

THE TENNESSEE VEGETABLE GARDEN

SMALL-SCALE MICROGREEN PRODUCTION

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Vegetable production is increasingly popular for Tennessee residents. The value of growing home vegetables includes economic and nutritional benefits resulting from the provision of fresh vegetables as well as enhancing personal health and well-being through gardening activities. However, many residents are unable to garden in a traditional manner due to lack of suitable soil or space. Additionally, time or other restrictions may present a challenge. However, there are methods of growing vegetables without the necessity of soil, an outdoor garden site or high cost or time requirements. To address these opportunities, this factsheet has been prepared by UT Extension to support home gardeners and propel them to success in growing microgreens on a small scale.

MICROGREEN BASICS

WHAT ARE MICROGREENS?

Microgreens are plant shoots that are harvested and typically eaten raw. They are different from sprouts because the roots are not eaten. Age and size set microgreens apart from baby greens, which always have true leaves and are often an older, larger plant at harvest. Microgreens can be eaten at the seed leaf (cotyledon) stage, but often one to two true leaves are allowed to form and provide more plant weight. Microgreens are typically 1-4 inches tall at the time of harvest. Production can vary by species, but often microgreens can be grown from seed to harvest in 10 to 14 days if conditions are optimal.

HOW AND WHY ARE THEY USED?

Microgreens can have a unique place in a meal as a garnish or added to salads, sandwiches and smoothies. Microgreens are always plants that have edible stems and leaves. They are eaten raw to maximize flavor and nutrition and because cooking often destroys the small, delicate plants. The first impression of these small greens is often the visual interest they can add to a variety of dishes (Figures 1a and 1b). They provide a range of textures and colors to accent a dish or highlight the visual aspects of a meal. Many microgreens, such as arugula, fennel, cilantro and basil have distinct flavors that help to improve or diversify the flavor profile of the dominant greens in a salad or other dish. Microgreens also can be mixed together and eaten by themselves as a salad. Try several cultivars and give yourself a chance



Figure 1a. *Amaranth microgreens.* (Photo credit: Bumgarner)

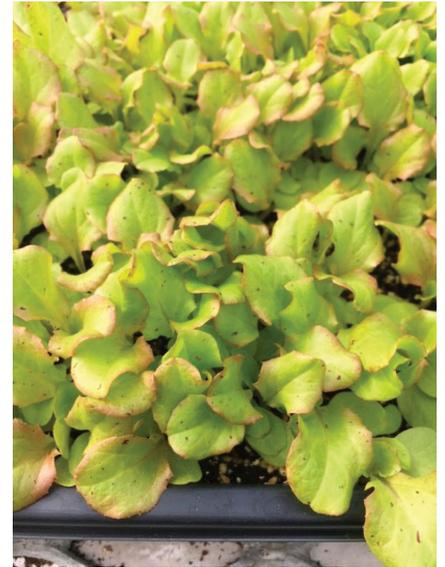


Figure 1b. *Speckled loose-leaf lettuce microgreens.* (Photo credit: Metallo)

to become familiar with these greens if they are new to your palate and diet. Studies have shown that these immature crops, when compared to mature vegetable crops, can contain higher concentrations of antioxidants and other phytonutrients potentially beneficial to human health.

MICROGREEN CROPS

SELECTING CROPS FOR HOME MICROGREEN PRODUCTION

Deciding which crops to grow as a microgreen is the first important choice. It might be good to try a few to determine which you prefer, but the large number of options can be a bit overwhelming. So, select a few to begin and then expand into new crops as you gain experience. There are several factors you should consider in selecting microgreens to fit your needs and growing location including available light, temperature, crop requirements, and desired flavor or texture. Try to select crops that can grow together well and prefer similar conditions.

• **Season and growing location** — Keep in mind that crops grown as microgreens are still either cool- or warm-season crops just as they are

when grown in the garden. Cool-season crops, such as broccoli and arugula, will germinate well with temperatures around 70 F, but can also grow at slightly lower temperatures. Warm-season crops, such as amaranth (Figure 1) and basil, will germinate more quickly and at a higher percentage when temperatures are 75 to 80 F. Also consider the light available. Some cool-season crops, such as lettuce (Figure 1b) and arugula, may perform better under slightly lower light conditions than basil and

some other warm-season crops.

• **Ease of production** — Due to differences in location and management practices, it is difficult to precisely list easy and challenging microgreen crops. Some of the cool-season crops in the Brassica family, such as broccoli, arugula, radish and pac choy, can be good crops to try initially due to their moderate light and temperature needs and relatively quick growth rate. Basil, cilantro, fennel, parsley and carrot tend to be slower germinating and/or growing, which can



Figure 2. *Fennel microgreens grown in soil in a shallow germination tray at 14 days.* (Photo credit: Metallo)

Cool-season vegetables grown as microgreens	Warm-season vegetables grown as microgreens	Herbs grown as microgreens
<i>Kale, Broccoli, Cabbage, Beets, Swiss Chard, Pea, Lettuce, Mizuna, Arugula, Pac Choy, Turnip, Radish, Endive, Mustard, Cress, Carrot</i>	<i>Amaranth, Sweet Corn, Sunflower</i>	<i>Basil, Cilantro, Parsley, Fennel, Dill, Marjoram</i>

Table 1. Common vegetable and herb species grown as microgreens.

sometimes be a challenge (Figure 2). Also, larger seeded crops, such as pea, beet, chard and sunflower, are often soaked prior to seeding to speed germination. This extra step may add some complexity for novice growers.

• **Personal taste** — Microgreens can be a bit of an acquired taste, so it is best to start with some familiar crops. Broccoli, kale, pac choy, cabbage and lettuce can be mild and relatively familiar crops to try initially. Arugula, some mustards and cress provide stronger flavors, so they are often used in smaller quantities. Essentially, there are no wrong choices if you enjoy growing and eating them!

PURCHASING SEEDS FOR HOME MICROGREEN PRODUCTION

It is essential to purchase raw seeds that have not been treated with fungicides or pelleted. Beyond that requirement, there are many options for purchasing seeds. Many seed suppliers now have seeds specifically marketed for microgreens, and this can often be the most economic route. Regular untreated garden vegetable seed could be used, but it may be cost prohibitive. An additional note is that much of the seed marketed as microgreens may not be labeled by cultivar, which could be a means of cost savings. Some of these unnamed

cultivars may be less preferred when grown to maturity (lack of disease resistance, etc.), but may perform well as a short-term microgreens crop.

Also be aware that seed can be purchased as a single species or as pre-mixed microgreens selections. These pre-mixed packages may combine mild and/or spicy flavors as well as colors and textures to make deciding on crops and species more straightforward for the beginner. Purchase only as much seed as you will use in a few months and store it in a cool, dry location to prevent reduced germination and vigor.

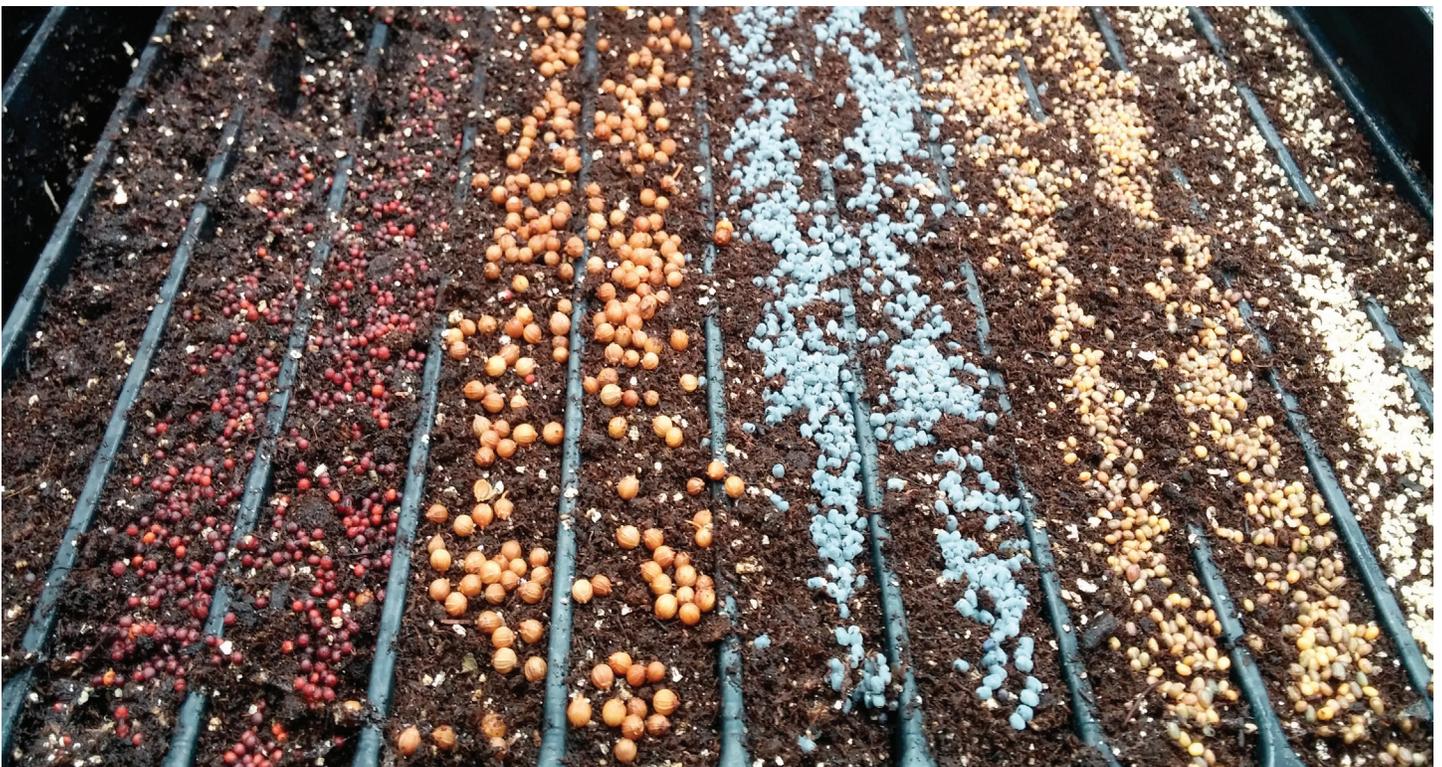


Figure 3. A range of microgreen crops seeded in a greenhouse tray that has divisions for easy seeding of multiple crops. (Photo credit: Bumgarner)

GROWING

GROWING TRAYS AND CONTAINERS

A range of containers can be used for home microgreens production. Be sure that containers are clean before use and have bottom drainage. Greenhouse seedling trays are a good option that can be ordered from a range of suppliers. Whole or half flats that are open can be used, or trays with divisions can provide an easy way to grow small amounts of several species (Figure 3). Many containers can be recycled and used for home microgreens. Clear plastic containers used to sell blueberries or raspberries can be great options for small-scale production when cleaned well before reuse.

GROWING SUBSTRATE

A commercial seedling mix is a common option to provide a substrate that is generally free of pathogens and can provide moisture and aeration for the microgreens. These germination mixes containing peat and vermiculite can be a great place to begin because they drain well and also hold moisture to provide the best germination conditions. A common benefit of these

soilless seedling mixes is that they can contain a small charge of fertilizer to feed the young microgreens once they germinate. One drawback to using soilless mixes for microgreen production is that substrate can get on microgreens during watering or harvest. Other options include paper and other growing pads designed specifically for microgreens production (Figure 4). These can provide a surface that enables microgreens to be produced without any peat or other particles sticking to the plants. However, these materials will require fertilization because they typically do not contain a fertilizer charge.

HOME CULTIVATION INFORMATION

Microgreens can be grown indoors or under moderate light levels in a home greenhouse or sunroom and prefer temperatures between 65-78 F. They can also be seeded close together in trays and other containers, producing a nice amount of harvestable plant material in a relatively small growing area. These factors make microgreens ideal for urban residents who don't have a yard or for gardeners looking

for a novel way to bring greens indoors. When scouting for suitable growing areas for microgreens, it is important that the area receives greater than 5-6 hours of sunlight a day and has protection from harsh weather conditions. Sites for growing microgreens can include sunny windows, a sheltered porch or patio area, and hobby greenhouses.

SEEDING MICROGREENS

Microgreens are generally seeded by hand as evenly as possible over the substrate surface to efficiently use all of the planting space, promote good air circulation for disease prevention, and reduce initial competition between seedlings for light, water and nutrients. Clumping of seeds can lead to overcrowding issues.

Microgreen species with similar requirements can be mixed together for simplicity and greater crop diversity. Additionally, seeding rate can depend on harvest timing. If harvested at the cotyledon stage, microgreens can be planted denser than those grown to the true leaf stages since they will require less space when growing (Figures 5, 6).

Microgreens can be planted in as little as 1-2 inches of substrate. However, more substrate in the growing

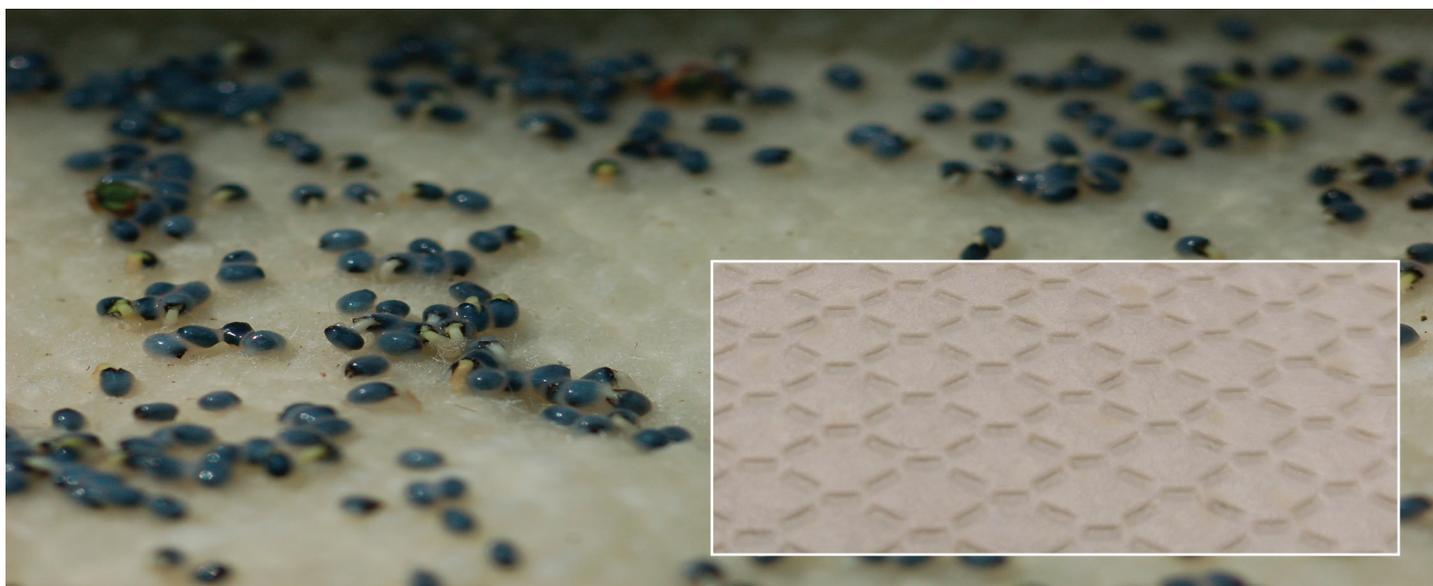


Figure 4. Basil seeds just beginning to germinate on a paper pad in a greenhouse tray. Inset is close up of paper pad prior to moistening. (Photo credit: Bumgarner)



Figure 5. Red cabbage microgreens at the cotyledon stage after 16 days. (Photo credit: Metallo)



Figure 6. Basil microgreens at the true leaf stage after 25 days. (Photo credit: Metallo)

container may reduce watering frequency. Larger seeds are generally covered with 1/4 inch of substrate to prevent drying during germination (i.e., pea, beet, chard and sunflower). Small seeds — such as arugula, kale, broccoli, amaranth, chives and basil — are often simply seeded and then watered in. As long as the substrate is kept moist, they will germinate well without being covered.

Use a misting nozzle to gently water the microgreen seeds after seeding. Using a mist-style nozzle also helps to avoid shifting the seeds around on the tray after seeding (a kitchen sink sprayer can be a good option). A moist paper towel or cloth can be placed over the tray to maintain moisture during germination, but be sure to remove it as soon as germination occurs. Likewise, plastic tray covers (called mini-greenhouses) can be used to retain moisture. However, these small domes heat up quickly under bright light causing temperature increases that can lower germination or kill young seedlings.

CARING FOR MICROGREENS

Microgreen seeds should be kept moist during germination and young plants watered as needed to prevent drying. After germination, bottom watering is best because it keeps stems and leaves dry and reduces disease risk. This can be accomplished by setting the container in a tray of water for a few minutes to let the substrate draw in water through the drainage holes in the bottom of the container. Do not leave the container sitting in water as this can saturate the growing substrate. The substrate should be kept moist, but not saturated. Overwatering can lead to stunting, deformed growth and an increase in disease pressure. Speed of substrate drying will depend on light and air movement in the area as well as depth. If light levels become too intense during the summer months, the seedling growing area can be covered with a shade cloth or microgreen containers moved to a shadier area.

Since microgreens are harvested at an immature stage, typically little to no fertilization is needed if the soilless substrate contains a small amount of

fertilizer. Slow growing microgreens, like parsley and basil, can be fertilized with a dilute mix of soluble fertilizer after the seed leaves have opened fully to speed up growth. If growing on a paper or other pad, and not in soilless mix, soluble fertilizer will need to be provided with the water because these materials do not provide nutrition. Clear water is often used until germination occurs, and then a dilute soluble fertilizer can be provided with each watering. If growing with a pad instead of peat substrate, it is important to completely wet seeds and moisten pads to start the germination period. Once the seeds have germinated, keep the grow pad consistently moist. Algae are normally found on these materials and can be managed through good sanitation, such as washing trays between uses.

PEST AND DISEASES

Typically, there are few pest and disease problems associated with microgreens because the growth cycle is short and soilless mix or paper pads are essentially free of pathogens. Problems with poor germination or



Figure 7. Algae growing on substrate around parsley microgreens. (Photo credit: Metallo)

seedling death are often linked to over seeding, over watering, poor airflow, low light levels and extreme temperatures. Algae growing around young plants can become a problem with microgreens that are slow growing, but it generally poses little threat to plants (Figure 7).

Microgreens that are seeded too closely have issues with poor air flow and water saturation in the root zone. Low light levels and overcrowding will cause yellowing of leaves, stretching and thinning of stems, and spindly growth. Continuous exposure to high temperatures will cause leaf curling, stunting, yellowing of leaves, and seedling death. Potential pest issues include thrips, whitefly, and aphid. Seedling diseases that can impact microgreens include pathogens that cause damping off, such as *Phythium* and *Phytophthora*. Many of these diseases can be prevented through good sanitation practices, adequate air circulation and proper water management.

HARVESTING, STORING, AND USING MICROGREENS

Microgreens are commonly harvested at one time for convenience using clean scissors or small hand pruners. To harvest, gently support the tops of the microgreens and cut near the base of the seedlings being careful to avoid picking up particles of soilless mix. Harvest as much of the stem as possible to obtain the highest edible yield from the small plants. Microgreens are delicate, so handle them with care when harvesting and washing.

It is important to thoroughly wash off any soilless mix or plant debris before storage. Set the wet microgreens on paper towels and gently pat dry to get rid of excess water before placing in containers for storage.

Microgreens should be placed in a rigid plastic container to protect against crushing. They can be stored in the refrigerator (40 F) for a few days up to a couple weeks depending on species. However, one of the benefits of home microgreens is being able to harvest immediately prior to consumption. So, you may want to stagger seeding and harvest to reduce the need for storage.

Microgreens are used fresh and can be added whole or chopped into various dishes. Coarsely chopping herb microgreens helps to bring out their unique flavors and aroma. Microgreens should not be heated since they quickly deteriorate when cooked, although they can be added as garnish on top of hot dips or dishes. They can be used liberally in cold dishes like salads, smoothies and sandwiches. Microgreens are unique greens that can be used to enhance the visual appeal, texture, flavor and nutrition of snacks and meals at home.



Figure 8. Pea microgreens ready for harvest. (Photo credit: Bumgarner)

For a demonstration of seeding and harvesting microgreens, view this short video: agresearch.tennessee.edu/video/research.asp?t=Microgreens&v=157



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