



MICROGREENS

QUICK GUIDE TO GROWING NUTRIENT PACKED GREENS



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From the moment a seed sprouts, new life and new life-giving forces are being created. The quality of the soil and the care of the grower are the guiding hands. At every step in its life cycle the plant offers different culinary possibilities to the imaginative cook, possibilities that are becoming increasingly recognized in kitchens everywhere. It takes a great deal of knowledge of soils and irrigation and attention to detail to nurture those seeds to the desired stage of growth, and then much careful thinking and planning to harvest, pack, and market them at a sufficient profit to make your living farming.

OUR GOAL is to cultivate lifelong partners, not just graduates. Over the years, we have worked with students from 5 to 65. They arrive eager to learn more about farming and culinary techniques to improve their quality of health and well being. When they depart after completing our apprenticeship or workshop sessions they scatter to the corners of the earth, some to pursue new, untried interests, but many to carve out a career in the broad world of food production. It gives us great joy to see them taking their place in the ever-growing rank of small-scale, earth-friendly farmers. And we heartily celebrate their skill and expertise in the production of that most exquisite of salad ingredients in microgreens. HOSCO emphasizes a cooperative approach. Student training and incubation within HOSCO's existing food business infrastructure have the advantage of accessing a facility to practice their craft while learning about the local food system which includes vegetable and fruit farm production and processing and preparing locally produced foods for sale to the local market.

GIBRON JONES



Urban farming is in Gibron Jones' DNA. As a kid, he helped tend his family's 17,000-square-foot garden in Walnut Park, where he learned the benefits of growing his own food. After a stint living on an Austrian pumpkin farm, Jones left a successful multimedia career in the music industry to return to his St. Louis roots. He launched Hosco Shift, a nonprofit with farms across St. Louis and a mission to teach others how to operate urban agriculture businesses. Here's how this music industry pro became a food justice advocate.

Since 2010, Gibron has worked through his company HOSCO, in St. Louis to address food access problems; nutritional education and improving economic conditions through locally produced foods and products. Gibron has been building, developing and teaching aquaponics and workforce development since 2012. Gibron has trained directly under Will Allen of Growing Power a internationally known grower and leader in urban agriculture, aquaponic food production and system development. After working to build several systems with Growing Power in Kansas City and at Growing Power located in Milwaukee, HOSCO was formed to create similar processes here in St. Louis. In 2011 Gibron was hired as the lead consultants for the St. Louis Science Center's \$7.5 million agricultural exhibit "Grow."

Since 2011, Gibron has operated a season-long educational apprenticeship program that educates and trains participants in sustainable agriculture from seed to market Progressive Food Cooperative Apprenticeship engages in every aspect of operating the small farm – from seed propagation in greenhouses to transplanting, weeding, harvesting and selling. Apprentices learn soil fertility principles, organic pest and disease management, proper harvest and post-harvest handling techniques, direct marketing, and CSA operations.

Gibron is currently working on the North City Food Hub "NCFH". NCFH is a 1.2 million dollar shared use kitchen completed on North Sarah Avenue projected to open spring 2014. NCFH will serve as a place for community members to make products in a licensed kitchen. Gibron will also train and educate students and apprentices in agriculture, food prep and developing value added packaged food products through HOSCO's existing WIOA and Department of Labor Apprenticeship program

Bohlen Family Farms Partners With Hosco Farms and Baker Creek Heirloom Seed Co To Grow Unusual and In-Demand Vegetables



It's been six years since Bohlen and his middle brother, Thomas, and their neighbor, Louis Arman, first planted vegetables in a lot across the street from their home in Ferguson, Missouri. The brothers grew up eating fresh produce; Bohlen says he didn't even realize what an amazing cook his mother was until he ate at a friend's house in sixth grade, where a frozen chicken was roasted in the oven with no seasoning.

"I thought everybody was at home eating good," he says, shaking his head. "When I moved out of my parents' house, I wanted to be able to cook for myself. I realized that it was expensive. I didn't even have the money to cook [healthy food] every day; I had the money to cook ramen noodles every day. So I started growing stuff."

The brothers began vending at the Ferguson Farmers' Market in 2011, and one Saturday, about a year and half into the project, their mother introduced them to an old friend who needed help at her farm. That family friend, in turn, introduced the brothers to Clyde Bruckerhoff, who also required assistance on his land in Perryville. Bohlen began something of an apprenticeship with Bruckerhoff. Their partnership grew until, earlier this year, Bohlen moved down to Perryville full time to work the land owned by his mentor.

The property, which is a couple hundred acres and features two living spaces and an event space, is operated by Hosco Farms, a St. Louis nonprofit that "aims to provide its members with a complete farming skill set that will enable them to work in a variety of food-related fields, with the eventual goal of owning their own cooperative business." Each year, David Bohlen and his family grow something they've never tried before, from heirloom corn to Chinese broccoli and Peruvian peppers. Hosco is also one of the largest microgreens producers in the area; founder Gibron Jones grows about 6,000 pounds annually.

"It's a timely process, but you get a lot less failed plantings when you do it by hand, because you can assure that everything you did by hand was done properly," he says. "That passion and energy are partially because Bohlen grows what he likes to eat; after all, the desire to feed his family fresh food is what led him down this path five years ago.

"The reason I like farming is because I like eating food; I like experiencing new foods," Bohlen says. "I can't say every farmer has that same mindset going into it; farmers are not always food-lovers. Sometimes it's just their profession. That's why we're always growing different things that I hear folks love, whether it be across the world or here in Missouri. I hear folks speaking about things that I haven't had access to myself, so I know it's not readily available. So we grow for our own interests first – and that's why it allows me to passionately tell people about it." ...excerpts taken from Feast Magazine, Nancy Stiles May 25, 2018 Bohlen Family Farms, Florissant, Missouri, facebook.com/bohlenfarms

Why Microgreens?



Over the past twenty years, interest in local, fresh, and organic food has been on the rise. There has been a rejuvenation of the small farm and a renewal of appreciation for fresh vegetables. The revival of the farmers market, the inception of the CSA model (Community Supported Agriculture), and the overall movement towards clean, whole foods has been extraordinary and is continuing to grow. People are rediscovering the importance of fresh, locally grown food. This movement has shown that it is not just for the affluent, not only for those interested in farming, but for the whole of the population and future generations.

With their ability to accentuate and deepen our connection with nature, we believe that microgreens have a place in the growing interest of food. Harvested very early in their lives, microgreens are tender, delicate, and highly flavorful. They have a crisp yet melt-in-your-mouth texture and a variety of flavors that swing from sweet to savory to earthy to spicy. Throw in the exuberant beauty of their reds, yellows, greens, and purples and you have a salad that is pure delight. With all of the varied tastes and textures, integrating microgreens into your diet can be fun and easy. Embarking on this venture of growing and eating your own greens doesn't require that you change your diet. Packed with great taste, these little greens can be added to just about anything. Eaten alone as a salad or added to soups, entrées, sandwiches, burgers, or anything else you can imagine, microgreens will enhance your food and your life.

Over the past few years, microgreens have gained popularity as a hot new culinary trend. From New York to Los Angeles, chefs have been enjoying them as a way to creatively accentuate plates of food and add new depths of flavor to their dishes. While this trend has grown, a select few growers have taken advantage of this niche market. Even in metropolitan hubs, where chefs are able to buy most of their produce from farmers markets, much of the microgreens market has been dominated by mail order.

The purpose of Microgreens is to give you an avenue to the joy of growing and eating your own food. We can imagine a time when every rooftop, windowsill, and small yard is alive with trays of microgreens. Even people driving campers across the country could be growing a tray in their window while germinating another under the bed. You will find that growing greens is surprisingly easy. We will show you each of the simple steps it takes to grow, harvest, and prepare your own microgreens.



For the Commercial Grower

Growing microgreens is a way of expanding the scope of your operation to include this largely untapped market. We have never shown our greens to a chef who wasn't excited about using them. This excitement is filtering into the consumer market as well, making demand even stronger. As more and more people are experiencing the qualitative difference of fresh local produce, your microgreens will sell easily. Offering your community this year-round resource can be a great way to diversify your operation. Another benefit these greens offer is their ability to bring in quick farm income while also contributing to its fertility.

On many farms it often takes at least a couple of months to start recouping the money invested in potting soils and composts. While the small farm's primary focus is not usually on making a buck but rather the health of the land and its surrounding community, steady income is essential to meeting the needs of the farm and farm family.

Microgreens require minimal initial investment, with most varieties costing less than two dollars per tray for seed and soil. Once sown, they can start generating income in just two to three weeks.

After your trays have been harvested, composting your soil now filled with stem and root matter is also quick and easy. In the heat of the summer this soil can be amended, composted, and ready to use in under a month. We have made a special worm bin for this purpose. As our trays are composted, a large amount of earthworm castings are added to the soil, enriching it even further. At this point it can be used to start your seedlings, incorporated into your fields, or even used to grow more microgreens. With all of their advantages, you can see why microgreens can enhance the small farm.



For the Home Grower

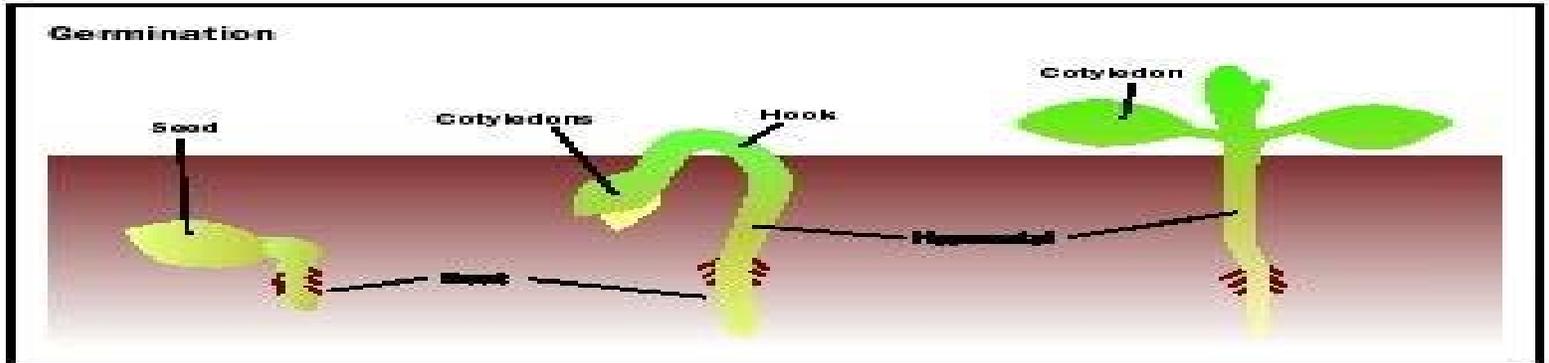
Growing your own microgreens gives you access to fresh, living greens all year long with minimal investment of money, time, or previous knowledge. The little amount of space they require makes them a perfect fit for both urban and suburban families who do not have room for a garden. Suddenly we are given the opportunity to create masterpieces in our own kitchens. You will see how microgreens can transcend the gourmet world and become part of everyday life. They give us an opportunity to slow down and appreciate the beauty of food. Taking the time to experience our food in this way is a wonderful gift to give to ourselves and our families.

Aside from their extraordinary taste and aesthetic appeal, microgreens are also extremely nutritious. The ability to harvest and eat them within minutes gives you access to their most nutritionally rich state. They give us a strong dose of digestible vitamins, minerals, and phytonutrients. While your taste buds enjoy their intense flavor, your body will reap the benefits of their concentrated nutrients.

It's a rare thing to eat something so good that you get goose bumps from how delicious and alive it is. We have been growing and eating microgreen salads for years and still the very thought of fixing one for ourselves puts smiles on our faces. We are always amazed at how much we can eat in one sitting; it's comparable to drinking a cold glass of water on a hot summer's day. Our body is in complete agreement with your mind that this, right now, is the greatest thing you could give yourself.



Sprouts, microarugula, baby arugula



Sprouts, microgreens, and baby greens are all stages in a plant's development. Each has identifying characteristics and varying nutritional values. A sprout is the first stage of a seed's development. The word "sprout" is actually synonymous with germination. Grown in different types of containers, these seeds are kept moist and at room temperature until they germinate. Instead of allowing them to grow in a medium and establish into a plant, sprouts are consumed right after they germinate. Often slightly opaque and yielding a crunchy texture, they have become increasingly popular for their nutritional value.

When grown in a medium (soil or otherwise), the second stage of a seed's development involves the establishment of its roots and the opening of its first leaves, called cotyledons. Greens harvested at this stage are called microgreens. If microgreens are allowed to continue to grow, they put on their next set of leaves, called "true leaves." True leaves are the leaves of a plant that distinguish it from another plant. While many brassicas (cabbage, broccoli, arugula, etc.) all have very similar heart-shaped cotyledons, when their true leaves develop they look quite different and are easily distinguished from each other. These greens are harvested in their infancy, and are only allowed to grow in the soil for a week or two. They have all of the health benefits of sprouts with the added advantage of trace minerals brought up from the soil they are grown in. At this stage their texture, appearance, and flavor are much more like a salad green than a crunchy sprout. If the seed were allowed to continue to grow past the true leaf stage and, given enough space and time, it would eventually reach the baby green stage. Baby greens are tender leaves that are popular in salad mixes often called mesclun or spring mix. They are more flavorful and tender than leaves from a full-grown head of lettuce but lose some of the intensity of flavor and nutritional value that they had at the microgreen stage.

Health and Microgreens

As human beings, our roots lie in the soil. Although many of us have forgotten this important link over the past few generations, our connection with nature is so ancient and fundamental that it cannot be completely disregarded. If while we are eating we pause for a moment, we can easily follow our food back to the plants, the animals, the soil, and even the wind, rain, and sun. All of these things have their confluence on the farm. There is no avoiding that the health of the earth and the health of human beings are intimately tied.

Traditional agriculture has been practiced for thousands of years all over the world. Small scale and worked by hand, these farms are highly diversified and skillfully tended. Diversified farmers make the craft of soil stewardship their primary work, farming in a way that actually contributes to and enriches the life of the farm and everything and everyone that interacts with it. The animals raised here are alert with healthy coats. The soil is rich, dark, and sweet smelling. The plants are lush and grow vigorously with little sign of stress. The food grown here contributes balance and health to its surrounding community. Even the average passerby can notice that “inexplicable something” that permeates the air around such a farm.

The larger a farm is in scale and the larger its industrial intentions, the further it diverges from this diversified small-farm model. Over the last century there has been a gradual shift in the scale and focus of the farm in this country. By the end of World War II, it was commonly thought that modern, mechanized industrial systems were superior to small-scale traditional methods. Along with industrialization came the beginning of chemical fertilizer use in agriculture. After the war, many of the compounds that were used in the production of bombs were transformed into agricultural fertilizers.

During this time, belief that farms needed to be large to take advantage of the factory philosophy took hold. Many farmers moved off the land and into the cities to join the growing trend of industry. The family farm slowly disappeared as big agri-business took hold.

Over the last century, the United States has lost over 4.5 million farms. According to the U.S. census bureau, the percentage of people living and working on farms has gone from 40 percent to less than 1 percent.

Along with this restructuring of our nation’s farms came the inevitable compromise of the quality of produce available. In Paul Bergner’s book, *The Healing Power of Minerals, Special Nutrients and Trace Elements*, USDA statistics are included that illustrate this decline. These figures show mineral and vitamin content declining in several types of fruits and vegetables between the years 1962 and 1992. Among others, calcium dropped by almost 30 percent, iron by 32 percent, and magnesium by 21 percent.

Produce nutrition is limited by the quality of soil it was grown in, how it was harvested, its

treatment after harvest, and how old it is once it reaches your fork. To get a sense of how nutritious microgreens are, we must first look at how these variables affect the nutritional content of our produce.



Small diversified farm in Florissant, MO

How-to-Grow Ten-Step Process

Growing microgreens is a simple process that can be done in ten steps. You will discover that it takes little time, energy, and experience. You will quickly become skilled and efficient as you integrate the growing of fresh, nutritious greens into your life.

Step 1: Filling Your Trays With Soil

Now you are ready to grow microgreens! The first step is to fill your trays with the growing medium that you have chosen, creating the seed bed. We find that filling the trays with about an inch to an inch and a half of soil is sufficient. Use your hand to level out the soil. Make sure not to fill your trays to the very top to avoid soil and seed spilling over the edges when you first water. Use your soil press to smooth and flatten the soil, being mindful not to compact your seed bed. Over compaction will result in poor, slow growth.





Step 2: Sowing Your Seeds

Now that you have a smooth, even seed bed, you are ready to sow your seeds. Take a small pinch of seeds with your fingertips and sprinkle them over your tray using the same motion as if you were spicing a dish in the kitchen. Take your time to evenly spread the seeds over the entire tray. If you find that you have sown too many or too few seeds in any portion of the tray, simply add more seed or spread out the excess. You can either stick to one variety for your entire tray or sow as many types of seed as you like, creating a mixed tray. This is nice if you are sowing only a couple trays at a time but still would like a variety of greens to eat. The only thing to be aware of when growing a mixed tray is to use varieties that are able to be harvested at approximately the same time.

The density of sowing depends on the seed variety and the size at which you would like to harvest. If you want a dense tray of cotyledons, we recommend broadcasting a thick layer of seed.

If you would like to experiment with growing your greens to their “true leaf” stage, simply sow them less densely and allow them to grow for a longer period of time. In the beginning, it may take some experimenting to get your sowing down. You may find that you have sown some varieties too densely and are encountering poor growth and rot in your trays. On the other extreme, if you have sown them too sparsely, your yield per tray

will be very low. Soil quality also plays a role in sustaining the growth of your greens. Start out with just a few trays and find your balance. Once your tray has been sown, you will want to give it a light pressing. The objective is to very lightly seat your seed in the soil, again being mindful not to compact it. Seating your seed ensures that your seeds have contact with the soil so that they can easily set roots.



Step 3: Covering Your Seeds

For this step you have three options. Traditionally, one would cover his or her seeds with soil; a layer about the depth of whichever seed is being sown, but making sure the seed is covered. Another option is to cover with cloth or paper towels. Your third option is to leave your seeds uncovered if you are germinating them in a dark place. Out of these three methods, we believe covering trays with towels to be the easiest and most effective.

Covering with Soil

If you to choose to cover with soil, smaller seeds (i.e., brassicas, endive, amaranth, etc.) will require you to cover them with sifted soil. While soil sifters are available, we find that using a pasta strainer works just as well and can be found in most kitchens. Simply put a handful of soil in the strainer and shake it over your trays. After doing this you will be left with the larger pieces of your potting soil that won't fit through your strainer. Set these aside and

repeat this step until your seeds are covered. When covering your larger seeds (i.e., pea, chard, beet, etc.), sifting is unnecessary. Just take a handful of soil and sprinkle an even layer over the tray. After you have covered your tray, you will want to give it another gentle pressing. Apply the same amount of pressure as when seating your seed. If you find that once you have watered your trays you are starting to see seeds on the surface, just sprinkle a little more soil over the top.

Covering with Towels

An alternative to covering with soil is to use cloth or paper towels. While we don't use this method for most large seeds, it is extremely effective for covering smaller seeds. Laying a towel over your sown trays creates a moisture blanket. Take your lightweight cotton or paper towel and lay it directly on your seeds. Once in place, keep moist until the seeds have germinated.

After our first season, we started experimenting with towels. We found that the towels had all the benefits of covering with soil and none of the drawbacks. This method started saving us time and money. We cut our soil costs and saved time covering our trays. Towels also allow you to sneak a peek into the day-to-day progress of your germinating seeds. This can be entertaining to children, as they can look under the towel and watch the seeds slowly open and develop into plants.

Uncovered Seeds

With this method you are not covering the seeds with anything. This means more time must be spent monitoring moisture to ensure germination. Your trays will need to be under some kind of protection, whether it be a greenhouse or lids. It will also be helpful to keep these trays out of direct sunlight, especially in the summer. This will help with maintaining adequate moisture. If you choose to leave the seeds uncovered, pay careful attention when seating them.



Step 4: Initial Watering

The next step is to water your trays. Set your sprayer to a light/medium shower setting so that the entire tray gets gently soaked. Preliminary watering is the only stage at which overwatering is not an issue as long as your seeds are not drowning in water. However, underwatering will result in poor or no germination. A germinating seed must remain moist. If the seed bed, and therefore the seed, is allowed to dry out, the process will halt and your seeds will no longer be viable.



Step 5: Cover with Lids

Once your trays have been watered, you will need to cover them with lids if you are not growing in a greenhouse of some sort. The reason for using these lids is to speed up germination by holding in heat and retaining moisture. Keep in mind that if using plastic lids, you will want to keep a close eye on your trays when in direct sunlight. Due to the “mini greenhouse effect” that the lids create, temperatures inside can become substantially greater than the air outside. This is a benefit for stimulating germination and growth, but it must be monitored in order to avoid excess buildup of heat in your trays. If you notice that things are a bit too steamy inside, simply move the lid slightly to the side to create some ventilation.



Step 6: Watering Your Germinating Seeds

As your seeds are germinating, it is important to keep a close eye on their progress and to maintain proper moisture. When using the towel method, observe the dampness of the towel and water daily, keeping the towel and the seed below it moist. One benefit of the towel method is that it gives you a window into the germination process. Instead of the seeds being hidden from your view, you can lift a corner of the towel at any time, allowing you to watch the stages of germination. You want your seeds to remain covered until they are fully germinated. After a few days, you will notice that the towels will have started to lift off the soil, giving you a hint that your greens are getting ready to need to see the light. As illustrated in the photographs, certain germinating seeds acquire a white fuzz on their stems. This is not mold and is a natural part of the process as your seedlings set roots.

Trays covered with soil will require a bit more attention. Soil will dry out more quickly than towels, so make sure these trays are watered a couple of times a day. With microgreens, your trays will be so densely sown that when they germinate, the covering layer of soil will lift with the seeds. If the soil is not evenly rinsed from the seeds early in this process, they will remain under the soil in darkness. These seedlings will quickly become weedy and pale. When watered at this point, the covering soil can drown and kill much of the tray.

That said, we covered our seeds with soil our entire first season of growing our greens. While it is not difficult to do, losing trays because you are a few hours off can be frustrating.

If you choose not to cover your seeds, take caution when watering. A gentle shower will ensure that your germinating seeds aren't disrupted. Remember that whichever covering method you choose, your seeds will need consistent moisture to germinate.



Stage 1



Stage 2



Pulling Off Towel



Stage 3

Step 7: Finding A Good Spot To Grow

One thing that makes growing microgreens so accessible to so many people is the lack of space they require. People often refer to us as “porch farmers,” as we are able to support our entire microgreen client base on less than 100 square feet. If you don’t have enough room to plant a garden in the backyard or don’t even have a backyard, a windowsill, porch, patio, or front step will provide plenty of space to grow fresh, delicious microgreens for yourself and your family.

As we all know, plants need light to thrive. The germination process, however, does not require light. This allows you to keep your germinating trays anywhere, so long as they are kept warm and moist. Once germinated, microgreens, like most other plants, require light to grow and flourish. This process of taking sunlight and converting it to energy is known as photosynthesis and is a fundamental process in the growth of your greens. Once your seeds have germinated, you will want to find a sunny spot inside or outside for them to grow.

Choosing the location of your trays requires paying attention to your greens. In the heat of the summer, some varieties may prefer full sun, while others require dappled shade. No matter what the variety, some amount of light and warmth are required. You will find that plants deprived of light will begin reaching for whatever light source they can find. They will then become “leggy” and scrawny as opposed to being strong, stout healthy-looking plants. You will also notice a change in their color. While the trays given enough light are looking like a dense lawn of richly colored greens, the trays deprived of light will begin looking yellow and weak, making them more susceptible to rot and disease. This is easily avoided. Let them see the light! Strive to find a place for your greens that provides the most amount of sunlight. A sunny windowsill, your porch ledge, or even your front step could all serve as great places to grow your greens.

If you feel you are unable to get adequate sunlight, grow lights are also an option. There are a variety of grow lights available from your local gardening store or online, ranging in size and price. Keep in mind your energy costs when purchasing a system. Living in sunny places, you may never use them, but they could be quite helpful in places where sunlight is scarce during the winter months. Grow lights can be set up anywhere that is convenient. A basement or unused closet could easily be transformed into a greens-growing haven.



Step 8: Maintaining Your Growing Greens

Now that your seeds have germinated, they will require light to grow and thrive. If you are using the towel method, you will now want to remove the towel and the plastic lid. Once the towel is removed, it can be composted, used in a vermiculture system, burned, or thrown away. If growing indoors, you can flip your lid over and place your tray inside. This will keep excess water off of your counters. Be sure to empty this water daily so that your soil isn't standing in water.

Depending on the variety, the greens will need to remain in the light for an average of seven to fourteen days. A fast-growing green like arugula will require a minimum growing period, while slow-growing basil will need more time. Keep in mind that weather, location, and watering patterns all play a role in this timeline. While you may go through several growing cycles with the same results, great variation does tend to occur if any of the previously named factors are altered. Should you decide to branch out after experimenting with some basic varieties, you will notice that more exotic microgreens such as mint or sorrel will take substantially longer to both germinate and grow to size. Specific data on average germination and growth times for a number of crops is located in the Individual Crops chapter of this book.

Since your seedlings are now out in the light, you must pay attention to their moisture. Merely looking at the surface of the soil will not give you an accurate reading of its moisture content. You will need to get your hands dirty. Stick your finger in the corner of the tray to make sure that all of the soil is wet. Watering once a day is often sufficient—just be careful not to overwater. Overwatering at this stage can drown the seedlings and stop the growth process. Underwatering will result in wilted greens. Once their cellulose structure has been compromised by either over- or underwatering, the greens may remain damaged but are often able to recover. You might notice this if you have chosen a poorly lit place for your greens and later relocated them. You could also leave your greens during a cloudy day, thinking you have watered them sufficiently, only to find that it is sunny when you return and your greens have wilted. Often, a gentle soaking will revive them after a couple of hours.

This phenomenon occurs all the time in nature, especially in hot, dry climates where plants must preserve their energy. If facing intense direct sun and thereby heat, energy is sent to the roots to sustain the life of the plant, allowing the leaves and flowers to droop and wilt during the heat of the day. One could come upon such a plant midday and think it was dying, only to find the same plant in its full glory during the coolest part of the evening. That said, you want to avoid as much stress on your greens as possible, keeping them properly watered. Take note of the strength of the sun and avoid watering midday. When plants are watered in the heat of the day, the drops of water act as little magnifying glasses and can burn the leaves. This is easily avoided by watering either in the morning or evening in climates and times of year when the sun is at its strongest.



Step 9: Harvesting

When to Harvest

Microgreens can be harvested at different stages of growth. You can either harvest them just after their cotyledons have opened or wait for them to put on a second set of leaves, known as true leaves. If allowed to continue to grow, eventually the greens will begin to show signs of stress such as yellowing, stunted growth, and looking weak or “leggy” (tall and unhealthy), and they will start to rot from underneath. This generally starts to happen because of how densely you are sowing the seeds and the small amount of soil you are growing them in. If the same seed were allowed to grow less densely, in a bigger container or directly in the ground with plenty of room for its roots, you could watch it grow through many stages. Depending on the variety, it would eventually grow into a full-sized plant from which you might harvest its fruit or leaf (i.e., a head of broccoli or full-grown leaves of arugula). Soil quality also plays a major role in the health and vitality of your greens. If you are using a lesser-quality soil, signs of stress will become apparent much earlier and more frequently.

How to Harvest

When getting ready to harvest your greens, one of the most important factors to be aware of is the heat of the day. Cutting the greens while they have been in the sun for a few hours or even in the shade during a hot summer’s day will result in wilted greens that will quickly turn to mush. You can always try soaking them in cold water to revive them, but they are usually too far gone to perk back up. Early mornings and evenings are the ideal times to harvest. The key here is to keep your greens cool. Harvesting at the proper time will keep them looking as fresh and alive as when they were growing. This is especially important for greens you plan to sell to others or store for yourself.

We find that scissors make the most effective tool for harvesting microgreens. Think of cutting your tray like giving your greens a haircut. Hold a section loosely with one hand and use the other hand to snip with your scissors. Your greens may range from one to four inches tall, depending on the variety and age at which they are cut. To get a nice ratio of greens and stem, cut about one inch above the soil for most greens. If the greens have been allowed to get tall or you prefer less stem, cut higher up. After your cut, take the greens in one hand and loosely flick the stem side of the cut to knock off any soil or damaged ends. This step will keep your home salad clean and will save time washing if you are planning on selling your greens. After cutting, put each handful in a bowl or on a plate and use as much as you need. Unless you are cutting above the cotyledons, your trays will not grow again. The remaining soil and roots can be composted. The chapter on composting will give you more information on “recycling” your used soil.

We harvest our greens differently if we are cutting to sell or if we are making a home salad. When harvesting for our restaurant orders, we use a small digital scale and zero out the weight of a plate to get accurate weights as we are cutting. We usually harvest a bit more than we need to account for lost weight after washing.

When we are harvesting for ourselves it's much more casual. Obviously we do not use a scale and often snip a bit from several trays, making a custom salad as we like it. Don't feel like you have to harvest a whole tray or harvest from only one variety at a time. You can also experiment with greens at different stages of growth and create a unique mix by using just a couple of varieties at different sizes. This will provide different textures and a varied look to your mix.

One of the greatest things we find about growing microgreens is the ability to cut and eat them within minutes. This allows you to have the freshest, tastiest, and most nutritious salad available right from your own home. In the [Recipes: Food as Art chapter](#), we describe different mixes we like and pair them with recipes for you to explore, but keep in mind that your only limitations are your taste buds and imagination.



Step 10: Washing and Storage

Washing

Unless you are planning on selling your greens to restaurants or individuals, it is often unnecessary to wash them. You can treat them as you would salad greens from your garden or the store by giving them a quick rinse before serving them.

Some growers choose not to wash their greens before they sell them. In operations where soil-less methods are used (i.e., hydroponics), selling unwashed greens is more of an option. However, if growing with soil, washing the greens is important so that you can offer a clean product, free of soil and rotten leaves. The process of washing the greens gives you a closer look at your product and allows you to remove any soil, debris, seed hulls, or rotten leaves before you sell it to your client. This will give you the confidence of knowing exactly what you are selling as well as an edge over any competition selling unwashed greens.

The process of washing microgreens is simple but can also be tedious and time consuming.

We find that purchasing a plastic tub to use solely for washing greens is convenient. You will want to find a size that fits in the sink where you will be washing to have easy access to running water. Wash your greens in cold water to maintain freshness. Proper lighting is important so that you can get a good look at your harvest and remove any duff or rotten leaves easily. We find that a well-lit room and the use of a headlamp makes this process much easier. Technique varies in the cleaning of greens. Most of the seed hulls, seeds, duff, and damaged leaves float to the top, where they can be easily skimmed off using your hand. Soil and other heavy particles often sink to the bottom. This process takes an eye for detail and a great deal of patience. In order to really showcase your greens, we find it important to be impeccable with your processing. While this may seem daunting at first, with practice, you will become both skilled and efficient. You may find that you invent new methods that help you to streamline processing. Different crops often call for different methods. While some greens are effortless to wash, others prove more difficult and require more time and attention. We have found that greens that are especially dirty or full of damaged leaves require a two-stage washing method. After the initial washing, we take out a handful at a time, examine it on a plate, pull out anything we have missed and continue until finished. Often, these greens will require a second rinse. If you choose to use the “towel method” for covering your germinating seeds, they will require far less washing than if covered with soil. Covering with towels eliminates half of the soil and seed hull normally found in your rinse water, thereby cutting your work in half. When we switched from covering with soil to covering with towels, we went from three to four rinses per crop down to one or two.



Drying

After your greens have been washed, your next step is drying. Using a small fan is very effective. You will want to use your fan on a low to medium setting and be sure to keep an eye on the greens. You will need to turn and fluff them every few minutes, being careful not to overdry them. Your beautiful, delicate microgreens can turn quite the opposite if allowed to become over- or underdried and stored in the refrigerator.

Storing

If you are storing your greens for yourself, we recommend using a resealable bag, filled with a bit of air, and putting it directly in the refrigerator. Another option is using a reusable container. Although quite perishable, microgreens will last at least three to four days and often up to a week or more, depending on their quality, variety, and the amount of moisture in the container.

If your greens are being sold, you will want to invest in a small accurate scale and either food-grade resealable plastic bags or plastic clamshells (resources available in the back of the book). We find selling four-ounce packages to be convenient for both the chef and the grower. Creating a label of some kind is useful to distinguish the date the greens were harvested as well as their variety.

Scale of Production

Home Grower

When deciding how many trays to grow, your first consideration will be how many people you would like to feed. Every home has people who eat a varying amount of greens; therefore, the number of trays you need will also vary. For a family of four, we would start with two to three trays, twice a week. Because the growing cycle is so short, it is easy to start small and adjust accordingly. Each tray can be sown with a few different varieties to have an enjoyable assortment of colors, flavors, and textures. You will generally have a batch of trays that you are harvesting from, a batch that is germinating, and a batch you are sowing. This will allow for the constant flow of fresh greens for the home. If you're growing for just yourself, or space is a consideration, sowing even one tray a week would be great. Having a small influx of fresh homegrown greens for the family is priceless.

Commercial Grower

If you want to sell your greens to restaurants or individuals, start small. This will allow you time to work out any kinks, choose varieties that work for you, and get a sense of the average weight per tray. As with the home grower, sowing twice a week will allow for a constant flow of greens for your accounts. When we started our small operation, we took on one or two accounts at a time. This enabled us to get comfortable with supplying the new demand. As the season progresses, you will notice that your chefs will have their favorites and will also want new varieties to try. Once again, the short growing cycle and frequent sowings will easily accommodate any fluctuation in your orders.



Troubleshooting

1. What if my seeds aren't germinating?
2. What if my germinating seeds are sticking to the paper towel when I pull it off?
3. What if I see mold when I pull up my towel?
4. What if the seeds come up thickly in some spots and sparsely in others?
5. What if my greens start to rot?
6. What if my tray of soil gets a crack in it?
7. What if my greens are getting tall and weedy?
8. What if my greens are yellowing and stunted?
9. What if the leaves of my greens look burnt?
10. What if my greens become limp after I harvest?

1. What if my seeds aren't germinating?

There are a few simple questions to use as a checklist when encountering this problem:

Seed: Am I using a relatively new, viable seed?

Checking the seed viability is quite easy as long as you know the source of the seed. If you purchased the seed, valuable information will be available to you on the packet. You should be able to find a lot date, ideal temperature range for germination, average percentage of germination, and sometimes days until germination. If you find that your seed has a low germination rate (anything below 80 percent) you may want to buy new seed, choose a different seed source or variety, or sow the seed more densely next time. If you have allowed your seeds to get hot or wet, their germination rate may be affected.

Moisture: Are my trays drying out during the day?

Underwatering is much more of a concern than overwatering during the germination process. Never let your towel and top layer of soil dry out. However, oversaturating your soil at this stage is not advisable because you can leach important nutrients. Your objective is to keep your soil, and therefore your seed, moist. In the beginning stages of germination, before the seeds have set roots, focus on keeping the top layer moist instead of worrying about soaking the entire tray.

Temperature: Is the temperature where the greens are germinating too hot or too cold?

Extreme heat or cold is often a factor in poor germination. It is easy to obtain good germination rates with temperatures ranging from 55 to 75 degrees F. Due to the variation from variety to variety, referring to your seed packet can be helpful, as this information is usually provided for you.

If you are encountering any problems with the germination of your seeds, don't be discouraged. One advantage of growing a tray of microgreens versus a field of lettuce is your small investment of time, space, and energy. Simply start another tray, change any variables that you suspect are hindering the germination and growth, and see what happens.

2. What if my germinating seeds are sticking to the paper towel when I pull it off?

Waiting for your first seeds to germinate and grow into microgreens can be quite exciting. If curiosity gets the best of you and you begin taking off the paper towel too soon, simply stop and lay it back down. Feel free to peek at your seeds' progress without completely removing the paper towel. You will know that you have taken it off prematurely if most of the germinating seeds and their fuzzy roots are sticking to the towel as you pull it from the soil. Give the seeds another day, checking in the corner to see if they have rooted. A good sign to watch for is the paper towel lifting off the soil. This shows that the seedlings are pushing up the towel and are ready to see the light and open their first leaves. If you wait too long to remove the towel, your seedlings will be at a great disadvantage. They will become tall and weedy, making them more susceptible to rotting and matting. Getting your timing down may take a couple of cycles, but it will soon become second nature.

3. What if I see mold when pulling up my towel?

You may notice a white fuzz around the roots of your seedlings depending on when you remove your towel. It is easy to mistake this for mold. Rest assured it is part of the natural process of germination and growth. Once the tray is watered, the white fuzz will disappear. However, in poor conditions, mold can occur. If you are experiencing cold, dank, damp weather for long periods of time, your germinating seeds will suffer. You will notice a distinct difference between the white fuzzy roots and the mold. While the fuzz is light and surrounds the root area, you may notice the darker mold covering bare soil or surrounding the seeds. Warm weather crops such as basil and cilantro will be more susceptible to mold. Crops that need a longer germination period and have to withstand the previously named conditions will also be vulnerable. Control your environment to avoid the occurrence of mold. While germinating, use heat mats if necessary or move your greens to a warmer area. Once you spot mold in the tray, uncover your seeds, water them lightly, and provide an environment with more light and air circulation.

4. What if the seeds come up thickly in some and sparsely in others?

There will be times when the tray of microgreens you are growing looks like perfectly even, thick lawn. However, you may occasionally find that your trays have uneven germination and/or growth. There are a few factors at play here. The most obvious is how evenly you are sowing. Slowing down and focusing on spreading the seed evenly is important for even germination. Practice makes perfect.

Another cause of uneven germination and growth could be the quality of the soil or how well it has been mixed. While most of the potting soils that we have tried have shown good results, there have been a couple of types that have seemed to hinder germination of certain seeds. This factor may take some experimentation to resolve, so try different soils to find a good match.

Where the tray is germinating may also play a role. If one part of the tray is in direct sunlight and the other half is in dappled shade, you will notice the corollary germination and growth. When germinating your seeds, find a spot in the shade. Find a place for your growing greens with an even amount of sun and/or rotate the trays if necessary.

Lastly, the seed itself might affect growth. We have noticed with certain batches of seed what we call “wave germination.” In this phenomenon, seeds germinate at different times, making for an uneven tray. Uneven germination and growth is usually more of an aesthetic issue than it is a real problem for the home grower.

5. What if my greens start to rot?

There are two main reasons why rot can become a problem. The first is that your greens have too much moisture with too little sunlight. In the heat of the summer we usually water once early in the morning and then again in the evening. This works well when conditions are hot and sunny. However, if a cold front were to move in for a few days, bringing clouds and temperatures in the 60s, watering this same way would quickly result in patches of rot setting into your trays. With cooler, less sunny conditions, watering once in the morning would suffice. Problems with both over- and underwatering are your best access to learning what each crop prefers. You have to take time to notice the conditions your greens thrive in and play with the variables.

Another possible reason for rot in your trays is the quality of water that you are using. Municipal water usually contains chlorine, which plants hate. This is easily remedied with most drinking-water filters. The pH of your water being excessively high or low is another factor to be aware of. Nutrients that would normally be accessible to your greens get locked up and become unavailable. There is a bit of a range of pH preference in the common microgreen varieties, but most like a pH of around 6.5. Testing is easy once you acquire the proper equipment. The pH monitors range from liquid solutions to portable digital units. Keeping your pH in check can solve many problems. Not only will you notice stronger growth and increased yields, but most importantly, you will have healthier plants that are

less susceptible to rot and disease.

6. What if my tray of soil gets a crack in it?

You may discover that your soil shifts when trays are moved around. Deep crevasses may occur if the trays aren't carried with even support. Although this may look alarming, your seeds will germinate as usual, and cracks will not affect growth in trays that have already germinated.

7. What if my greens are getting tall and weedy?

Light is always the main factor when you find that your greens are getting weedy. You will notice a distinct difference between healthy, stout greens that are getting adequate light and the tall spindly greens that are reaching for any light that they can find. These greens often become lighter in color as they funnel all of their available energy into seeking out the light. This problem is easily solved by either natural sunlight or grow lights. Make sure you have chosen an area that gets full to partial sun for most of the day. If you find that areas available to you do not have long enough sunny periods, you could choose to move your trays about, following the sun. While moving one or two trays around during the day might not be much of a bother, if you have to move ten trays, this could prove quite time consuming and will increase the chances of dropping trays. If you find yourself in this situation, you may choose to investigate grow lights. Resources for energy-efficient models are available in the back of the book.

8. What if my greens are yellowing and stunted?

Greens become stunted when they are not given enough nutrients to thrive. When growing them in soil, the type of soil is the first thing to look at. Some lesser-quality soils don't have the diversity of nutrients needed to sustain growth. Instead of continuing to grow, you will find that the seedlings simply halt their growth and begin to yellow and eventually rot.

Water pH can also be a contributing problem. See "What if my greens start to rot?" for pH tips.

9. What if the leaves of my greens look burnt?

Sometimes the strength of the sun can cause burning of the leaves. This damage is irreversible and weakens the integrity of the greens. Leaves that have been burnt are less aesthetically appealing, and their longevity after harvest also becomes compromised. Sun damage is easily avoided by relocating your greens to partial shade when the sun is very strong. Avoid watering in the heat of the day, as this can also cause burning. You may find

more damage on the edges of your trays because they tend to dry out sooner. In this case, take your time to cut around these greens to salvage at least part of the tray.

10. What if my greens become limp after harvesting?

Because of the delicate nature of microgreens, care must be taken when storing them after harvest. Do not let your harvested greens sit in open air (especially in the heat) for any length of time. When washing your greens, be sure to get them into a cool water wash quickly to keep them fresh and vital. Sloppy storage can also lead to limp greens. Be sure that the container that you are using to store your greens, whether it be bags or a sealable container, is sealed tightly. When treated and stored properly, greens can last up to a week or more in your refrigerator.



Recommended Books and Resources

Buy Local

We always recommend checking to see what your local gardening or horticultural store has to offer before looking online and ordering from faraway places. The concept of buying local goes beyond food; supporting your local economy plays an important role in the sustainability of our communities. You will also find that shopkeepers are often very knowledgeable and can answer many of your questions.

Apprenticing

We cannot say enough about the importance of hands-on experience when learning the craft of farming. Opening a textbook on agriculture will only get you so far. Fortunately, there are opportunities to work with experienced farmers. If you have any desire to learn the practical aspects of working with the land and crops take this opportunity! There are several extensive networks available to link you with your ideal situation. From season-long commitments to flexible openings, apprenticeships are a fantastic way to deepen your understanding of the land and whatever specific passion you may have or may develop.

<https://scorecard.mo.gov/scorecard/>

<https://www.hoscofarms.com>

Community Supported Agriculture

CSAs provide communities and their local farmers a way to come together to form partnerships. Also known as subscription farms, they have been popping up all over the country since the mid '80s. Although there are endless variations on the theme, the basic idea of a CSA is that the farm provides a share of the harvest each week to their shareholders. This usually amounts to a box filled with a variety of whatever is being produced (i.e., vegetables, fruit, dairy, meat, eggs, or bread).

At the beginning of the season, a farmer determines how many shares he or she can produce each week. Families or individuals then pre-buy these shares; pricing structures range from paying for the season's produce in advance to flexible payment plans. This model secures the farm's income at the beginning of the season, ensuring that the community has access to local farm goods.

CSAs allow for people to connect with the source of their food. They also provide a great opportunity for children to learn about where their food comes from. They can see their veggies growing, meet the farm animals, and even pick some strawberries themselves. This gives people a chance to experience their produce through the seasons, finding new ways to cook whatever is in abundance and to anticipate what is coming in the months ahead. It is a wonderful way to support your local farmer and eat seasonally. Look to see if there are any CSAs in your area by checking out www.localharvest.org/csa.

Books

We have found this reading material to be useful and inspiring. Much of it expands on topics that we have touched on in the book.

The Small Farmer's Journal edited by Lynn Miller—Whether you are interested in any aspect of life on the small farm or curious about draft animals, this magazine is a phenomenal resource.

The New Organic Grower by Eliot Coleman—Not only is this book an essential read for anyone interested in growing vegetables, but his annotated bibliography is the best that we have come across.

Four Season Harvest by Eliot Coleman

The Garden Primer by Barbara Damrosch

Soil and Health by Sir Albert Howard

Johnny's Selected Seeds in Maine: www.johnnyseeds.com, (877) 564-6697

Kitazawa Seeds in California: www.kitazawaseed.com, (510) 595-1188

Soil

Soil can be very expensive and inefficient to ship. Look to see what kind of quality soils you have locally. If you aren't able to get any of the soils that we recommend, try to find one with similar ingredients.

Fox Farm (Ocean Forest Blend, Happy Frog) www.foxfarmfertilizer.com

Power Flower available at www.plantitearth.com

Vermont Compost www.vermontcompost.com

Growing Supplies

For trays, lids, heat mats, and anything else that you might need, check out:

Johnny's Selected Seeds in Maine www.johnnyseeds.com, (877) 564-6697



Sources

Individual Crops

Amaranth

www.hort.purdue.edu/newcrop/afcm/amaranth.html

<http://www.hort.purdue.edu/newcrop/proceedings1990/v1-127.html#HISTORY%20AND%20TRADITIONAL%20USES>

Arugula

www.gourmetsleuth.com/arugula.htm

<http://greekfood.about.com/od/herbsspices/p/arugula.htm>

Basil

www.herbsociety.org/basil/bhistory.php

<http://en.wikipedia.org/wiki/Basil>

Beet

<http://food.oregonstate.edu/faq/uffva/beet2.html>

<http://plantanswers.tamu.edu/publications/vegetabletravelers/beets.html>

Broccoli

<http://food.oregonstate.edu/faq/uffva/broc3.html>

http://www.organicfood.com.au/Content_Common/pg-broccoli-facts.seo

Cabbage

<http://davesgarden.com/guides/articles/view/753/>

www.whfoods.com/genpage.php?tname=foodspice&dbid=19

Celery

<http://www.foodreference.com/html/celery-history.html>

<http://food.oregonstate.edu/faq/uffva/celery3.html>

Chard

<http://food.oregonstate.edu/faq/uffva/swisschard2.html>

<http://growingtaste.com/vegetables/schard.shtml>

Cilantro

www.soupsong.com/fcilantr.html

<http://www.whfoods.com/genpage.php?tname=foodspice&dbid=70>

Cress

http://mansfeld.ipk-gatersleben.de/pls/htmlldb_pgrc/f?

[p=185:46:2392652887563286::NO:::module,source,akzanz,rehm,akzname,taxid:mf,botnar](http://mansfeld.ipk-gatersleben.de/pls/htmlldb_pgrc/f?p=185:46:2392652887563286::NO:::module,source,akzanz,rehm,akzname,taxid:mf,botnar)

<http://www.hort.purdue.edu/newcrop/1492/neglected.html>

Endive

<http://food.oregonstate.edu/faq/uffva/endive2.html>

www.endive.com/cuisine_nutrition.cfm

Mustard

<http://www.whfoods.com/genpage.php?tname=foodspice&dbid=93>

Pac Choi, Tokyo Bekana

http://en.wikipedia.org/wiki/Chinese_cabbage

[http://www.hungrymonster.com/FoodFacts/Food_Facts.cfm?
Phrase_vch=Herbs&fid=5908](http://www.hungrymonster.com/FoodFacts/Food_Facts.cfm?Phrase_vch=Herbs&fid=5908)

Pea

<http://gardening.wsu.edu/library/vege006/vege006.htm>

Radish

<http://food.oregonstate.edu/faq/uffva/radish2.html>

<http://en.wikipedia.org/wiki/Radish>

Composting

Carbon to Nitrogen Chart Information

http://whatcom.wsu.edu/ag/compost/fundamentals/needs_carbon_nitrogen.htm

<http://ucce.ucdavis.edu/files/filelibrary/1808/353.PDF>

www.css.cornell.edu/compost/chemistry.html

Materials

Seed Viability Chart Information

www.ext.colostate.edu/Pubs/Garden/07221.html

www.ext.vt.edu/pubs/envirohort/426-316/426-316.html

www.ipm.iastate.edu/ipm/hortnews/1995/3-3-1995/seedv.html

Health and Microgreens

Source of United States losing over 4.5 million farms information

<http://eh.net/encyclopedia/article/gardner.agriculture.us>

Source of Percentage of U.S. Population Working on Farms

http://www.nass.usda.gov/Publications/Trends_in_U.S._Agriculture/images/farm_populatic

Source of Paul Bergner's Book Information

www.soilandhealth.org/06clipfile/Nutritional%20Quality%20of%20Organically-Grown%20Food.html

Bergner, Paul. 1997. The Healing Power of Minerals, Special Nutrients, and Trace Elements. Prima Publishing, Rocklin, CA. 312 p.

