ECOLOGY ACTION'S
GARDEN COMPANION

GROW BIOINTENSIVE® News from Around the World

IN THIS ISSUE:

The Jeavons Center Mini-Farm Report

By John Jeavons, Ecology Action Executive Director

I've been doing this for a while now, so people often ask me for gardening advice. And while I can occasionally address a question directly with a generally applicable tip, the *real* answers can only come from **getting acquainted with the land where you are, and learning to work harmoniously with your part of the Earth, your garden**. As my mentor Alan Chadwick said: "*It is not the gardener that makes the garden. It is the garden that makes the gardener*."

But I also understand that everyone must start somewhere, and "get to know your land" may not be immediately helpful when confronting an aphid invasion, so my second answer (maybe it should be my first? Only?) is: **educate yourself**. The beauty of growing food and working with the soil is that every year, every season, every day in the garden is a reinvention and re-creation of the knowledge—the rich human heritage—handed from one gardener to the next, across time and space, stretching across the globe and back to the first person who planted and tended a seed to harvest...and then taught someone else to do it. If you're wondering about it, someone else probably has, too. And so, in answer to the questions I receive, I say: read, Read, **READ**!

Over our first 52 years, in answer to our own and others' questions, Ecology Action has published over fifty books, booklets, and how-to videos, and a huge array of related articles, all available to the public in print and/or electronic format (growbiointensive.org/publications_main.html). For a really good introduction to growing food and soil using GROW BIOINTENSIVE® (GB) Sustainable Mini-Farming, I recommend the following selections:

Q: Where do I start? A: My first book, *How to Grow More Vegetables* (HTGMV) is 350 pages long and provides a comprehensive introduction to GB. It is a good book, if I do say so myself, and I recommend it ... but it's long, and detailed. If you want a wonderful, shorter, approach for novice farmers, try *The Farmer's Mini-Handbook*. We've translated this popular "30-page HTGMV" into nine languages so far (French, German, Hindi, Portuguese, Russian, Spanish, Turkish, Korean, and Miskitu). With key illustrations, few numbers (yay!), and in the "enhanced" version, eight beautiful full-color teaching posters, *The Farmer's Handbook* offers a wonderful approach, as beginners grow into an expanded process. And it's free at growbiointensive.org/ePubs!

Q: How can I possibly grow grain without a hundred acres and a combine? A: For everyone who wants to know how GB can make basic grain raising and harvesting possible on a small scale appropriate for a home garden, I recommend Self-Teaching Mini-Series Booklet #33: *Grow Your Own Grains*. It really does work. And growing grains with GB, you grow calories and compost crops simultaneously! Right now, the TJC mini-farm soil is beautiful and enhanced through the growth of barley, cereal rye, and wheat crops, from which we expect a good harvest of delicious grain and compostable biomass later this year.

Q: How can I grow crops in a drought? A: The past four years were difficult ones at TJC, with wildfires and a severe drought impacting our ability to grow crops. For a time, we had to reduce our annual growing space to seventeen 100ft² beds (plus perennials). But even when rainfall dropped to 20 inches from our usual average of 45+ inches annually, we continued to grow our crops with high productivity. This is because GB uses only ⅕ to ⅛ the water required to grow the same crops using conventional methods. As climate change makes seasonal rain uncertain, it's important for every gardener to become skilled in water conservation to protect the harvest, and our ecosystems. Self-Teaching Mini-Series Booklet #35: *Growing More Food with Less Water* is a good place to start this journey.

Q: How much energy does GB really save? A: It is easy to prove GB provides higher yields and lowers water and fertilizer use: we can weigh produce, measure water use, and keep track of fertilizers. It is not so easy to evaluate the total energy input in farming systems, which includes the calories (energy) of labor, calories embedded in the tools we use, and calories used getting food to our plates—processing and preserving. In Self-Teaching Mini-Series Booklet #37: *Energy Use in Biointensive Food Production*, two crops (onions and flour corn) serve to illustrate how *as little as 6% the energy is used across the board with GB* compared with conventional farming.

Q: I read *The Farmer's Handbook*, what should I read next? A: Once you've mastered the

basics and have a reasonably improved soil and skill-set, you can use GB and smart crop choices to plan and grow a nutritionally complete, balanced vegan diet for one person on 2,000ft² (or less). That's 1/50 the area currently used to grow an average US diet. You can start with just one growing bed and work your way up! Self-Teaching Mini-Series Booklet #38: *A Path to Peace and Sustainability: Growing Soil, Food and Seed in As Little As 1,000 Sq. Ft.* combines beautiful writing and design with excellent details on this topic, and is a good "vision document" that provides a deeper dive into both the philosophy and the method of GB for the beginner...and beyond.

Q: What do you do at TJC when...? A: Every garden site differs, and what works in one place may not work in another. But for those curious about our methods, Self-Teaching Mini-Series Booklet #41: *Reflections on Crop Cultivation Practices* is the inside scoop for our location in the mountains east of Willits, CA. This booklet contains crop information and cultivation approaches, developed over half a century at TJC, updated as we continue to learn from our work.

Q: I'm learning GB, there's a lot going on in the world, and I need inspiration! A: We hear you! Ecology Action is a small organization, with a big responsibility to spread GB to as many people as possible. The accelerating challenges we face—individually and globally—means more people than ever (billions around the globe) will need the skill to grow fertile soil, abundant nutritious food, and an income—and be functioning and beneficial parts of their community. To address this need, I developed the (**just-released!**) Self-Teaching Mini-Series Booklet #44: *Ultra: Accelerated Leaning and Teaching Approach* as part of an initiative to train as many people as possible to become GB practitioners in as little as a 6-week to 6-month period. The goal of the Ultra initiative is for each trainee to have the equivalent of a 3-year Ecology Action Apprentice's *perspective and grasp* of GB, although they will not yet have all the technical information on using the method. The booklet is intended (with some clarification by a mentor when necessary) to provide a foundation for people training to use GB as they learn to work with nature, to create solutions to the challenges facing us, and to thrive as individuals and as a part of the whole. It is not intended to provide training in the day-to-day techniques, which can be learned from resources offered by Ecology Action our global partners. Instead, it is intended to provide a feel for the *experiential and conceptual understanding* of the philosophical and even what might be called a spiritual (or deep subconscious) connection with the seasons, cycles, and choices that a seasoned gardener develops a feel for over time, and which beginning practitioners of the GB method sometimes struggle to understand.

Q: What can we do about...everything? A: Self-Teaching Mini-Series Booklet #45: *The Negative Tolerance Buildup Effect and a Positive Transformation* (**just-released!**) shows how GB can transform five key challenges in the world into positive opportunities:

- Grow fertile farmable **soil** instead of depleting it.
- Conserve **water** while increasing yields.
- Use less **energy** in all forms.
- Require far fewer imported **nutrients** while growing more nutritious food.
- Grow healthy, abundant food for a healthy, balanced **population**.

This reading list is not a comprehensive one, but it's a good place to start. And as you explore and learn and grow your garden and your skills: stay curious, use your "Aikido Eyes," collect your data regularly, and work from a place of Joy. And as always, remember: "*You must give to nature more than you take. Obey it, and the earth will provide you in glorious abundance.*" - Alan Chadwick ●

Victory Gardens for Peace Mini-Farm Report

By Matt Drewno, VGFP Mini-Farm/Seedbank Manager

Our Victory Gardens for Peace Research Mini-Farm is perched about 100 feet above the Pacific Ocean in the town of Mendocino, California. We generally experience cool summers and mild winters with occasional storms. Historically, our town received 80 inches of rain annually. For the past few decades, that average has been on steep decline. Nowadays, we get about 40 inches of rain a year on a good year. Winters on the North Coast can be mild, and they can be wild. As I write, in the last week we have had over 10 inches of rain and two storms which brought winds above 70mph! Needless to say, our garden is healing after some powerful storms!

At this point in the winter, on a good year, I am eager to see the garden dry out a bit. Our heavy wet clays and location down slope from some steep hillsides causes us to flood for most of the winter. It's always a challenge to get cover crops established early, but not too early, so that a microclimate can fill in and protect our soil from the flooding. In the last 100 years, prior to our garden, the topsoil had been removed from this site three times, and occasionally graded to improve drainage (the original Highway 1 was a gravel road that came right through the garden). For much of the 2nd half of the 1900's it was overgrazed with sheep, lamas, and most recently horses, until all that would grow was buttercup, a plant toxic to animals.

The Mini-Farm at Victory Gardens for Peace

image: vgfp

I haven't seen many gardens that have been grown successfully after such abuse to the soil. But the sad reality is that many soils around the world have seen this kind of misuse. And as a counterpoint to that, it is amazing to see people all over the world using GROW BIOINTENSIVE® to reclaim lost soils and bring them back to life. It's some of the most heartening experiences to watch people all over the world grow food and soil in a harmonious way. These farmers and gardeners carry on the timeless traditions of doing work by hand, without noisy, polluting machines, and synthetic sprays and powders. It's good to know that with a garden spade, some seeds, a watering can, and some homegrown compost, we can get back on the right foot.

A gentleman walked by our mini-farm last year and caught my attention saying, "*Hey! You're a real-dirt farmer!*' What greater compliment! I thanked him and offered him some seeds. He came up to the seed bank, we talked about his garden, I gave him some of our old newsletters and then he went back on his walk. Moments like these remind me that there is much more going on in the world than all the bad news we hear. I feel blessed to be able to work with the Earth, and people, to keep the traditions which have kept us healthy and fulfilled since the beginning of time.

As we move into spring, the garden is coming back to life and celebrating the increasing sunshine. This return always brings me back to the beginning, but each beginning is informed from the lessons learned on the garden path. This year, we are focusing on our low-input experiments, carried over from the last few years of training with John Beeby and his Soil Test Analysis and Amendment Recommendation (STAAR) Course. Our staff person Matthew Gammett will be growing out his 10-Bed, 1,000 square foot complete diet design, which also includes all of his own compost materials. We look forward to welcoming our two interns from Kenya, Teresiah Nyambura Njai from the Garden of Hope Project and Philomena Njeri from the GROW BIOINTENSIVE Agriculture Center of Kenya (G-BIACK). They will be with us from April-November 2024 for our 8-Month Internship Program. And of course, many friends, good learning and seeds to come! •

Diet Divine

By Matthew Gammett, VGFP Staff

Hello from the Victory Gardens for Peace in Mendocino, CA! On the rainy, chilly, and blustery days before spring comes into full swing, while we rest inside, what can we do to further our knowledge and experience in the art of GROW BIOINTENSIVE (GB) farming/gardening? How about creating/polishing a 1,000 sq. ft. Diet Plan? This has been my task as I gain a deeper familiarity with GB methods.

How many different diets can you create? The sky is the limit; but for many people, so is space—and the potential carbon production possible in that space, with which to build annual soil-sustaining compost piles. With the help of Ecology Action's Self-Teaching Mini-Series Booklet #31: *Designing a GROW BIOINTENSIVE® Sustainable Mini-Farm* (growbiointensive.org/ePubs), this process is as close to simple and pain-free as it can get. Our modern agribusiness food systems and methods of teaching farming rely on a **MORE-BIGGER-FASTER** mentality, while the methods and techniques that comprise the GB method rely on a *SMALL-ELEGANT-SUSTAINABLE* approach. There is a dance to deciphering the requirements for producing all your own calories, income, and soil-nourishing compost in as small an area as possible. For a 1,000 sq. ft. garden, this is challenging and requires us to draw on the time-honored traditions and techniques of the GB method.

Booklet #31 walks you through this process, step-by-step and day-by-day, to reach the goal of designing a complete diet, using simple forms that you fill out to gain clarity on what it is exactly that you need to do to accomplish this. In my own experience, this kind of process is totally unique in the whole world of agricultural educational materials, to Ecology Action. GB parses the sustainability of our garden/mini-farm by utilizing certain percentages of crops with specific capacities for carbon and/or calorie production. Recommendations for general sustainability are that you should not devote more than 2.5 to 10% of your mini-farm to low-calorie producing crops (like lettuce, kale, tomatoes), 30% to high-calorie production root crops (like potatoes, leeks, parsnips), and 60% to high-carbon *and* -calorie producing crops (like quinoa, flour corn, barley).

As you follow this 60:30:10 ratio and fill out the forms, you will begin to see how the process unfolds. It may seem daunting at first, but you just have to commit to the process and START NOW! From my experience it is best to not over-analyze or try to strategize for a specific outcome as you first embark on the form calculations, unless you want a headache and some wasted time. Sharpen your pencil and avoid the finality of ink on paper. This is not just a rote exercise with a predetermined outcome: this is truly a process of self discovery and "self uncovery" if I may coin a new term. What do you truly like to eat in your heart of hearts? Does this crop selection fall into your plan with the ratio of 60:30:10 guidelines? What can your climate and farm site best produce with the reality of the weather patterns and soil with each passing year? Do you have enough space or skill to grow this crop? You will certainly find out! I think if you follow the process like so many have before you, will be pleasantly surprised with what you're able to produce each year, towards the journey of learning to nourish and feed yourself, and helping others around you to do the same. Once you have completed the forms, don't stop there! This process will continue to refine and define itself, and your future self will be grateful you took the time and effort to undergo the challenge of our time. We are all re-imagining our selves with each passing hour, day, and year, and the garden is the perfect place to make the changes happen in your own life.

The challenge we all face, and will face more and more, is that the way our current culture treats the great mother Earth has to be shifted towards a caring, loving, and productive stewardship of the life-support systems of the biosphere. With GB practices and methods this becomes like breathing, or drinking water, effortless yet eminently necessary. I want to wish you the best of luck for the year to come and may this spring help you to grow as much as your vegetables will! •

Soil Science Spotlight: The Dr. John Doran/ USDA Soil Quality Test Kit Guide, Part 4

By John Beeby (growyoursoil.org)
Ecology Action Soil Fertility Advisor

Soil testing and the correct use of organic amendments are important parts of GB. John Beeby and Ecology Action created the "Soil Science Spotlight" to introduce the topic to the GB community. Read the whole series at growbiointensive.org in the "Protocols" section.

In parts 1-3 of this segment, I introduced Dr. John Doran's USDA *Soil Quality Test Kit Guide* (bit.ly/DoranSoilTest), and discussed the *Guide's* tests for infiltration, bulk density, physical observations, aggregate stability, earthworms, and soil respiration (growbiointensive.org/SoilScienceSpotlight). In this issue, I want to talk about another of the *Guide's* tests: **pH.**

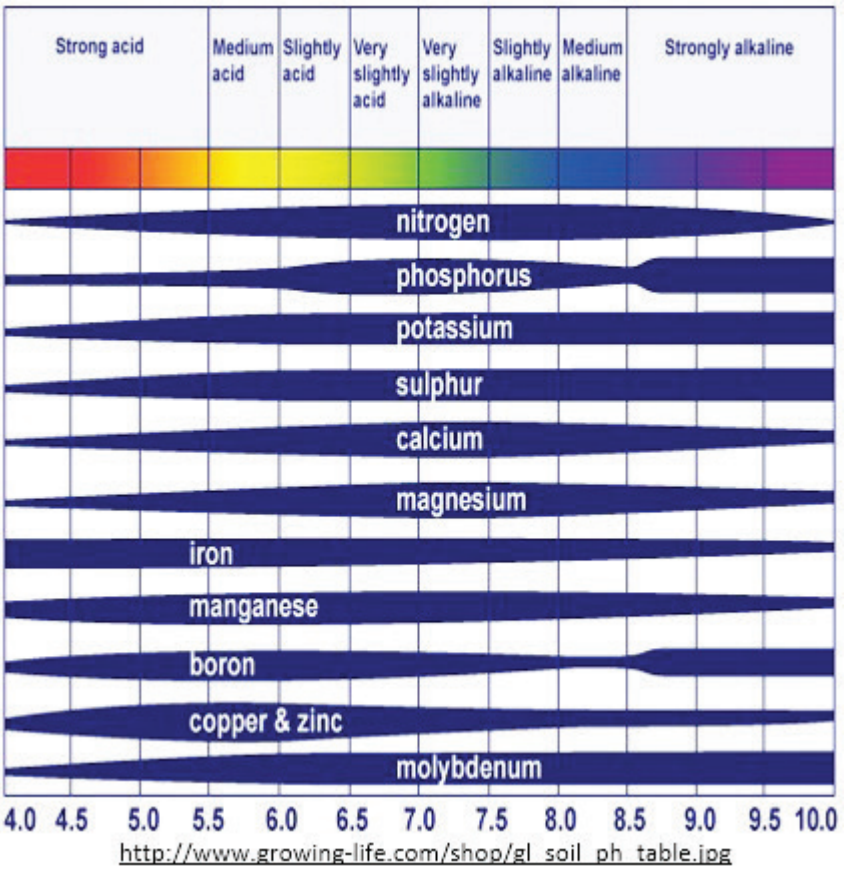
Soil pH has not always been recognized as an important parameter for soil health. Even the famed soil scientist Dr. William Albrecht discounted the importance of soil pH. However, we have learned a lot about soils and crops over the last 50 to 60 years! Soil pH has been shown repeatedly to be a fundamental property of soils that affects nutrient availability and the health of macro- and microorganisms. In addition, because all parts of soils are connected, soil pH can affect soil structure and the ability of air and water to enter the soil, and can also affect the nutrient-holding capacity of organic matter and some clays in the soil.

We can see in the graphic (right) that a nutrient might be *present* in the soil, but not available for the crops to take up simply because of the soil's pH. The width of the dark blue region for each nutrient represents its availability to crops at each of the pHs shown below; the wider the area, the more available it is.

So what is pH and why does it have such an effect on soil nutrient availability? ***pH is simply a measure of the amount of hydrogen ions (H+) in the soil***. The more hydrogen atoms, the lower the soil pH and the more acidic the soil is.

The opposite ion, the yin to hydrogen's yang, is hydroxide (OH-). The more hydrogen there is, the less hydroxide there is and vice versa, so the more hydroxide is present, the higher the soil pH and the more alkaline the soil is.

So what does all this mean for nutrient availability? Nutrients are largely taken up by plants as ions. Most agricultural soils have a pH between 5 and 8. We can see from the graphic below that many agriculturally important nutrients, such as nitrogen, potassium, sulfur (sulfate), calcium, and magnesium, are readily available in this pH range. However, some nutrients, like phosphorus—of which crops need large quantities—are only readily available in the range between pH 6 and 8. This is entirely due to the nature of phosphate (PO_4^{3-}) and specifically its very large negative charge (3-). When the soil's pH is less than 6, soils typically have a lot of free iron and free aluminum, both of which have a high positive charge: Iron (Fe^{3+}) and aluminum (Al^{3+}). These highly positively charged ions are naturally attracted to highly negatively charged phosphate, and so they bind with phosphate through ionic bonds to form either iron or aluminum phosphate. This binding process, called precipitation, causes these free ions to become minerals and no longer available for crop root uptake. Then, when the pH is 8 or above, typically soils have a lot of free calcium (Ca^{2+}) which is also highly attracted to



http://www.growing-life.com/shop/gl_soil_ph_table.jpg

phosphorus due to its highly negative charge. There are additional chemical complexities involved that explain phosphorus's availability above 8.5, but since most agricultural soils are not this alkaline, we will skip over more chemistry for now.

The other set of nutrients whose availability is highly dependent on soil pH are the trace elements or minor elements, namely iron, manganese, boron, copper, and zinc (as well as molybdenum). These are readily available in acidic soils, but much less available in alkaline soils. Using iron as an example: when a soil becomes alkaline, it has a lot of hydroxide ions (which are negatively charged) and very few hydrogen atoms, as mentioned before. The abundant negatively charged hydroxide ions react with iron (as well as zinc, manganese, and copper) to form iron oxide. This transformation causes iron ions to become minerals, and unavailable for crop root uptake. The abundance of hydroxide ions also reduces boron availability, but in this case it is not ionic bonding that occurs, but a more complex interaction called ligand exchange.

Okay, so that was a lot of chemistry to explain why the availability of some nutrients (most phosphorus and the trace elements) is highly dependent on pH. But what does it mean? *It means that if your crops are showing consistent symptoms of iron deficiency (for example), it is quite possible that your soil has plenty of iron in it, but it is just not available in sufficient quantities in ionic (plant-available) form to meet the needs of your crops.* If you know iron availability is pH-dependent, rather than wasting money on iron sulfate fertilizer (which won't help your plants if pH is causing the iron to be unavailable), you could consider first testing your soil's pH, and then, assuming the test shows the soil is too alkaline, lowering it with elemental sulfur, thus making the iron already present in your soil more available and able to meet your crops' needs.

Soil pH also plays an important role in ensuring the soil is a healthy environment that can support a diversity of soil macro- and microorganisms. Like crops, most soil life thrives in a soil environment that is between a pH of 6 and 7. If the soil pH is outside of that range, it will only be able to support a limited number of species that have adapted to that harsher environment. Of course, soil life also needs sufficient air, water, organic matter, and nutrients to thrive, and not just a specific pH range, but just like with plants, pH affects nutrient availability for many microbes. A happy, healthy, diverse population of soil life that has plenty of air, water, organic matter, and nutrients can naturally create healthy soil with good soil structure, allowing air and water to pass easily into soils and allowing soils to hold onto more water and produce good crops even under drought conditions.

Soil pH also affects the ability of a soil's organic matter, 1:1 clays, and oxides contained with the soil, to hold onto nutrients needed by crops and prevent those important nutrients from leaching and being lost. If you are blessed with a soil that has a lot of 2:1 clay in it, your soil has a strong ability to hold onto nutrients regardless of the soil's pH. However, the other compounds in soil that are able to hold onto nutrients, namely 1:1 clays, oxides, and organic matter, all have reduced abilities to hold onto nutrients when the soil pH is low (acidic soils). While adding compost to an acidic soil will help that soil in a number of ways, including improved soil structure, the power of that compost to hold nutrients is greatly reduced by the soil's low pH. So, *it is important to keep in mind that in order to improve the fertility and long-term productivity of an acidic soil, you must not only add compost but also increase the pH of that soil by adding lime.* Then, that soil can retain more of the nutrients it naturally has, and can retain more nutrients that you may add through fertilization once you understand what nutrients the soil needs and does not need to increase its fertility. •

Grow YOUR SOIL

Soil Science Spotlight

If we understand a soil, we can improve it

JUST RELEASED! Read Your Soil: Improving Your Soil Without a Soil Testing Lab

By John Beeby (growyoursoil.org)
Ecology Action Soil Fertility Advisor

Each soil is unique, just as each person is unique. And just as there is no medicine good for all people, there is no purchased fertilizer or other input beneficial to all soils. Like doctors, we must first understand a soil before we can hope to improve it.

Testing soil by sending a representative sample to a soil testing lab is the primary way a farmer can understand what their soil does and does not need, in order to improve it and avoid adding nutrients that could be detrimental to the overall health and fertility of the soil. However, most small farmers in the world do not test their soil because it is far too expensive to ship and test a soil sample, and then get a recommendation for fertilization based on the test results. As a result, most farmers do not know what their soil needs or how to improve it, and either have to overfertilize it—wasting their money and the earth's resources—or not fertilize it and suffer with low yields year after year.

What if there were a way farmers could understand their soil and what it needs to become more fertile, using only simple tools and tests they can conduct themselves, as well as their own powers of observation, and eliminate the need for a soil testing laboratory? All farmers would then be in a position to understand their soils and how to improve them by giving them the nutrients and inputs they need, and not what they do not need.

The tool that empowers all farmers to do that, just released, is **Read Your Soil**. It combines the use of cultivated plants to indicate nutrient deficiencies (Beeby, *Test Your Soil With Plants* 2nd ed., 2013 growbiointensive.org/ePubs/index.html) with Dr. John Doran's *USDA Soil Quality Test Kit Guide* (bit.ly/USDADoranGuidePDF) to determine soil characteristics like pH, soil texture, electrical conductivity, compaction/root depth, and topsoil depth and color. **Read Your Soil** then analyzes the farmer's inputs to create a recommendation to improve their specific soil. Once you sign up at www.readyoursoil.com/tabs/account, you can use the app free of charge, without ads, on your phone, tablet, or laptop. It can also be accessed off-line for field use and will generate a recommendation even without internet access. We are continuing to develop the app and hope to increase the number of indicator crops for different regions of the world, as well as add further functionality, so we would be appreciative of any feedback you have.

Now anyone with a phone can use **Read Your Soil** to help a farmer improve the physical, chemical, and biological nature of their soil with simple tools, tests and observations—all without a soil testing lab. Only healthy soils, carefully and sustainably managed with methods like GROW BIOINTENSIVE® can produce high yielding, healthy, and pest/drought-resistant crops. Create your account today, and let's go grow some soil! •

The Guardian: How India's 'Millet ambassador' preserves ancient grains – and helps promote food security

The following is an excerpt of an article published in The Guardian *in June 2023, which you can read in its entirety at https://www.theguardian.com/global-development/2023/jun/23/india-millet-laheri-bai-ambassador-preserves-ancient-grains-helps-promote-food-security. The resilience and adaptability of heritage crops (like millet), which have evolved into a deliciously diverse array of varieties adapted to a wide range of climates and soils, are a vital part of building true food security. From the Victory Gardens for Peace Seed Bank on the Mendocino coast to the G-BIACK Seed Bank in Thika, Kenya, GROW BIOINTENSIVE projects across the globe support the free exchange of open-pollinated and heritage seed varieties. Biodiversity = healthy plants = healthy people!*

Collecting seeds in her mud-walled farmhouse home in central India has pushed Laheri Bai to become a farming celebrity. Earlier this year, after Narendra Modi, the prime minister, tweeted he was "proud" of Bai and the 150 varieties she had preserved, it prompted the Indian media to call her the country's "millet ambassador". Bai and her 1.2 hectares (3 acres) in the east of Madhya Pradesh state have become a symbol of a government policy to promote old, traditional grains that will prove sustainable in the face of climate breakdown.

The 27-year-old Bai follows the practices that used to be common in this area, bunching together different types of *mota anaj,* or millet, to hang to dry in neat rows from the rafters in the ceiling.

... Laheri Bai's seed bank [*Bewar Beej Bhandar*] ensures traditional grains are kept alive amid a wider effort to promote millet's suitability for cultivation in challenging climate conditions ... [and] takes up one of the two rooms of the house in Silpidi village she shares with her parents. ... Bai has no formal education but a deep knowledge of millet varieties, nutrition and food security passed down through generations. Her grandmother taught her to collect and preserve disappearing local varieties used in Bewar farming, an ancient method of shifting cultivation practised in the uplands to grow millet, maize and legumes in a single plot.

India is the largest producer and second-largest exporter of millet—a highly nutritious, gluten-free grain that can grow in harsh conditions. Millet has been a staple food in many regions of India for thousands of years, and is eaten as porridge, *roti* flatbread, *dosa* pancakes and with lentils in *khichdi*. However, the "green revolution" that started in the 1960s saw the production of millet fall as wheat and rice gained prominence.

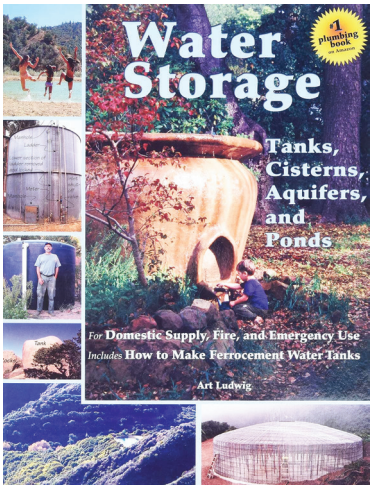
Bai says her motivation came from a realisation "*that our ancestors lived healthy, long lives compared with our generation because they ate millet*", though she adds: "*In the 1990s, people started eating subsidised rice and wheat, and forgot good old millet. I think this has made us unhealthy and prone to diseases.*"

... Bai is from the Baiga, an Indigenous community from the states of Madhya Pradesh, Chhattisgarh and Jharkhand. Her village is in Baigachak—land reserved for the Baiga by the British Raj. Today, Baiga are classified as one of the *Particularly Vulnerable Tribal Groups of India* due to the declining population of the ethnic group. ... When millet is harvested in January and February, Bai exchanges her seeds, known for their quality, with farmers in her village and surrounding areas. "*It's a two-way process. Where, if I give a kilo of millet seeds, I will get 1.5kg of the same or different variety of millet seeds,*" she says. In 2022, Bai distributed seeds to about 350 farmers across 25 villages in the district.

Ranmati Bai (no relation), who also lives in Silpidi, is a member of Sama Salhar Beej Samiti, a cooperative of 10 Baiga women. She says: "*Though we all exchange and collect seeds for our bewar, Laheri decided to conserve and make a seed bank for the future. This has made her famous today.*" ●

Book Review: Water Storage: Tanks, Cisterns, Aquifers, and Ponds

By Art Ludwig, Reviewed by Mary Zellachild



"*This do-it-yourself guide is an invaluable resource for designing, building, and maintaining water tanks, cisterns, and ponds, and sustainably managing groundwater storage. It will assist you with handling your independent water system, fire protection set-up, and disaster preparedness plan, while keeping costs low and incorporating ecologically sound designs. It also includes building instructions for several styles of ferro-cement water tanks.*" (Amazon)

This book is crammed full of photos, drawings, charts and text that should answer the questions of almost anyone wanting information about creating, maintaining, and/or protecting water storage—from small containers up to complex systems. The author addresses a huge diversity of topics on the subject, including storing water in soil, aquifers,and ponds, improving the quality of stored water, and materials to avoid when creating water storage, while suggesting a surprising number of materials that can be used. He devotes a 24-page appendix to the details of building a ferro-cement water storage tank. Ludwig states that it isn't necessary to read the whole book (unless you really want to); a person can simply find the information that covers what he/she is currently working on.

The author has been designing ecological systems since 1982 and focusing on water and wastewater systems since 1989. He believes in living as simply and ecologically as possible, following nature's example. This book illustrates the depth of knowledge he has accumulated through this experience, and the way that he shapes his designs to correspond to his beliefs. Ludwig's website, Oasis Design is an outstanding resource. The water storage page oasisdesign.net/water/storage has a wealth of appendices, photos, and detailed designs for a variety of water storage options, as well as a link to purchase the book (we always recommend buying from the author if possible!) ●

Ethiopian Teff Flatbread: Injera

By Shannon Joyner, Garden Companion Editor

My first experience with Ethiopian food was at a restaurant in Portland, OR. I was a student at the time, and sitting on cushions with friends around the low table as the server brought a platter covered with a giant, spongy flatbread called *injera*, topped with savory little mounds of different Ethiopian specialties seemed the height of sophistication—and certainly a treat, contrasting strongly with the cheap, highly processed institutional food served in our cafeteria. No utensils were used, just our clean fingers, ripping a bit of warm bread off from the edge, and using it to scoop up morsels of braised greens, stewed chicken, and spicy lentils from the center of the platter. Hilarity ensued as we attempted to figure out how to pick up a very slippery whole hard-boiled egg in a savory red sauce. Everything was delicious. Ethiopian food is similar to Indian curries in that it falls into the same "saucy-spicy-lots of vegetables" category, but the flavors are really unique, and I have yet to replicate them successfully at home. The bread, however, I've had more luck with. At many restaurants, *injera* is made with wheat flour, as it's cheaper and easier to source than teff in the U.S., although with gluten-free grains gaining popularity here, it's now easier to buy teff flour than it was 10 years ago. Teff provides a uniquely delicious flavor, ferments rapidly to give the perfect spongy texture, and has a nutritional profile—high in protein, iron, and calcium, and with a low glycemic index—that makes it worth seeking it out (if you can't find it, though, you can try sorghum or buckwheat flour, too). There are many *injera* recipes online, with varying degrees of complexity. Some use a starter, and a batter, and a sort of cooked teff roux called *absit* as an emulsifier. Others use only teff flour and water with a leavener to make an unfermented batter like regular pancakes. I found this one at yangsnourishingkitchen.com/injera-fermented-ethiopian-teff-flatbread/ which combines a bit of fermentation and a bit of leavening, to give a nice flavor and texture without an overly complex preparation. *Injera* is delicious served with *Misr Wat* (Ethiopian spiced red lentils daringgourmet.com/misir-wat-ethiopian-spiced-red-lentils), or can be used like any other flatbread or wrap, with any fillings or toppings you like.

Injera (~4-5 servings)

2 cups teff flour (I use Bob's Red Mill)
4 cups water, divided
3/4 tsp salt
1/2 tsp baking soda
1/4 cup ghee or olive oil

Place the teff flour in a glass or ceramic bowl, add 3½ cups of room-temperature water, and stir well to combine. Cover the bowl with a tea towel, and leave the mixture on the countertop to ferment for 2 days, undisturbed (if you have a cold kitchen, you can put it in your oven with the light turned on (just don't forget it's in there and accidentally cook your starter!) The mixture should be start bubbling, and smell sour/fresh.

After a minimum of 48 hours of fermentation, the teff should sink to the bottom of the bowl, with a layer of foamy liquid on top. Do not stir the mixture, but carefully pour off all the foam and liquid, leaving the teff solids in the bottom of the bowl. Gradually add about ½ cup of fresh room-temperature water to the solids, and stir to make a thin batter, similar in consistency to crepe batter. Stir in salt and baking soda.

Generously grease a pre-heated 12-inch cast iron skillet. Pour in enough batter to cover the bottom of the skillet to form a flatbread of roughly ¼ inch thick. Cover with a lid, and cook on medium heat for 3-5 minutes, until the top of the injera is dry (don't flip it over), then use a spatula to transfer the flatbread to a warm plate. Repeat until all the batter is used up. Enjoy! ●

Introducing Teff to TJC

By Suraya David-Sadira,
Assistant Mini-Farm Manager, TJC

Teff (*Eragrostis tef*) is a fast-growing grain that originated in Ethiopia. It produces the world's smallest identified grain—roughly the size of a poppy seed with a test weight between 60 and 72 pounds per bushel—and is thought to be one of the first plants domesticated as a grain for human consumption, between 4,000 and 1,000 B.C.E. Teff has long been a staple food in Ethiopian cuisine where it is made into a fermented flatbread called *injera*, and more recently, teff has gained popularity outside Ethiopia as an alternative grain for its gluten free qualities. It has also been gaining the attention of agricultural researchers as a forage crop over the last few decades. As producers struggle to adapt to restricted water supplies, identifying high-value forage crops that will grow with limited water has become increasingly important. Due to its drought-tolerance, high biomass yields, and good nutritional profile, teff is growing in popularity with farmers. "*Between 2005 and 2010, teff acreage in the US increased [from ~5,000] to more than 100,000 acres, based on encouraging research results in Oregon, New York, and elsewhere … Teff is typically higher in protein and forage quality than other common forage grasses. …teff compares favorably to other forage crops in its efficient use of water and fertilizer. Protein levels in teff hay are typically higher than common grass hay species, but are lower than alfalfa. However, teff requires less N fertilizer and irrigation water than comparable grass hay, and requires only about half the irrigation of alfalfa for optimum yields.*" (extension.oregonstate.edu/catalog/pub/pnw-709-teff-grass-forage-nitrogen-irrigation-requirements) While all varieties of teff can be used as forage/biomass, some varieties are better for grain crops than others, and it is important to remember that there are different varieties that either give a good grain yield or a good biomass yield, and some that may be good for both.

Given its long history with human agriculture and its adaptation to hot weather, arid conditions, and marginal soils (agproud.com/articles/33013-teff-a-worthy-contender-among-forage-options) I am interested to see how different varieties of this multifaceted crop might fit into the biointensive models. Grown under optimal conditions, teff can reach maturity in 45-60 days. Teff has adapted to many different soil types, allowing it to do well in environments ranging from dry/arid areas to waterlogged soils. It has also been found growing in a wide range of altitudes from sea level to 9,186 feet. It is easily grown, and susceptible to few diseases, but does have a vulnerability to freezing (a soil temperature over 65°F is necessary for germination and optimal yields) which will limit the growing season in some regions. Teff is a self-pollinating annual grass that reaches about 2.5-3.5 feet at maturity and seems to do well at relatively close plant spacing, probably somewhere between 4-6 inch centers.

My plan for this year's Teff Project:

When beginning research on a crop, I believe it is first important to know its optimal growing conditions. The existing conventional agricultural research indicates that teff can be grown with different spacings and in different times of the warm season; but since we are uncertain of the best spacing and the best timing for the GROW BIOINTENSIVE method of close-spacing, those are the first things we should research. This year, I plan to do four test plots of 25ft², testing two different spacings at two different timings. The two spacings will be 4-inch centers and 6-inch centers, and the two different timings will be started June 15th and July 15th. With a 45-60 day maturity, we should hopefully have our first season's results in August/September. I'll let you know what I find out in the fall! In the meantime, if you're interested in reading more about this tiny but powerful plant, take a look at *Teff Grass: Crop Overview and Forage Production Guide* online at kingsagriseeds.com/wp-content/uploads/2014/12/Teff-Grass-Management-Guide.pdf. ●

image: https://world-crops.com/tef/

FAQ: Why Should I Try Growing a Complete Diet?

By Ecology Action Staff

Question: Why should I grow a complete GB diet, (and how much time will it take?)?

Answer: Thanks for the good question!".

When we at Ecology Action began our work back in the 1970s, most people weren't ready to launch into the idea of growing a complete diet, and didn't even consider growing grains on a small scale to be possible. This was because at the time, grains were cheap to purchase and people felt it took too much time to incorporate this element into their gardening.

Times changed, however, and in 2008, the price of wheat tripled. Our international mail order catalog, *Bountiful Gardens* (no longer available), was inundated with orders for grain seed; the price of commercial grain products, coupled with the decrease in the availability of imported grain, had people worried that they would not be able to continue to get the grains they wanted. Fast forward to 2024, with the global economy still reeling from the pandemic years, supply chain challenges, and lots of inflation, and...well, people are even more interested than ever in growing their own food security.

What is causing the changes?

The rising prices and lack of availability of staple crops are due in part to the fact that the local farming knowledge-base is being lost, and the U.S. and other countries are outsourcing more and more of their agricultural production. In the case of the U.S., the number of farmers has dropped to less than two-tenths of one percent of the population. This is happening, in part, because farm production expenses and working debt are increasing, while farm income has stayed relatively flat (agweb.com/news/business/taxes-and-finance/9-farm-financial-statistics-know-2022). And we're losing small farms and seeing a decline in the quality of farmland, too, according to the The Guardian: "*Record numbers of US farms are going out of business with small farms and Black farmers the hardest hit—again, according to the 2022 agriculture census, a comprehensive snapshot of the state of America's farms and farmers published every five years by the Department of Agriculture (USDA). Yet industrial factory farms rearing thousands of livestock in confinement have further expanded into rural America, acquiring smaller farms, raking in taxpayer subsidies and generating environmental harms.*" (theguardian.com/environment/2024/feb/15/us-agriculture-census-farming) The problem is, if major food producing countries like the U.S. are passing off the responsibility for their food security to mega-producers and to other countries, and we are all in the same boat as far as dwindling availability of fertile, farmable land and skilled farmers, who is going to be able to pick up the slack?

The U.S. isn't alone in losing its farming population—the demographics of the world are also changing: the UN projects that by 2050, 68% of the world population will live in urban areas, with a lot of that transition taking place in China, India, and Nigeria. This poses two challenges: 1) farming literacy worldwide is being lost; and 2) more people are moving into the consumer position with fewer providers.

What can we do about this?

So, with all of this in mind, consider that dedicating three 100ft² beds to grains could provide you with a 1 lb loaf of bread each week for a year. With an additional three 100ft² of hull-less oats you could enjoy 2 large bowls of oatmeal for every week of the year.

If the **8 hours a day it would take <u>one</u> person to produce a complete annual diet for a <u>family of four</u>** seems daunting, then consider starting small, with the objective of growing 25% of your own grains and vegetables. Sometimes the perceived obstacles of a large project resolve themselves once you begin, and when you experience the wonderful benefits that result from improved health, vitality, and a sense of empowerment as you create your own food security, you'll see it's worth the effort.

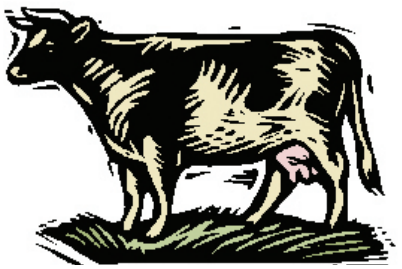
The important thing to remember when growing a *complete diet* is that the "60:30:10 ratio" is the key to having a sustainable, regenerative system that requires few (potentially zero) external inputs, and

will keep producing year after year. What this means is that if you scale back your grains to 25% of your annual diet, then proportionally scale back the 30% and 10% crops as well. For more clarification on what these ratios mean, and how to use them in your garden, see page 39 of *How to Grow More Vegetables*, 9th ed. I also recommend Self-Teaching Mini-Series Booklets 33: *Grow Your Own Grains* and #38: *A Path to Peace and Sustainability: Growing Soil, Food and Seed in As Little As 1,000 Sq. Ft.* as good resources for getting started in this process (growbiointensive.org/ePubs).

Sustainability is the key to a successful GB mini-farm.

Because we are working with such a very small space (as little as 2,000 ft² for a complete diet for one person working with good soil and gardening skill), we have to consider how to move away from depletion and toward regeneration and resilience in every aspect of a mini-farm. There is a tendency for people to want to "balance the equation" by importing nutrients for replenishing soil from external sources like seaweed and animal or human waste. The challenge is that there is barely enough seaweed to meet the current demand, and increasing extraction of a resource only tips the imbalances in another direction. As for human waste, most is not captured in a way that can be safely used, and is mixed with industrial wastes and other toxic waste products, making it unsuitable as a soil amendment. For more information on the potential for the safe, legal use of human waste see *Future Fertility: Transforming Human Waste into Human Wealth* by John Beeby (growbiointensive.org/publications_main.html).

While initially it's possible to make use of animal manure that is already available, it is not optimal to depend on it, because a) it can cause salt buildup in your soil, and b) it is ultimately a part of the depletion problem, not a part of the solution. This second point is due to the fact that to feed one cow, you would have to grow an acre of fodder each year. The fodder itself contains 1 giga-unit of carbon. Once it goes through the cow, the resulting manure only contains 2/3 of that giga-unit of carbon, and once the manure is cured, it contains only 1/3 that giga-unit of carbon. The cause of this carbon loss is the fact that both the metabolism of the cow and the microorganisms in the manure release the carbon as CO_2 into the atmosphere, and so the carbon isn't getting into the soil where it is most needed, and it is contributing to global warming. In addition to the carbon problem, as it grew, the fodder for the cow took up minerals from the soil that are now tied up in the cow's bones, tissues, milk, and meat, so many of the minerals don't get back to the soil either. (For more about Biointensive gardening and livestock see growbiointensive.org/FAQ/FAQ_Livestock.html.)



Small is beautiful—and productive!

The bottom line is: there are many reasons to try growing a complete diet, and spring is a great time to start, but you don't need to jump in at the deep end! Begin by growing your food at the level that feels manageable. While it's definitely empowering to grow a complete diet, it's better to start small and adhere to the principles that will sustain you and your soil, so you experience both the abundance you can produce with relatively little effort, and the joy that results when we become life-givers. You, and your garden, can grow over time.

And remember, just because you're working on a small scale, it doesn't mean you can't have impressive results! A small-farming success story I enjoy is that of Russian farmers, where in 1998, 3% of farmable land was in *dachas* (kitchen gardens) attached to country homes. The remaining 97% of farmable land was in large-scale, commercial operations. Phenomenally, because of the level of personal involvement farmers put into the *dachas* with various forms of intensive gardening and mix-cropping used, the production from these small farms—only 3% of the land—ended up almost equaling yields from all the land under large-scale production in that country.

What is exciting is that, in the process of getting directly involved in healing the soil and growing our food in our own back-yard or community gardens, we re-engage a part of our spirit that has historically been linked with nature, and establish a communication with a larger energy system that can easily help us to understand what is needed to turn the tides of scarcity to abundance. To nurture the Earth and each other while working side by side makes any task more joyous, and in the process of creating sustainability in our lives, we begin to heal that place in ourselves that may have felt separate, alone, and disadvantaged. GROW BIOINTENSIVE grows healthy soil, which grows healthy food, which grows healthy people...and a healthy ecosystem for us all! ●

Know your Transplants: Movers, Divers, Sprinters and Sprawlers

In GROW BIOINTENSIVE agriculture, with few exceptions, the method of growing plants from seed is to first plant the seeds in a shallower flat, allowing them to germinate, and then pricking the resulting seedlings out to a deeper flat where they are allowed to grow until it is time to transplant them into the garden bed to minimize "in-bed" time, as well as the amount of water and seed used for each crop. This article gives a good guide for when and how to transplant different garden varieties according to their root structure.

image: ecology action

Garden vegetables can be grouped by their root structure and their tolerance for transplanting. This system tells you which crops like to be transplanted; which don't want to be disturbed; and which can wait the longest to get to their final position in the garden. Root type is important when choosing companion plants as well. If plants are going to be growing in close quarters, they will get in one another's way much less if they have different types of roots. For example, carrots or parsnips will burrow down into levels below a lettuce plant's matlike root system. There are four major root-type groups: **Movers, Divers, Sprinters, and Sprawlers**. Below you'll find simple strategies for sowing and transplanting each group.

Movers:

These are mostly the traditional European *brassicas*: cabbage, Brussels sprouts, kale, broccoli, cauliflowers, and so on. They have been selected over the centuries for transplanting into the garden. Tomatoes, and to some extent peppers, are summer crops that can also be handled in this way. They grow fairly slowly, (which makes cabbages more frost-hardy and gives tomatoes the framework to support fruit). Traditionally, onion roots are snipped a bit at transplant to trim off broken ends and stimulate new growth.

All movers have a fibrous, dense root system that is actually stimulated by transplanting. In studies at Cornell University, cabbages had much larger root systems at maturity if they had been transplanted; and those that had been transplanted twice had the largest of all! These slower-growing, transplant-loving crops can stay in their final seedling flat or pot for about a month, then can be transplanted to a nursery bed (or in the case of tomatoes, ever-larger pots) until space opens for their permanent homes. **While transplanting doesn't bother them, crowding does. So don't hesitate to move them as often as need be to maintain adequate spacing**. Just make sure that they get plenty of compost and dependable moisture while they're growing. A mulch can be helpful as well. **Varieties include**: Amaranth, Brussels Sprouts, Broccoli, Cabbage, Cauliflower, Collards, Eggplant, Kale, Kohlrabi, Leeks, Onions, Okra, Peppers, and Tomatoes.

Divers:

What sets divers apart is their roots: most are tap-rooted and send down one main root fast and deep. Root crops like carrots and parsnips are divers, but some leaf or stem crops like Fennel and Chard, and some summer crops like beans and corn, are part of this group, too. Even when they have more than just one main root, divers tend to have a few, large, succulent roots rather than a mat of small flexible ones. These succulent roots are brittle, like a good carrot or a bean sprout. They break when a cabbage root would bend.

Divers do not like transplanting, and should be either direct-sown, or transplanted when quite young, before their roots get too big. On the other hand, they are not so worried by crowding. In the garden, that means you can put them in their permanent spot while earlier crops are still in place. In spring, you may be able to sow them into openings in your winter cover crop. An example would be sowing beets under the shade of caged tomato vines, or chard under spring peas. Most legumes, like peas, favas, and lentils are not tap-rooted, but their roots are shallow, brittle and easily damaged, so treat them as divers and direct-sow or transplant from seedling flats quickly and carefully.

Varieties include: Asparagus, Beans, Beets, Burdock, Carrots, Celery, Chard, Corn, Fennel, Lentils, Parsnips, Peas, Radishes, and Salsify.

Sprinters:
These are the juicy, leafy, fast-growing plants that mature very quickly: Asian greens, Lettuce, Spinach, and Mustard. They have been selected over the centuries for crisp juicy leaves, mild flavor, and fast growth. They can be sown in place or transplanted once—but then they need to get down to business and finish up. They bolt quickly once they are mature, or under stress.

Traditionally, the farmer sows and harvests multiple quick crops a year, which are cut and used right away (or pickled as in Kimchi). For example, heads of lettuce or bok-choy that are cut and refrigerated properly will often stay in good condition longer than similar heads that are left in the ground. **If you buy or grow these in pots—especially if they are little six-packs—get them in the ground as fast as you can.** Potbound plants will bolt. **Varieties include**: Amara, Aztec Spinach, Bok Choy, Napa/Chinese Cabbage, Chicory, Endive, Lettuce, Mizuna, Miner's Lettuce, Minutina, Mustard, Purslane, Orach, Radicchio, Spinach, Tatsoi, and Turnips.

Sprawlers:
Sprawlers are large plants with a need for a far-ranging root system. All the squash tribe—including melons and cucumbers as well as winter and summer squash—are sprawlers. Corn, sunflowers, and okra share the same requirements. They need conditions that support a large, fast-growing root system, and their roots tend to be somewhat fragile. **They can be transplanted (carefully) once when small but have traditionally been direct-sown. All of them love organic matter and can use vast amounts of fertility if it is available**. So, they are best given a final, sunny position early, even if it means cutting an opening in your winter cover crop, or planting the young starts among your spring peas and lettuce. I like to plant squash by hoeing openings in a bed of winter vetch, which enriches the soil. The vetch can be cut, stacked to one side to dry, and later used as a nutrient-rich, weed-smothering mulch for the squash. **Varieties include**: Corn, Cucumbers, Melons, Pumpkins, Okra, Sunflower, Squash, and Watermelon •

Dahlia Project Update

By Suraya David-Sadira
FTT and Assistant Mini-Farm Manager, TJC

In 2021, we established an experimental 10-Bed Unit at The Jeavons Center with a diet design including dahlias as a versatile carbon/calorie/income crop. This is an ongoing project, and we're still growing dahlias in 2024, tweaking and improving the selection and cropping technique. Suraya is working on a Self-Teaching Mini-Series booklet that will give a detailed account of her work with dahlias as a GROW BIOINTENSIVE crop. So this is the final installment on this series of articles—for now. As a wrap-up, we've got the highlights of what we've discovered so far, so that if you want to try growing dahlias for biomass, calories, and a beautiful crop of flowers, you can benefit from what we've learned.

- Plant tubers horizontally, not vertically.
- Only water tubers once, when first planting and then not again until sprouted.
- Prune dahlias down to 2 or 3 growth nodes when they are 9" tall. This will encourage more bushing and main stems to grow.
- Be sure to trellis dahlias to support their growth.
- When cutting flowers, cut with long stems to encourage growth from lower nodes. 9-18" is usually good.
- To increase dahlia's vase life, cut flowers in the morning when they are most hydrated, then, put them in warm-hot water in a dark place until you are ready to distribute them.
- Dahlia tubers are highly susceptible to root rot, so don't over-water. You may need to dig them out in the winter to prevent water damage, depending on your growing zone and soil type. If you are in zone 8 or higher you can leave them in the ground, but you will want to tarp or cover to protect from rain.
- When dividing tubers, it is important to make sure each tuber has a viable and intact neck and eye.
- When storing tubers, make sure to place them in a material that can absorb moisture but not dry them out. Shredded paper works great.

You can read my previous article on the tuber harvesting and dividing process in my article from 2022, at: growbiointensive.org/Enewsletter/Spring2022/dahlias.html •

Ecology Action's Garden Companion

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Ecology Action Events: 2024

Dear GROW BIOINTENSIVE Family,

Our schedule (subject to change) of public events is as follows.

***Onsite* Garden Tours:**
VGFP on May 4 ● TJC on May 5 ● VGFP on Oct 12, 2024
http://growbiointensive.org/tour

***Onsite* Growing Your Biointensive Skillset 9-Saturdays Class Series at VGFP**
June 1 - July 27, 2024
growbiointensive.org/9WeekCourse

***Online* Fall 4-Saturdays Introductory Workshop:**
Nov. 16, 30, Dec. 7, 14, 2024
growbiointensive.org/workshop.html

Our full 2024 schedule of events:
growbiointensive.org/events_main.html
or call 707-459-0150

Watch our 2-Week Farmer Training Course:
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