

**GROW**  
APPALACHIA

# TECHNICAL GARDENING MANUAL



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# INTRODUCTION

**First of all,** we want to welcome all gardening newcomers to the Grow Appalachia family! (As for all of the oldcomers, welcome back!)

If you don't already know, Grow Appalachia is the largest food security program in the United States, growing **over 1,750,000 pounds of food** in its first five years. That number has risen since then, and it keeps rising--thanks, primarily, to folks like you. We are so happy to have you in the family. Gardening can be intimidating, but by taking big steps towards sustaining yourself, you're also taking baby steps towards changing the world. You should be proud of being part of such a radical project.

This manual is intended to explain some of the technical subjects of gardening in an entertaining and easy-to-understand way. We begin with the basics of planning your garden, and later sections touch on more advanced topics. Depending on your skill level, feel free to skip around in this manual. (You won't get in trouble!) Also, keep in mind that this is a living document, so you can contact us to suggest revisions!

Now go and get your hands dirty!

Sincerely,

**the Grow Appalachia Mothership**



# PLANTING CONSIDERATIONS

Gardening is easy, right? All you do is measure some rows, till the earth, and plant your seeds. From there, your garden will grow on its while you sit back and relax... Right?

Wrong. Like all worthwhile pursuits, gardening requires devotion and routine maintenance. Your heirloom tomatoes can indeed blossom from A all the way to Z, but they will need your help getting there, as you water and perhaps trellis them along their path to ripeness. Yes, the seeds you've sown today will need attention tomorrow.... And the tomorrow after that, all the way to harvest time.

And before we can consider tomorrow's work, we have to consider yesterday's.

## PREVENTATIVE MEASURES

Often, the best way to solve a problem is by ensuring that it never happens. Of course, an incredible cook can salvage a cooking fiasco without the perfect ingredients or tools, but just imagine how much tastier the dish would be if all the right pieces had been in the kitchen all along.

The same applies to gardening, where the earth is your kitchen. Here's what you can do in the early stages of gardening to ensure that you don't end up with a fiasco months down the road.

## SOIL TESTING

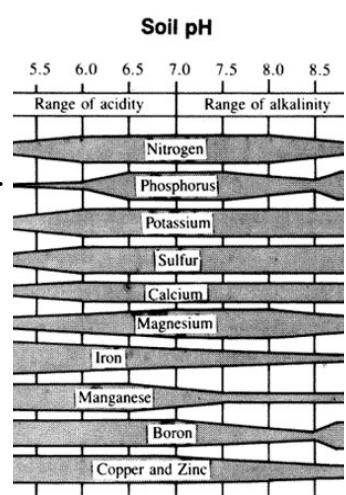
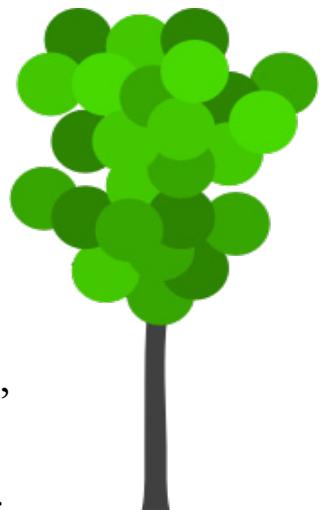
Ideally, gardening is a thoughtful activity, one involving creating life, admiring nature, and cultivating mindfulness. Soil testing does not fit well into this picture, bringing to mind images of a lifeless chemistry classroom.

Nevertheless, soil testing is vital, since the pH level of your soil will determine what macronutrients and micronutrients are available for your plants. The lesson is that plants, like people, need adequate shelter and access to good “food.”

Your standard soil analysis will provide you with information about your soil's three most important macronutrients: nitrogen, potassium, and phosphorous. Calcium is sometimes included in this analysis, and you can often request information about other nutrients, like magnesium, sulfur, and iron, for a fee.

A note: While soil analyses typically recommend amendments, materials that you can add to improve your soil's make-up, you will rarely receive nitrogen-based recommendations. Nitrogen readily leeches from soil during heavy rains, making it too tough to gauge the true nitrogen content of a sample at any given time.

The pH scale ranges from 0 to 14, with 7 being neutral. Most plants prefer a pH level that is just slightly acidic—somewhere between 6.2 and 6.8. If your soil is too acidic, you might need to add calcitic or dolomitic lime to it, whereas soil that is too alkaline (with a pH of 7.0 or higher) might require a sulfur- based amendment. If this sounds too confusing, don't worry. You can get a soil test done by a local cooperative extension office in most places for less than \$10, and they will give you more specific recommendations to ready your soil for planting.



## SOIL COLLECTION

Depending on your extension agency, you might be able to collect the soil yourself and send it in. If you take this route, the best time to test is in October or November, leaving you time to make adjustments and plan for your spring garden.

To collect the soil, you'll need a trowel (or some other digging tool) and a bucket. You should dig out a hunk of soil about six inches deep. That hunk doesn't really matter, so dump it somewhere.

Now you'll need to collect a profile slice of the dirt and toss it in the bucket. (This allows you to capture a picture of the whole root zone.) Repeat this process six more times throughout your garden and then mix all of those samples in your bucket. Finally, you can bag this concoction and ship it off for analysis. All you've got left to do is await the results and apply the recommended amendments.

## OTHER CONSIDERATIONS

The results of your test will let you know what plants will naturally thrive in your garden, but that won't be much of a hurdle with the right amendments. Other factors to consider when choosing the plants for your garden include:

**Seasonal Sensitivity** - Some crops will thrive in the summer, while others can tolerate a little frost. (Other crops are perennials, which means you can plant them just once and harvest them yearly, or biennials, which take two years to grow.) Warm-season crops, which need high temperatures to make fruit, include corn, cucumbers, melons, peppers, snap beans, squash, and tomatoes. Cold-season crops, including beets, broccoli, cabbage, carrots, lettuce, peas, and spinach, should be planted in early spring, to be harvested early in the summer, or in late summer, to be harvested in the fall or early winter. Though they're "cold-season crops," they can only survive mild winters. Some of these crops are even more prolific in the fall due to less pest pressure and disease.

**Variety Resistance** - Not all vegetable varieties that you want to plant are created equally. Some varieties are particularly susceptible to mildew. Others will attract swarms of pests. Others will fall to disease more quickly. Contact your local extension agency to learn more about the best varieties to plant in your area. (Resources are also available online, if you know where to look.) On a similar note, when purchasing transplants, take care not to buy sickly, deformed plants just because they're on sale! There's a good reason they're on sale.



**Access to Sunlight** - No vegetables can thrive without sunlight, and most of them will require at least six hours of sun per day. These plants need full sun. Spots that receive between three and six hours of sunlight a day are considered in partial shade, which will not do for most growing vegetables. Nevertheless, plants grown for their stems, leaves, or buds can sometimes tolerate these conditions.

Some plants that do well in partial shade include leafy greens, garlic, and beans--although they will also do fine in full sun, which is always our recommendation. Also, try to find out when the sun will hit your garden. Try to choose an area that has a southern or southeastern exposure. These areas warm up faster during the spring and receive the most sunlight, comparatively speaking.



**Garden Planning** - You will want to be certain that the layout of your garden makes sense based on your plants and locations, and this is a process that should be done on paper. (Of course, there is computer software out there, for those who are more technologically inclined!) Make sure that you understand what your different plants will look like once they fully mature. Otherwise, you might end up with a garden that is too sparse or too cluttered, both of which can be tough to maintain. And neither will be particularly pleasing to the eye. You might think that this is a technique that pros will eventually outgrow, but this is actually what pros will do from year-to-year, collecting data on how well each crop grew in its particular location and using it to make smart moves in the future.

**Crop Rotation**- Crop rotation is a part of garden planning. It is a technique for minimizing future pest and disease issues. Essentially, your plants can be divided into types or families, and pests, bacteria, and fungi, which all can live in the soil season after season, usually gravitate towards particular families. If you rotate through planting different crop families in the same spot, however, you will remove the food source for these pests and diseases.

For the sake of simplicity, we will focus on three families: brassacus, solanaceous, and cucurbits. Brassacus includes things like cabbage, kale, and mustard, and these plants share pests like flea beetles, harlequin bugs, and stink bugs. Solanaceous plants include tomatoes, potatoes, and peppers, while cucurbits include squash, pumpkin, and

zucchini. The take-away here is that you want to make sure that during your next growing season, each piece of soil is occupied by a new family, even if pests and diseases did no damage in the previous season.

### Final Considerations:

- \*Make sure your plot is level and well-drained. You could try to observe it before you plant and see how swampy it gets during rainy weather. Avoid planting in those spots if possible.
- \*Another observation strategy is to look where the weeds are most sturdy and rich. This area will also be conducive to the thriving of your plants.
- \*Always keep something in the ground! This is called succession planting and requires that you understand the maturation dates of your plants so that you know when you'll be planting new crops.



For more information on the maturation dates your plants, contact your extension agency!





# MULCHING

When thinking about mulching, it's easy to get caught up in the visual aspect. Some mulches, like hardwood chips, can look quite nice spread between your rows, but even "unusual" mulches like newspaper can help to shape the space of your garden, giving it a much needed sense of organization. However attractive any particular form of mulch might be, most mulches will benefit your garden in so many ways. Effective mulching amongst your plants and rows will cut down on weed growth, conserve more than 50% of soil moisture, and even regulate soil temperature by cooling the roots of your plants. Plus, so many different items can serve as mulch—composted leaves, grass clippings, pine needles, black plastic—and each to different effect. Even your plants themselves can act as a "mulch," if their canopy of leaves becomes dense enough.

## HOW TO MULCH

Mulching is simple enough. You basically want to apply the mulch wherever you would like to suppress weeds—or wherever you'd like your garden walkways will be.

First, you will remove any existing weeds in the mulch zone. (Keep in mind, though, that disturbing the soil surface after weeding can bring new seeds to surface.) After removing weeds, you will loosen the topsoil, perhaps with a cultivator, and mix any preexisting mulch with the soil. Then, you can use a wheelbarrow (or a bucket for small projects) to transport the mulch around the garden, applying two inches wherever it is needed, making sure not to create mulch volcanos around your stems.

## WHEN TO MULCH

Knowing when to mulch can be a little more tricky, but the task is still relatively simple. As a general rule, you will want to mulch as you're planting your seeds, while taking some time throughout the year to replace the mulch as it thins out. You also will want to mulch every year, around midspring, once the soil has warmed up a bit. If you have an abundance of mulch and time, you can basically apply mulch whenever you find a sliver of bare ground.

## TYPES OF MULCHES

If your soil is already healthy and you want a garden that will look impressive, bark, pine needles, or shredded wood chips will all serve you well while lasting a long time. You should, of course, limit your use of woodchips to walkways. As they break down, they can steal nitrogen from soil, which is not good for your plants—but is great for the weeds that you don't want in your path. More practical forms of mulch include:

**Seed-Free Straw (Not Hay!)-** This one's a favorite for vegetable gardens. Seed-free straw covers the ground well, and you can move it around easily after you've placed it. This straw also attracts spiders, which may sound scary, but they will devour many of the pests in your garden.

**Paper Mulch-** This mulch can seem a little unsightly to some, but it does provide gardeners with a unique method of recycling. Besides, we think it's kind of cool to turn old newspapers into something useful!

**Plastic Sheeting-** Although this might seem unattractive, it can benefit your garden in many ways. Plastic mulch is about three feet wide, and to use it, you cut small holes into it for each of your plants. While darker plastics inhibit weed growth better, all plastic mulches will warm your soil quickly in the spring, sometimes by up to five degrees. This is handy when you're growing heat-loving plants. The primary disadvantage of this mulch is that you must remove it and dispose of it, which can consume some of your precious time.

**Leaf Mold-** Although this form of mulch might look a little unattractive, it can benefit your garden in many ways. Plastic mulch is about three feet wide, and to use it, you cut small holes into it for each of your plants. While the darker plastics do better at inhibiting weed growth, all plastic mulches will warm your soil very quickly in the spring, sometimes by up to five degrees. This comes in handy when you are growing heat-loving plants, especially during unusually cool summers. The primary disadvantage of this form of mulching is that you must remove it and dispose of it, which can consume some of your precious time.



# WATERING

Water is the source of all life, so it's only natural that watering your plants is one of the most important forms of garden maintenance. While Mother Nature will help you out a bit, providing some rainfall here and there, her aid can be a little unreliable. Here are some basic tips and tools that will help you out when the rain doesn't come.

## WATERING TIPS

- Water your plants regularly (about an inch of water per week) while watering a bit more when it's really hot outside. Try to water your veggies when the top couple inches of soil have dried out, and make sure that you're watering deeply. Otherwise, you'll be encouraging shallow roots.
- Sometimes the reactions of your plants can tell you all you need to know about their watering needs. If your plants are droopy in the mornings, they almost definitely need water!
- Try to learn the watering needs of different types of plants and then group together the plants that need frequent watering. This will allow you to be more efficient in the garden.
- Water according to the consistency of your soil. Sandy soil will not retain water as well as clay soil, so you will need to water it more frequently. Keep in mind that while your soil may look wet, you can't know for

sure until you gauge it with your finger.

- It's often better to water in the morning. Water that sits overnight can sometimes lead to disease in the plants, while midday water often can't withstand the heat of the sun.
- If you're using a sprinkler and want to ensure that you're not overwatering your plants, you can use a tuna fish can and time how long it takes for the can to fill with an inch of rainwater. This will allow you to set a timer for your sprinkling system. The same principle applies with drip irrigation. Just put the can under your drip tape!

## WATERING TOOLS

**Rain gauge** - Although this tool provides no water to your plants, it lets you know how much water your garden is getting naturally. This can be useful when the weather has been rainy and you're worried about overwatering your vegetables. After all, too much water can kill a plant just as well as too little water, suffocating them at the roots. When using a rain gauge, make sure that you place it so that nothing is above it but the sky.

**Digital timer** - This is a great tool for the gardener who is juggling many projects at once. You can buy a decent timer for only \$20, and once you have it, you can set it to water your plants at a particular time of day once a week, so that you don't have to.

**Overhead hoses** - This method definitely has appeal for folks who like a hands-on approach. With hoses, you can soak each plant for a couple of seconds at a time, adjusting the strength and pressure as needed. It is important, however, to keep in mind the drawbacks of this method. For example, much of the water evaporates before it can benefit your plant, and water on plants' leaves can lead to disease.

**Drip irrigation** - This is perhaps the most efficient method of watering your plants, although it can seem a little intimidating when you consider installation and the potential costs. (A decent system might cost you about \$90 per 100 square feet, but if you treat it well, it can last you many growing seasons.)

At the same time, drip irrigation can save you a lot of time and money in the long run. It works with hoses that are stretched throughout your garden. These hoses have tiny holes which “sweat” small amounts of water into the soil. This water goes directly to the plants, wasting nothing on weeds or evaporation.

A more thorough look at drip irrigation can be found later in the manual.



# WEEDING

**Weeds** - the word itself sounds so ugly, but a weed is really just any plant that's growing where you don't want it. Weeds are a problem mainly because they compete with your vegetables for nutrients, which means that your harvest won't be as plentiful as you'd like. Fortunately, although anything can be a weed in the right circumstances, all weeds can be dealt with in the same essential ways.

In other sections, we've already talked about ways to reduce weeds before they can sprout. Weeds love bare ground, and a smart, tight placement of your rows will prevent some foreign seeds from hitchhiking into your garden on the back of a blue jay. (Okay. Maybe that's ridiculous, but weed seeds can travel through a bird's waste, which serves as a fertilizer and moisture packet!) Furthermore, proper mulching will reduce the amount of weeds that you have popping up.

Here are some tips on controlling the weeds that have managed to sneak through your defenses.

## WEEDING TIPS

- Weed as often as possible, depending on how much time you have to spend on other gardening tasks. Make sure to weed at least once a week.
- Attack the weeds soon after they sprout, before their roots have grown too deep, and make sure you remove the whole weed, unless the weed is too close to your vegetables.

- Weeding is easiest when the earth is moist.
- Mix up your weeding with other tasks, maintaining the health of your back by weeding in only thirty minute sessions. The modern world is, of course, a place of many comforts, so always remember that you can purchase ergonomic tools like weeding benches to make the job easier on your body than it was on those of your ancestors.
- Some people worry about throwing their weeds wherever and allowing them to clutter up their rows, so they might try to dispose of the weeds in a container. This is not necessary. Once your weeds are deprived of moisture, they will dry up quite quickly in the sun.

## WEEDING TOOLS

**Trowel** - Although trowels are a great tool that serve many purposes, from mixing fertilizers to digging holes, they only have limited value in weeding. Try to use them only when you need to get up close and personal with the weeds around the bases of other plants.

**Hoes** - These have been used by generation after generation of gardeners, and there's a good reason for it. They're effective tools and easy on the back. Most people know the chop and draw hoe, although this is an outdated variation that demands too much of your body. There are many types of hoes, so experiment with each in your garden to find the best uses.



For instance, the blade of the **stirrup hoe**, featured on the previous page, resembles the stirrups used in horseback riding. This tool requires little effort. You just push and pull the bottom of the blade to skim the soil surface.

The **scuffle hoe** functions in similar way to the stirrup hoe, except its blade is flat and more triangular. To use this tool, push and pull the hoe in a persistent “scuffling” motion over your weeds. It’s almost like scratching an itch--but more satisfying!



Finally, the **wheel hoe** is another great variation of the tool. It's often used for weeding wider areas, and it will keep you moving when your spirits are low. Try it out when you want to weed the mess of weeds between in all of your walkways.



# FERTILIZING



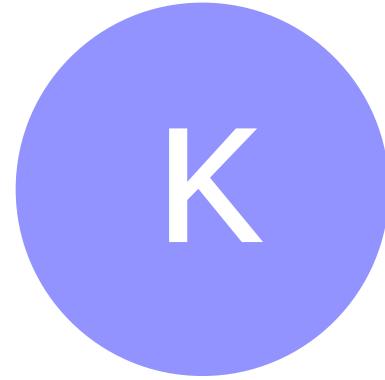
Your initial soil test will tell you quite a bit about the quality of your soil and the presence of three important nutrients: **nitrogen**, **phosphorous**, and **potassium**. Each of these is vital to the growth of your plants.



Nitrogen encourages leaf growth.



Phosphorous nourishes roots.



Potassium helps fruits and flowers blossom.

Fertilizer is going to be your method of controlling the presence of these nutrients, among others, in your soil. Each packet of fertilizer includes a three-number ratio of these nutrients. (N:P:K)

While many gardening resources will recommend a perfectly balanced fertilizer, with a ratio such as (10:10:10), you will have to experiment to figure out what works best in your region with your particular crops. Grow Appalachia recommends a fertilizer with a ratio of (5:4:3). A good recommendation for gardeners with ambitions of staying organic is a chicken-manure based fertilizer, which usually contains the above ratio of nutrients.

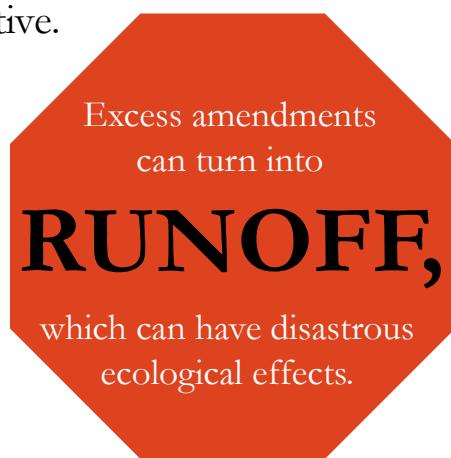
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There are two times when you need to fertilize your garden: while you're planting and midway through the growing season, approximately 75 days in. The first round of fertilizing is called **broadcast fertilizing** and should be done with a complete fertilizer according to the results of your soil test.

You'll need to mix the fertilizer into your soil with a hand spade or a tiller. Months later, you will need to apply what is called **side dressing**, a supplemental source of nutrients after those from the initial round of fertilizing have depleted. You will want to use the same type of fertilizer with the same ratio, except this time, you will make a four-inch deep trench alongside your row, filling it with the fertilizer and covering it back up. This fertilizer will reach the plants once the rain or your irrigation methods have mixed it with the soil.

## OTHER CONSIDERATIONS

Don't overfeed your plants while dreaming of rapid growth. It won't work. Furthermore, amendments can be expensive, and after a certain level of application, you'll be wasting them. This will happen either because they will become harmful to your plants or simply ineffective.



# PEST DISEASE AND CONTROL



Gardening well requires that you learn how to work alongside the natural world, but sometimes, as is the case with pests and plant diseases, the natural world tries to prevent you from doing your job.

## DISEASE

Although some diseases are noninfectious, coming from extreme temperatures or chemical injuries, what you will be most concerned about are infectious diseases. They can put your whole garden at risk. This section will serve as an introduction to the five basic causes of infectious disease. With this info, you can hopefully determine whether or not you should run to your extension agent for further identification help.

**Fungi** - These spread through spores that are a lot like the seeds of your plants. Fungal diseases can sometimes but not always be identified by the appearance of little chain-like threads called hyphae.

Remember:  
Not all fungi  
are bad for  
your plants!

**Bacteria** - These spread through a rapid division process to gradually reach overwhelming heights. These form in wet areas with high temperatures. Bacteria can't cross the veins of leaves, so look for angular patterns of infection.

**Phytoplasmas** - These are a lot like bacteria, even in the division process, yet they are mainly transmitted by insects. Phytoplasmas often create chlorophyll (green pigment) in areas where you wouldn't otherwise find it.

**Viruses** - Like computer viruses, these “recode” your plants. Plants infected with viruses might suffer from mosaic symptoms of seemingly harmless discolorations. (For example, yellow tulips with red streaks.)

**Nematodes** - These are parasitic worms that feed on the roots of your plants from both the outside and the inside. This leads to your plants looking wilted or stunted.

## PESTS

The varieties of pests that you will find in your garden can be overwhelming, but here's the scoop on a couple of the critters that we at the Grow Appalachia headquarters encounter:

**Colorado Beetle Potato**



*Insecticides hardly faze these critters, which like to chew through leafy plants. An early application can sometimes hold them. You can also handpick them in their many forms.*

**Blister Beetle**



*Your extension agent can recommend an insecticide for blister beetles, which will swarm over your leaves, devouring them. Don't feel guilty about squishing them right in the garden!*

## OTHER TIPS

**Clean your garden** - By removing waste material, like spent plants, and weeds from your garden as soon as possible, you remove possible breeding grounds for disease and insects.

**Pest recognition** - The number of garden pests is countless, and the best thing that you can do is learn to recognize those pests that are most common in your region. (Whatever the pest, many of them like to hide on the **undersides of leaves**, so be sure to check there!) To improve at recognizing pests, consult your local county extension office, which should have information on the biggest local pests. Part of pest recognition means knowing which are good.

**Mixed planting** - By mixing your plants in smart ways, you can discourage large numbers of pests from congregating in one area. Sometimes the pests that are attracted to one plant can even neutralize those attracted to another.

**Crop rotation** - If you adjust the layout of your garden each year, then you are always throwing curveballs at the pests and diseases, preventing them from multiplying so easily in one spot. Be careful not to plant seeds in the same spot as a closely-related vegetable was previously. For example, planting pumpkins where you had cucumbers or watermelons means that you could attract the very same pests and diseases.



**Use Integrated Pest Management** - IPM is an environmentally-conscious philosophy on pest management more than anything. It emphasizes beginning your pest management with low-impact methods like picking or hosing off pests, like the Colorado potato beetle from the previous section. According to IPM, a gardener should only resort to chemical management, such as insecticidal soaps, whenever other methods have failed. Products like PyGanic, which will devastate almost all of the insects in your garden, should only be used as a last resort.



## GA RECOMMENDED PESTICIDES

**Spinosad** - This product is perfect for isolating the bad critters without affecting any of the nice ones. Spinosad controls ants, beetles, caterpillars, Colorado potato beetles, Japanese beetles, and many others.

**Bacillus Thuringiensis** - B.t. has a more specific focus, targeting the digestive system of the lepidopteran moth's leaf-eating caterpillars. B.t. is a bacteria and won't affect beneficial insects or humans.

**Sluggo** - Sluggo is great at luring in a large variety of the slugs and snails that may plague your garden. Even a little taste of this iron phosphate blend will cause them to starve off.

Read pesticide and fungicide instructions very carefully. You could hurt your garden or, more importantly, yourself!





# SMALL LIVESTOCK

Livestock is a worry for many farmers, especially on top of the other complexities of gardening. Here at Grow Appalachia, our emphasis on first-time growers and smaller-scale gardens translates into a focus primarily on what we refer to as **small livestock**. While this term can include critters like rabbits, goats, and even pigs, our livestock choices are limited to **chickens** and **bees**.

Of course, even small livestock can make your gardening much more complicated. Experimenting with chickens or bees could ultimately be something that you regret. This section is here to help you make an informed decision.

## CHICKENS

Chickens are one of the more classic choices when it comes to small livestock. They're surprisingly social animals, and it can be a breath of fresh air to see their little bodies weaving throughout your gardens. More tangible benefits of chickens include:

- Chickens serve as a great gateway to owning larger livestock.
- Chickens are low maintenance.
- Chickens are inexpensive.
- Chickens lay eggs—making you more self-sustaining, whether you choose to eat the eggs or sell them.
- Chickens will happily maintain your grass and your pests—and they'll ultimately convert it all into rich, natural fertilizer.

At the same time, we do not mean to imply that introducing chickens to your garden will have no drawbacks at all. For instance:

- Chickens attract predators, which may affect your garden.
- Depending on your area, chickens can be strictly regulated, or they might pester your neighbors.
- Constructing a chicken coop can be cumbersome and intimidating.

## CHICKEN TRACTORS

Chicken tractors are one form of coop used by many of the Grow Appalachia participants who experiment with chickens. These tractors can have a variety of designs.

Essentially, these tractors are bottomless and can be pushed through your gardening space. In a way, these tractors can be seen as a way to harness the natural benefits of your chickens, allowing you to direct their maintenance powers where they are most needed. (You can also ensure that they won't ravage your vegetables.)

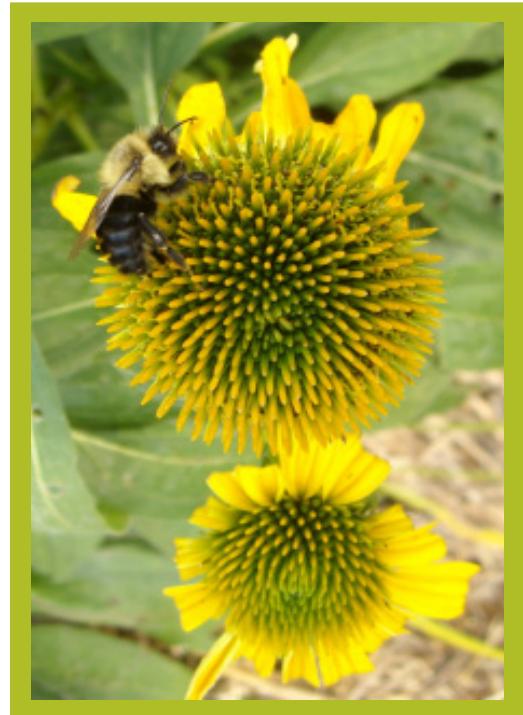


As long as your chickens can occasionally roam freely through your property, they only require between two and four square feet per bird. Otherwise, they will require ten square feet per bird, which isn't even close to ideal for one of the tractors.

If you have a lot of chickens, you will probably still want a more conventional coop, because you will need a **roosting pole** for each hen, as well as **nest boxes** for your eggs, shared between three or four chickens. Of course, some models of chicken tractors can include all of the necessities of a "domestic" chicken's life, with food and water containers dangling down from the tractor's roof and perches built into the sides.

## BEES

Although beekeeping isn't as "classic" of a livestock choice as owning chickens, the activity has been gaining a lot of buzz lately, particularly among twenty-somethings with big dreams of saving the world. This is good news, too. Bees are vital to our ecosystem, with these honey-makers being responsible for around one-third of the food that we eat daily. Over one-hundred different crops rely on pollination that only bees can provide.



Benefits of beekeeping include:

**Honey!** You can eat this delicious nectar or try to sell it. Either way, you're improving the self-sustaining power of your farm.

**Beeswax** can also be monetized. If you're looking to learn a new skill, you can convert this wax into candles, salves, and balms.

**It's time-efficient!** In the words of Kim Flottum, author of *Backyard Beekeeper*, bees require "more time than you need to properly care for your cat, but less time than needed to take good care of your dog." You'll need somewhere around 30 minutes per hive per week for maintenance, as well as 2 hours per hive twice a year set aside for harvesting honey.

**Improved production!** Your buzzworthy friends might improve the production of your garden by pollinating the vegetables and flowers that you've got growing.

On the other hand...

**Legal issues.** Although chickens can indeed irritate neighbors, bees outright terrify folks, inspiring many legal restrictions on beekeeping. (We don't mean to imply that these people are wrong in their fears. A roaming swarm of bees could be lethal, especially if it floated over to that child's birthday party next door.)

**Allergies.** You will need to be aware of whether or not you or any potential guests at your home have a bee allergy. Even those astronaut-like suits won't protect you from stings all of the time.



**Start-up costs.** Beginning as a beekeeper can be quite expensive. You could pay upwards of \$550 per hive.

**Steep learning curve.** With so many moving parts, some of which can sting you, it's easy to get intimidated with the prospect of beekeeping.

## BEEKEEPING CALENDAR

Although beekeeping won't demand too much of your time, the schedule for harvesting honey can sometimes strict, forcing you to put activities on your calendar well in advance.

In the **spring**, you'll begin by starting a new hive and harvesting from old hives, if you're a more experienced beekeepers. (Whenever all of the frames cells are full of honey, that's your signal to harvest.) You'll obviously also want to take some time to feed your bees, make sure that your hive is assembled correctly and possibly even find a new queen.

Fortunately for you, your bees will do a pretty good job of sustaining themselves during the **summer**, but it's always wise to check for any health issues and resolve them before they get out of hand.

The **fall** is when you'll harvest most of your honey, although you should leave enough behind so that your bees will survive and even thrive in the winter. You will also want to double-check your hive's ventilation and treat any of the diseases or pests that you've been noticing since the summer.

The **winter** will be quite a journey for your bees, and many amateur keepers will lose a lot in their first winter, the emotional turmoil of which can be quite a deterrent to future beekeeping. Thankfully, you can cover your hive with a jacket, just like you might when sending a child out into the cold. Staple either black tar paper or a heavy-duty plastic bag lined with insulation to the bottom of your hive, and you should be able to minimize losses.



# DRIP IRRIGATION

Waste is a common theme among gardeners. While waste can, on occasion, be a good thing, as is the case with many organic fertilizers, waste is usually as bad as it sounds. Raccoons might infiltrate your garden every night, nibbling from your tomatoes and leaving the half-eaten remnants to rot in the sun. You might plant your corn seeds too closely together, with the stalks growing like conjoined twins, neither receiving the full benefits of the soil.

Watering is another area where waste often occurs, which is unfortunate, since rainfall can be scarce and manual water can be expensive. Drip irrigation is a method of watering your plants that will prevent you from wasting resources like water and fertilizer.

**Drip irrigation** works through valves, pipes, and tubing that deliver water directly to the plant's roots, getting around the fact that conventional watering systems lose a lot of water through evaporation. Although some very basic forms of drip irrigation have been around since the first century BCE, advancements in drip technology have made it a favorite method among gardeners and farmers in the modern world.

## COMPONENTS OF DRIP SYSTEMS

There are a great number of drip irrigation systems out there, and selecting one might seem overwhelming. It's best that you consult with manufacturers and your local extension agent to find out what system best suits your unique needs. This

equipment can usually be found from local gardening supply stores and is also listed in many seed catalogs!

Whatever system you end up with, most consist of some variation of the following basic pieces:

**Drip tape** - A “line source” drip irrigation lateral product that incorporates a continuously produced flow path emission device into a thin-medium-walled seamed or extruded tube.

**Flat emitter dripline** - A “point source” lateral product that incorporates injection-molded emitters into a thin-to-medium-walled extruded tube.

**Oval hose** - A sub-main pipe made from polyethylene that is flattened to an oval shape during production to simplify transportation.

**Layflat** - A sub-main pipe made from flexible PVC that is coiled flat.

**PVC pipe** - A rigid pipe available in various thicknesses and cut lengths.



Some advantages of drip irrigation include:

- You can mix liquid fertilizer with the water—a process called **fertigation**.
- Drip irrigation is **90% more efficient** at delivering water to plants than other forms of irrigation. This means that little of your water is evaporating and that runoff isn't as much of a problem.
- **Reduced leaching** means that you won't lose as many nutrients and that your fertilizer will stay efficient.
- Through **irrigation scheduling**, you can monitor weather forecasts and make sure to water during cooler parts of the day, reducing evaporation.
- **Soil erosion** and **weed growth** are reduced.
- Wet foliage often leads to disease, and since this method delivers water directly to the root zone, plant disease is **dramatically cut**.

Of course, this is not to imply that there are no drawbacks to irrigation systems. For instance, the initial cost can persuade some farmers against their use. (Typically, the cost of drip irrigation is somewhere between \$40 and \$100 per 100 square feet.) Furthermore, drip tape can be time-consuming, especially if you hope to reuse it. Rodents can even damage your PVC pipe, creating more expenses for you to worry about.

As always, individual gardeners must weigh the needs of their particular garden set-up to determine whether or not drip irrigation is a worthwhile investment... although most tend to think that it is.



Combine your drip system with black mulch to increase your water efficiency and minimize waste.



# THE FLORIDA WEAVE

Tomatoes... It's difficult to imagine a complete garden without them. And in the kitchen, they're a favorite--a rich, versatile vegetable that is equally at home in nutritious salad or on a satisfying burger.

And yet when you're growing them, tomatoes can often be problematic. Their culinary versatility also translate into their growing habits as well, as they show a willingness to grow however they please, seeming to defy both gravity and the nearness of your garden plot. Biologically, your tomato plants want to mature and spread their seeds, dropping the tomatoes to the earth, so gardeners often seek out ways to elevate their tomatoes.

Other reasons to support your tomatoes include:

- Your tomatoes are less prone to insect and disease damage.
- Your tomatoes stay dirt-free.
- Your tomatoes are easier to monitor and harvest.

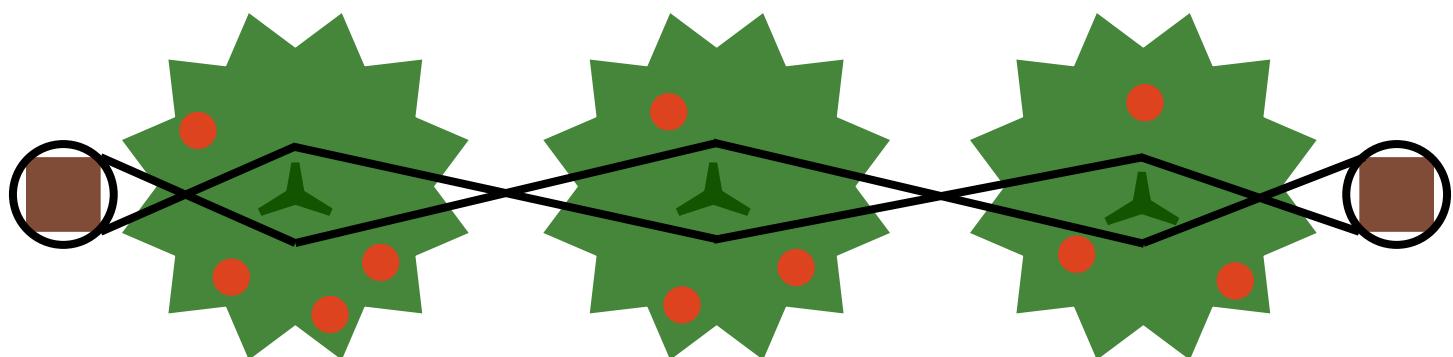
If you choose to support your tomatoes, then you've got another problem: What option to do you choose? Do you follow in the footsteps of your grandfather and create a cage for your tomatoes? Do you stake them?

While none of your options are necessarily bad and everything has its place, based on the particulars of your operation, we at Grow Appalachia recommend the **Florida Weave** method of tomato trellising. This method appeals to growers because it's inexpensive and it works.

## HOW IT WORKS

One thing that you need to keep in mind is that you want to do the trellising process pretty early on, before your plants are more than a couple of feet tall. If you try the Florida Weave method later than this, you run the risk of stalking your roots and traumatizing your plants, and it will be difficult to work around the tangled vegetation.

You'll begin by taking stakes around 8 feet tall and driving them a foot into the ground between every few plants. Next, you will want to take some twine, preferably something that's not too elastic, and tie it to one of the stakes about 8-inches high. After that, you can weave the twine in-and-out of the plants then wrap it around the other stake before returning to weave the other side to tie off your twice, which should be fairly taut. This alternating weaving pattern will ensure that your tomatoes stay supported in all sorts of inclement weather.



*An aerial depiction of the Florida weave. The dark-green figures at the center of each plant are the main stems.*

Just add more twine with every six inches of growth, keeping the plants supported. Once the season's over, your system can even be recycled, if you're extra careful about removing the twine and your stakes won't interfere with your other projects.

# PROTECTED AGRICULTURE



Technology is sometimes a scary word, especially in the garden. Afterall, gardening is, at its heart, about engaging with the land and working with it with your own body. At the same time, even a stirrup hoe must have seemed high-tech once upon a time. We have to be smart and adopt those technologies and tools that make our lives easier and make the most sense.

**Protected agriculture** is one technological area that gardeners shouldn't ignore. Protected agriculture can be defined as the modification of the natural environment to maximize growth, and examples include:

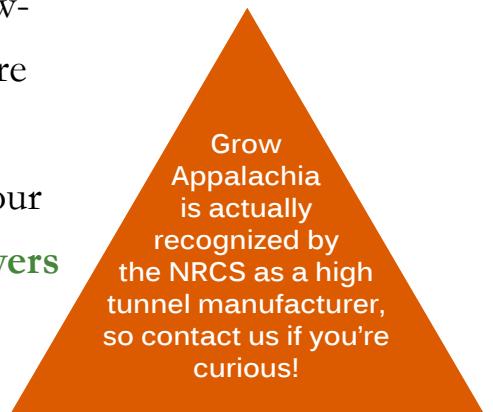
**Greenhouses** - These are structures that use glass or plastic coverings to capture incoming sunlight within the structure. This is a great form of season extension, allowing you to grow and harvest in temperatures that are too cool.



**High tunnels** - These are similar in effect to greenhouses. High tunnels are composed of metal semi-circles and covered with a polyethylene sheeting. This sheeting retains the heat of the structure, allowing it to be absorbed by the soil and plants before it can escape.



**Row covers** - Row covers serve as the most low-maintenance form of protected agriculture. They're like miniature high tunnels, placed about four feet apart! They also trap heat and therefore protect your crops from freezing conditions. **Floating row covers** provide mainly vertical protection, while others contain self-ventilating slits.



In addition to extending your growing season, these forms of protected agriculture also offer the following benefits:

- Increased yield of higher quality produce.
- More efficient water use.
- Reduction in pest control and its associated costs.
- Protection from intense heat, sun, wind, and frost.



# SOIL HEALTH

Imagine that you're a farmer in the 1700s. The fact that you can plant seeds into the ground and get food isn't all that surprising to. After all, your mother and father were farmers, as were many of your ancestors before them. You benefit from knowledge and insights gathered from across generations.

But while farming is not entirely supernatural to you, you do believe that there's still something kind of... magical to the process—something beyond your control. Often, you plug seeds into the soil only to find that your harvest is barely enough to feed your family in the coming months. Where does the blame lie? Perhaps you planted on the wrong weekday. Perhaps you pin it all on rotten luck. Perhaps you blame a family curse.

*Or perhaps the problem lies within the soil itself.*

Truthfully, our current knowledge about gardening is still imperfect. It was only very recently that we even started thinking in terms of **soil health**—a complicated concept that tries to account for much of the unpredictability in gardening.

Like a living, breathing organism, soil is made up of all these bits and pieces that are always shifting. Even the best doctors mess up when treating human ailments, sometimes creating awful side-effects. The same can be said of gardeners and their soil, which is unfortunate because good soil is vital for productive gardens.

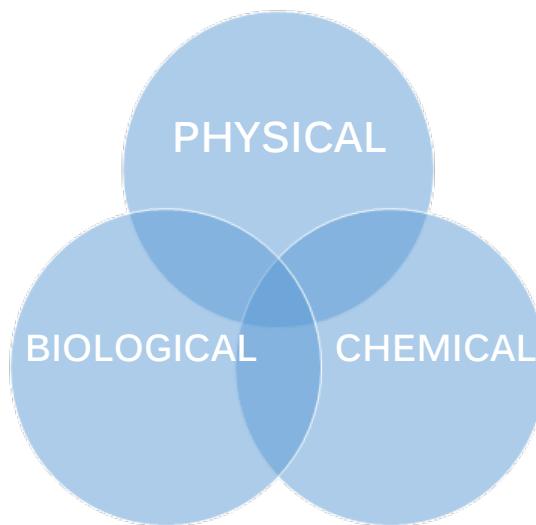
## WHAT'S SOIL GOOD FOR?

- It supports roots, giving them a stable place to thrive.
- It contains nutrients, providing your plants the food they need to grow.
- It controls water access, determining whether a rainstorm will turn your garden into a swamp or if the rain will infiltrate the ground, nourishing your roots.
- It minimizes pollutants, providing a home for minerals and microbes that will detoxify the materials that come into your garden.

## WHAT IS HEALTHY SOIL?

Even if our knowledge of how to improve soil health is imperfect, scientists are demystifying the complexity of soil a little more each year. Our current understanding of healthy soil is that it produces as much as is reasonable while leaving almost no negative impact on its ecosystem via contaminants or erosion. Ideal soil will be capable of producing great yields from a long-term perspective.

It's better to treat your soil like a complex system as opposed to static container for your plants, and this system can be broken down into three major overlapping categories. (The chemical category deals with pH and nutrients and has already been covered in the first chapter's section on soil sampling and in the fertilization chapter!)



## A PHYSICAL PERSPECTIVE

This category revolves around things like the composition of the little clumps of soil (called **aggregates**), how porous your soil is, and how compacted it is.

The ideal garden soil is a **sandy loam** that is half solid and half porous—a structural balance which allows for water and insects to move around. The little soil aggregates in your garden are essentially formed from a combination of three basic “particles.”

**Clay** - These particles are minuscule and flat, with a tendency to pack together tightly. As a result, clay retains water perhaps too well, hoarding it from hungry plants. To see if your soil is mostly composed of clay, roll a damp ball of soil and poke it with your finger. Soil with lots of clay in it will not break.

**Sand** - These particles are the largest of the three, and they're a bit jagged. Sandy soils will drain very easily, but this can be a problem, leaving your plants too parched. If you poke your damp ball of soil lightly and it breaks easily, then you have sandy soil.

**Silt** - These particles are jagged like sand but smaller. A damp ball of silty soil will break easily but will require a little more pressure than sandy soil.



*An ideal loam consists of 20% clay, 40% sand, and 40% silt.*

Of course, many of the physical aspects of soil health are beyond your control. For example, if you attempted to mix clay, sand, and silt together in your backyard, you're likely to create concrete, and that's not going to be productive!

One thing that you can do, however, is disrupt the soil as little as possible. Although this may seem counterintuitive, **tillage** actually ruins the soil structure, with its interplay of porous spaces and matter. Tillage opens up soil aggregates that were otherwise protected, making them vulnerable to bacteria. For example, you might think that water could do a better job of infiltrating soil that's been broken up, but instead, the soil will be so compacted that it won't allow anything through. Furthermore, tillage can disturb the balance of soil microbes. (Just imagine being a microbe and having your home attack by nonstop miniature earthquakes!)

## A BIOLOGICAL PERSPECTIVE

Ensuring that your soil stays healthy is mostly a matter of the complex web of organisms that exist just below the earth's surface. In fact, it turns out that the soil that is most fertile and diverse in its production happens to be soil that has the greatest diversity below ground. This universe that exists right below your feet consists of earthworms, nematodes, protozoa, fungi, bacteria—and all sorts of microbial monsters.

When all goes well, the roots of your plant release sugars needed by the microbes, which then provide the plant with water and vital nutrients. This is a delicate cycle, yet surprisingly enough, its one aspect of soil health maintenance that you have a surprisingly amount of control of:

- Introduce **insects** to your soil—but only if they belong there!

Earthworms will happily wriggle through your soil, improving its structure through aeration. Nightcrawlers do a great job of aiding water flow. They dig channels that are almost entirely vertical and deep, able to capture rainwater during summer thunderstorms, for instance.

- Add some **organic matter** to your garden. Compost, manure, leaf mold—these all serve to enrich your soil. They'll also help to feed your earthworm friends, who you shouldn't neglect.
- Avoid **fallow land!** If possible, avoid having bare ground anywhere that you will plant regularly. Living roots generate most of the food for those microbial monsters, and so fallow land means that those little guys will starve out. That means that when you plant in the future, your soil will be a hostile place indeed.
- To keep the microbes thriving and diverse, practice **crop rotation** and try to plant **perennial plants**, so that the garden is always occupied. If perennials aren't your thing, then plant a **cover crop** or two in-between growing seasons.



# CONCLUSION

*“Are we there yet?”* you might be wondering. As much as we want to scream an enthusiastic “Yes!”... We can’t.

Following the methods of this manual won’t guarantee that your garden will be perfect. But it is a first step. In gardening, as with life, guarantees are few and far between. New technologies that make gardening easier crop up every year. Soil scientists often find that our conventional growing wisdom is not the best way of doing things. And of course, pests sometimes adapt to our methods of control, forcing us to find new ways to outsmart them.

Gardening is a process that’s never finished, but you don’t have to do it on your own. Throughout this manual, we’ve stressed the importance of keeping in contact with your county extension agents. They’re smart people with lots of experience, and they usually know what’s going on at the new frontiers of the gardening world.

We at Grow Appalachia are also here for you. This manual is a living document, and if there’s something that we didn’t cover here that you want to know about, email us suggestions and feedback at [candace@growappalachia.org](mailto:candace@growappalachia.org) or give us a ring at 859-985-3687.

Until then, best of luck in your growing!