivation" — This is a system of agriculture for growing the plants and fish we want to consume, rather than a description of a wild, uncultivated environment.
- "fish and plants together" — These four words describe the heart of aquaponics. Without fish and plants being grown together, you don't have aquaponics.
- "ecosystem" — The dictionary defines an ecosystem as "a system formed by the interaction of a community of organisms with their environment." Aquaponics is an ecosystem of plants, fish, bacteria and worms.
- "constructed ecosystem" — This eliminates plants being grown on the shores of a lake or pond from the definition of aquaponics. While we are centering on a notion of an ecosystem, it must be an ecosystem that is constructed for the purpose of growing fish and plants together.
- "recirculating ecosystem" — This constructed ecosystem must also retain its water by recirculating it rather than allowing it to drain off into the water table. This is why aquaponics uses so little water compared to the systems that spawned it.
- "utilizing natural bacterial cycles to convert fish wastes to plant nutrients" — This speaks to the key mechanism that enables aquaponics to work. Without the nitrifying bacteria that convert the fish waste into plant food, the fish would soon die in their own waste, and the plants would starve for lack of nutrition. In other words, aquaponics is a system where plants and fish are grown together symbiotically. The waste product from the fish provides the food for the plants, and the plants in turn filter the water that goes back to the fish.

This is an environmentally friendly, natural food-growing method that harnesses the best attributes of aquaculture and hydroponics without the need to discard any water or filtrate or add chemical fertilizer. The second part of the definition focuses on the key benefits of aquaponics and introduces the notion that it is really the combination of two other sophisticated cultivation techniques: hydroponics and aquaculture. Both of these techniques require more intervention than an aquaponics system. Aquaculture has to ensure that the waste from the fish is removed before it builds to toxic levels, or the fish will die. Hydroponics requires a constant replenishment

and manual balancing of the chemical nutrients, or the plants die. By combining the two systems, aquaponics transfers much of the responsibility for reaching equilibrium between the filtration of the fish waste and the nutrient needs of the plants to Mother Nature. The second part of the definition also asserts that in combining these two techniques, the major problems of each are solved while the major benefits are retained. That is an incredible assertion. Before we go there and decide whether or not it is valid, we should take a moment to talk about hydroponics and aquaponics.

Hydroponics is a method for cultivating plants without soil, using only water and chemical nutrients. The "ponics" in "aquaponics" comes from hydroponics. The term "hydroponics" literally means "water working". Much of the greenhouse tomato, basil and lettuce production in North America today is done using hydroponic growing techniques, but you might have also heard of it because it is the favored growing method of marijuana producers.

Aquaponics is a hydroponic growing method in that it requires no soil. In both methods, the plants' roots are constantly bathed in highly oxygenated, nutrient-rich water, and both see growth rates far above those found in soil-grown plants. Aquaponics also borrows from many of the classic hydroponic system types. The flood and drain (also known as ebb and flow) style of growing on which this book focuses comes from the hydroponic world, as do NFT (nutrient film technique) and DWC (deep-water culture or raft) styles. This is where the similarities end, however. Aquaponics is an improvement over hydroponics for the following reasons:

Expensive chemical nutrients are replaced by less expensive fish feed. Hydroponic nutrient solutions are expensive, and are gradually becoming more expensive as some ingredients are becoming over-mined and increasingly difficult to acquire. A gallon of hydroponic nutrient solution costs \$30–60, and a few tomato plants will easily go through that during their productive lifetime. Meanwhile, a 50-pound (23-kg) bag of tilapia feed costs about the same amount, and at a 1.3 feed conversion ratio will give you 38 pounds (17 kg) of mature tilapia and simultaneously support about eight tomato plants. You never dump out your nutrient solution. Water in hydroponic systems needs to be discharged periodically, as the salts and chemicals build up to levels that become toxic to the plants. This is both inconvenient and problematic, as the disposal location of this waste water needs to be carefully considered. In an aquaponic system, rather than having these problems with chemical imbalance, you achieve a natural nitrogen balance that is the hallmark of an established ecosystem. The water in your system is a critical component that you nurture as part of that balance. In aquaponics, you never replace your water; you only top it up as it evaporates and transpires (evaporates from the leaves of the plants). This saves both water and time.

Maintaining an aquaponics system is significantly easier. I've spent years running both system types, and I can assure you that once cycling (starting the system by building the bacteria base or biofilter) has taken place, an aquaponic system is significantly easier to maintain than a hydroponic system. Hydroponic gardeners are instructed to check the EC (electrical conductivity) with a special meter daily, or at least once every few days. In aquaponics testing, this frequently just isn't necessary. Because an aquaponic system is a natural ecosystem, it will tend to move into a balanced steady state. You will need to check pH

and ammonia once a week and the only other check — for the nitrate level — can be run monthly. Aquaponics is more productive. A university study by the Crop Diversification Centre in Alberta, Canada (Savidov, 2005), has shown that after six months, when the aquaponic biofilter is fully established, a grower will see faster and better growing results with aquaponics than with hydroponics. Aquaponics is completely organic. Hydroponics is growing in a sterile, man-made environment. Traditional hydroponic systems rely on the careful application of expensive nutrients made from mixing together a concoction of chemicals, salts and trace elements. In aquaponics, you create a natural ecosystem where you rely on bacteria and composting red worms to convert the ammonia and solid waste from the fish into a complete plant food. It is a necessarily organic process. If pesticides are applied to the plants, the fish will suffer. If growth hormones or antibiotics are given to the fish, the plants will suffer. Aquaponics relies on nature and is rewarded through better growth, less maintenance and lower disease rates.

Aquaculture The "aqua" in "aquaponics" means "water" and refers to the aquaculture side of the aquaponics equation. The dictionary defines aquaculture as "the cultivation of aquatic animals and plants, especially fish, shellfish and seaweed, in natural or controlled marine or fresh water environments." Clearly aquaponics has a foundation in aquaculture in that the nutrients for the plants come from fish. Many of the early pioneers in aquaponics come from aquaculture academia, such as Dr. James Rakocy, who were initially interested in aquaponics as a way to solve the problem of fish waste disposal. (Bernstein, 2010)

The history of aquaculture actually dates all the way back to the ancient Chinese back in the fifth century BC. They would capture young fish in wild habitats then transfer them to an artificial environment to grow. The Romans were known to have cultivated oysters (are you surprised?) and there are even Egyptian hieroglyphs that are thought to represent intensive fish culturing. (Batis n.d.)

The first known example of "modern" aquaculture occurred in 1733 when a German farmer successfully gathered fish eggs, oversaw their fertilization and hatching, and then raised them to maturity. These techniques were exclusively focused on freshwater fish. Later the practice of creating farming "pens" off ocean shorelines for raising saltwater fish was developed. The most recent development in aquaculture has been recirculating aquaculture systems or RAS. This is a technique where fish are raised in large, densely stocked tanks. A big advantage of RAS is that it does not require natural bodies of water, so RAS systems can be set up anywhere, even in urban centers. Rather than shipping tilapia or perch thousands of miles across the country, they can now be raised near those who want to cook them for dinner. Another big advantage is that because of advancements in aquaculture science, fish can be raised very densely in RAS. Stocking densities as high as one pound of fish per gallon of water have been successfully achieved. On the other hand, RAS is capital intensive, energy intensive and risky. The risk stems from the high packing densities and the derivative need for oxygen-rich water. Aeration depends on systems powered with electricity. Because of the high packing densities, there is little time to act should the power fail. Millions of fish can be killed from lack of oxygen in less than an hour. The main disadvantage of RAS is the amount of waste the fish produce and, more

importantly, the waste disposal process. Fish produce waste through their respiration process, mostly in the form of ammonia, which they excrete through their gills. They also produce solid waste through their digestive process. Another source of waste in an aquaculture operation is the excess, uneaten food that sinks to the bottom of a fish tank. Current filtration methods — be they mechanical, chemical or biological — all rely on extracting the waste from the fish tank and disposing of it as a harmful byproduct. (Wheaton, n.d.) While aquaponics got its start in aquaculture, it fundamentally departs from the earlier form in a very important way — what is a waste product and a problem in aquaculture is a treasured input in aquaponics. This is a significant shift in aquaculture philosophy. As the blog post below illustrates, it might be a while before the aquaculture community embraces it. The blog was written by a member of the Aquaponic Gardening Community to recount her experience attending an aquaculture conference as an aquaponic gardener: Just got back from the 8th annual engineering conference on Aquaculture, Roanoke, VA. I was impressed by two things: How much they have accomplished in the high density production of fish, and how hard they are working to solve the very problems that aquaponics solves so well. Research papers presented and attended by engineers from 23 countries! They are investing an enormous amount of time, money and energy (literally, electrical energy) to produce tons of fish. Most of the major issues, DO (dissolved oxygen), waste products and water treatment can be managed effectively with aquaponics but not at the tonnage that they are trying to achieve. Most of the papers presented were on the order of how to solve those problems within a high-density aquaculture setting; raising fish in isolation. But why the high density? Why that approach? The majority of funding, of course, comes from the "industrial" corporations at the university research centers. Think CAFO ... i.e., confined animal feeding operations ... feed lots (cattle, hog, chicken, etc.) that can maximize profits on the smallest footprint. I saw some stunning results ... tanks full of Atlantic salmon, 8lb each, at least ... in pristine water, with an annual tonnage of 50, being projected, for delivery. Incredibly dependent on very, very high energy input, O₂ injectors (cost of the O₂), fed by the ocean "junk" fish, wheat and corn currently. When asked what our interest was (my husband & I), many conference attendees were fascinated by the idea of including grow beds to round out a fish growth system! Explaining that we are developing a sustainable farm with grass-fed beef, heritage pork, dairy cows and free range poultry ... and would like to add fish, as well as hydroponic grow beds, in addition to our organic gardens, for our local market. Our interest is to develop a system that could work in small communities with minimal energy and water use. It did not have to produce tonnage ... just enough for a local food market (i.e., the 100-mile diet). We were repeatedly asked to have information forwarded to them. Many of these requestors were PhDs, MDs and industry experts! — Amy Crawford, Aquaponic Gardening Community, blog post entitled "Interesting Challenge — Moving the Research Community to 'Support' the Local Community" What is aquaponics? — conclusion So while a gardener might describe aquaponics as organic hydroponics, an aquarium or pond hobbyist might think of it as an aquaculture system with natural filtration. Both are correct, and both are insufficient. Aquaponics is truly a unique

system unto itself. One where nature has stepped in and helped relieve some of the burdens inherent in each system. In a February 2010 New York Times article, journalist Michael Tortorello described Connecticut resident Rob Torcellini's aquaponics setup as "either a glimpse at the future of food growing or a very strange hobby — possibly both." In the next chapter of this introductory section we will talk about how aquaponics fits into the future of food, and the section after that will be about aquaponics as a hobby. Once you read these, perhaps you can then judge for yourself if it is very strange, or simply a unique and relatively undiscovered agricultural treasure.--This text refers to an alternate kindle_edition edition. Review" Aquaponic Gardening is an excellent primer for anyone considering home-scale aquaculture. Whatever your location or methods, the information should prove invaluable. Fish are within reach."— Peter Bane, publisher, Permaculture Activist and author, The Permaculture Handbook" This is a comprehensive handbook on how to grow real food, so meticulously documented, that failure is not an option."— Jeff Edwards, president, Progressive Gardening Trade Association" I have always wanted to figure out how to do sustainable aquaculture in the context of my home garden. Finally I've got the book to help me do it."— Paul Greenberg, author, Four Fish: The Future of the Last Wild Food" This is a delightful book to read! I've been involved with hydroponics and aquaculture for 30 years and still learned from reading this very thorough how-to book."— Henry A. Robitaille, PhD, former general manager, The Land Exhibit, Epcot Center" Learning how to garden through the creation of a completely balanced ecosystem is now clearly understandable, even to inexperienced gardeners."— Michael C. Metallo, President and CEO, National Gardening Association" Sylvia Bernstein has provided the "aquapons of the world" with a clear, impassioned, and elegant "Bible" to spread the good news about aquaponics."— James J. Godsil, cofounder, Sweet Water Organics, Sweet Water Foundation" Now the thousands of people who are discovering aquaponics every day have a resource for moving from the dream to the step-by-step reality of raising fish and food in their homes, yards, and even businesses."— John Thompson, AeroGrow International, Inc." This book is a vital resource for urban homesteaders."— Sundari Kraft, author, The Complete Idiot's Guide to Urban Homesteading" The science is so well explained, it is easily understood. I am ready to start. I love this book."— Jeff Lowenfels, author, Teaming With Microbes" I believe that home-scale aquaponics will become as common as the backyard chicken coop as we move toward a regenerative future that has made food security a priority."— Marco Chung- Shu Lam, Permaculture teacher, Environmental Studies Adjunct Faculty, Naropa University" The book we've all been waiting for.... a truly comprehensive guide to all things aquaponic."— Charlie Price, founder, Aquaponics UK" Sylvia masterfully lays out the art of giving balance to an ecosystem of flora and fauna."— Britta Riley, founder, Windowfarms.com" For those of you who want to grow fish I definitely recommend this book as a simplified method of constructing and operating an aquaponic garden."— Dr. Howard M. Resh, author, Hydroponic Food Production" If you want to garden aquaponically, this is the one source that will guide you from start to finish while also taking you on a wonderful trip through Sylvia's own personal aquaponic journey."—

Gina Cavaliero, managing director, Green Acre Organics / Aquaponics Enterprises, Inc."Every time I enter Sylvia's aquaponic greenhouse, a powerful sense of inspired well-being envelops me almost instantly, and after reading Aquaponic Gardening , I understand why."— Dr. Virginia F. Gurley MD, MPH, founder, Auraviva"This book is easy to read and is packed with information that will be very useful to the beginner and advanced aquaponics practitioner alike."— Murray Hallam, founder, Practical Aquaponics"When it comes to the emerging field of aquaponics, Sylvia Bernstein is one of those inspired innovators you need to pay close attention to."— Thomas Frey, DaVinci Institute"A practical, easy-to-follow guide that takes the mystery out of aquaponics. Now everyone can grow their own food even if they do not have a green thumb."— Ann Forsthoefel, former executive director, Portland Farmers Market"It might take a little bit of time for the general public to catch up with us and other "early adopters," but when they do (and they will) this book is going to be the top book recommended to them by all who really know what they're talking about."— Jesse Hull and Molly Stanek, Imagine Aquaponics"My wish is that Sylvia's revolutionary "how to" aquaponic wisdom becomes an adopted approach to food cultivation."— Matt McMullen, director, Facilities Management and Sustainability, University Corporation for Atmospheric Research"Sylvia Bernstein's passion for aquaponics, and personal stake in the subject make this book an essential read for anyone interested in the concept of sustainably produced food."— Marijke Peters, producer, Earth Beat, Radio Netherlands Worldwide--This text refers to the paperback edition.Book DescriptionDive into home aquaponics with this definitive do-it-yourself guide--This text refers to the paperback edition.Read more

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What people say about this book

Dean Earlix, "In response to one-star reviewers. If you're like me, you read the one-star reviews before buying anything on Amazon. After I read a few of those, I opted use the library instead of Amazon. After I binge-read the first half of my library copy, I bought it. That said, the book is not for everyone, as evidenced by (currently) 3% one-star reviews. These are the issues I think they had, and that others might have: Issue 1: This book is subtitled as a "Step-by-Step Guide" but actually delves into principles rather than being exclusively a guide. If you're looking for true step-by-step guides, you can find them on YouTube (including very good videos produced by the author) along with many websites. This book might not be for those who already know and understand the principles of aquaponics. For the impatient novice, I'd strongly suggest reading *Aquaponic Gardening* first so that you know why you're doing things listed in those step-by-step guides. Issue 2: This information is available for free on the web. True, but the author collected, organized, and summarized it in a way that most people (myself included) would benefit from. I found I appreciated having a conceptual framework from the book before diving into the resources on the web. That said, if you'd rather spend the money on equipment, you can learn the principles yourself by reading and watching, along with trial and error. Issue 3: Ms. Bernstein doesn't know everything and sometimes oversimplified. Also true, but that's a fair critique of every author. As a Ph.D. aquaculturist and former science editor for *Water Gardening Magazine*, I understood the rationale for most simplifications and found few real errors. Undoubtedly, a number of sharp people (many listed in the three pages of acknowledgements) contributed to making the book as good as it is. In summary, if any of the three issues discussed resonate with you, skip this purchase or use the library. But, after doing the latter, I am glad I bought it."

Murry J. Gans, "The perfect book for designing and building your first backyard aquaponics system.. If you want to get involved in aquaponics, this is the book for you. As the author suggested, I read it cover to cover before I began planning my aquaponics set up and I am very glad I did. I can see lots of mistakes that I would have made that would have cost me it's lots of wasted money and, frankly, I might have given up. But by following the instructions I was able to put together my aquaponics set up and IT WORKS!!!!One thing I would suggest is don't be a slave to exactly she suggests using. For example she suggests using 6 inch PVC to make a media guard, but my big box hardware stores don't carry 6 inch PVC. Instead, I used 4 inch PVC for the media guard and scaled everything else down on the autosiphon to fit inside it and it works like a dream. The important thing is to understand how things work and what needs to happen, and that is where this book really does the job. My Norwegian seaweed extract will arrive today and that will start my cycling so I can add my fish in a couple of weeks. Buy this book if you want to know about aquaponics. It is amazing!!!"

Mark Daniels, "Excellent introduction to aquaponics. This book is concise and a thorough

introduction to aquaponics. It is a little short on specifics in places, but there are plenty of videos on YouTube to fill in the details you may be wondering about. One caution, this book was copyrighted 2011, making it ten years old. This is such a rapidly growing field, it is possible that the latest developments may be omitted. As a newbie to the field it seems complete and very informative to me with some possible shortcomings. As a retired professional mechanical engineer, I immediately started contemplating ways to improve the set-ups depicted in the book and came up with several ideas, especially how to make better use of sump tanks. I wonder if others have already thought of the same thing and already come up with better sump tank designs. I also have different and I think innovative ideas to improve heat management of aquaponic systems in temperate climates that get too cold to grow crops in the winter and wonder if those improvements have already been included as well. But those things seem nitpicking. This book seems to be a great primer. I can't wait to get started."

Mr. Wayne, "Everything You Need to Know About Acquaponics. I've purchased a lot of how-to books in my life, but this is probably the best of the best. Sylvia Bernstein has obviously learned by her mistakes and came up with this fabulous book that explains those mistakes and how to avoid making them yourself. I spent a lot of money building my aquaponics system and used her book as my Bible from Step A to Z. So far, everything appears working to plan. I highly suggest anyone getting into aquaponics read this book cover to cover first."

Dan, "inspirational! unlike many other books of this genre,. inspirational!unlike many other books of this genre, this one is full of detail rather than high level theory"

NFradinho, "Super in depth information. A very good book not only for beginners, but also for more advanced aquaponics enthusiasts. Many important and technical information, lots of good tips and much more!A must have book for all the 'Green revolutioners' out there."

COJMH, "Great book - covers a reasonable amount in an easy Great book - covers a reasonable amount in an easy to read format and I particularly like the "Rules of Thumb" section and the mistakes part at the end. Would recommend this book"

Smiffy, "Good book. Good book for those thinking about starting aquaponics"

bezza123, "Excellent book full of information. This is such a good book for the aquaponics beginner or even for someone with a little experience. It contains all the information you could need to get started, and make a successful system. The only reason I havnt given it the full 5 stars is because its very focused on USA and Australia, although it does give some good general advice for other climates it would have been nice to have a little bit extra info specifically for UK readers."

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