



introduction to organic vegetables

Potting Media and Plant Propagation

Potting mixes should support developing seedlings. Most potting mixes are soilless to avoid soilborne diseases and promote good drainage. A mix of peat moss, vermiculite or perlite, and compost or organic fertilizers can provide a suitable environment with sufficient water-holding capacity, nutrient content, and aeration for plant growth and development. However, because organic nutrients are supplied slowly over time, meeting seedling nutrient needs can be difficult. This fact sheet outlines basic recipes for potting media and research on organic transplant production.

COMMERCIAL MIXES

Numerous commercial mixes are available for organic growers. Make sure you know what the ingredients are in a commercial mix and check to see if it is listed by the Organic Materials Review Institute (OMRI). It should state “OMRI listed” on the packaging. If not, check

the OMRI website (omri.org) to see if it is listed. It is always best to call your certifier to ensure that using the mix will not compromise your certification. Many commercial mixes contain wetting agents to facilitate water absorption by peat moss. Synthetic wetting agents are not allowed under organic production standards.

Depending on the certifier, a producer can also request that the certifier review a specific product/media. OMRI has not reviewed all products. For example, Pennsylvania Certified Organic (PCO) has an internal materials review and publishes a list of materials that they have reviewed and approved. Members of PCO can request a review of any product free of charge. To prevent delays in your certification, be sure to have material input preapproved by a certifier.

TEST YOUR MIX BEFORE YOU USE IT

If you are unfamiliar with your mix or have received a new batch, perform a greenhouse soil test. Mixes made with compost can be high in salts, which can inhibit germination. To test your mix, send it to a reputable lab for greenhouse testing. Remember, this is different from a soil test. For example, Penn State’s Ag Analytical Lab has a “Greenhouse Soilless Media” test that will analyze your media’s pH, soluble salt (electrical conductivity),

PENNSTATE

Cooperative Extension
College of Agricultural Sciences

and nutrient content. Media sent in as a soil sample is tested differently and results will not make sense.

Premium potting mixes tested with the saturated paste method recommended for greenhouse media will have a pH between 5.5 and 6.5, soluble salts between 1.5 and 3 mmhos/cm, nitrate nitrogen (NO₃) levels between 75 and 150 mg/L, phosphorus (P) levels between 5 and 20 mg/L, potassium (K) between 150 and 300 mg/L, calcium between 100 and 200 mg/L, and magnesium between 50 and 100 mg/L, with sodium contents falling below 160 mg/L (Warncke 1995).

Consider pretesting your potting mix by doing your own greenhouse bioassay. To do a bioassay, grow cress, oats, beans, lettuce, or another fast-growing crop with a high germination rate in your soil mix. If there is a problem with the mix, you will see it in reduced germination or poor seedling growth (see sidebar). You may also compare your new mix to a mix that you are satisfied with.

Recently, handheld EC (electrical conductivity) meters have become more popular and available at reasonable prices. See *Saline Soils and Plant Growth* (Sanchez 2010) for more information on how to test for salts using an EC meter.

MAKING YOUR OWN MIX

Even when making your own potting media, it is still important to ensure that the individual components of the media are specifically approved for certified organic production (see sidebar, next page). If you are purchasing compost to add to your homemade potting mix, most certifiers will require this compost to be reviewed (e.g., PCO requires an ingredient list from the source and a compost log in cases when the raw manure restriction is applicable). Fertility amendments, peat, coir, and other components must also be approved. Check for the OMRI label and talk with your certifier.

When you first start making your own potting mix, it's a good idea to try several different recipes that have worked for other growers and compare how they do on your own farm. A list of common potting mix recipes is provided at the end of this fact sheet.

Many organic potting mixes contain compost, which can provide many benefits. Compost adds organic matter to the mix and supports diverse microbial populations that can suppress soilborne-disease-causing organisms (Klein and Hammer 2006). Microbes break down organic material, releasing plant-available nutrients that are slowly available for your seedlings.

However, growers have increasingly reported problems with compost-based mixes. This may be because they rely on microbial release of nutrients, which may occur too slowly to meet plant needs.

A recent study compared 20 organic potting mixes (Leonard and Rangarajan 2007). They found that

Potting Mix Bioassay to Avoid the Effects of High Salt Levels or Herbicide Residue

Steps

1. Fill a flat with potting mix.
2. Count out 25 seeds of cress, lettuce, or other fast-germinating crop.
3. Seed flat.
4. Wait 5–7 days.
5. Count number of seedlings. If less than the legal germination rate (for lettuce, 80 percent), you may want to test your media for salts.



Lettuce seeded in potting mix with high salts (right) exhibited slowed and reduced germination rates.

transplants grown in potting mixes that contained blood meal or alfalfa meal in addition to compost were significantly larger. This was probably in response to ammonium nitrogen (N) levels two to three times higher than that of mixes without either compost or blood meal amendments. It may be a good idea to use a mix with a more readily available N form, like blood meal or feather meal, in addition to compost. Blood meal seems to stimulate microbes and increase nutrient availability from compost.

If you use compost, make sure you are using high-quality compost at the right stage of maturity. Unfinished compost may release volatile organic acids that can negatively affect seedling growth and development (Grubinger 1999). One classic method of evaluating compost readiness is by smell. Finished compost has a sweet smell. Anaerobic, sour, or putrid smells are suspicious. If your nose detects an off smell, turn the pile and let it heat again before you consider using it in a mix (Klein and Hammer 2006).

Problems with compost-based mixes often occur during early season transplant production. This may be because the mix is too cold, especially overnight when greenhouse temperatures drop.

Compost supports an active biological system. Microbial activity is linked to temperature and will not release nutrients if temperatures are cold and do not support their activity. To alleviate this problem, many growers provide bottom heat to their transplants.

SUPPLEMENTAL FERTILITY

If, after all possible precautions, your transplants are stressed due to nutrient-deficient media, you may need to use supplemental fertilizers such as fish emulsion. Organic sources of supplemental fertilizer include fish emulsion, soluble fish powder, kelp extracts, worm casting or compost tea, or other OMRI-approved products; see *Using Organic Nutrient Sources* (Sanchez and Richard 2009). These fertilizers can be applied to the soil by fertigation or foliar spray. Be careful with supplemental fertility. If you produce transplants in an



Commercial organic potting mixes to right with lower nutrient levels can result in stunted and nutrient stressed plants without supplemental fertilization.

Organic Standards for Compost

The National Organic Program (NOP) is very explicit about compost preparation. Compost piles must maintain a temperature between 131 and 170°F for at least 3 days in a static or enclosed vessel system, or at least 15 days in a windrow system, with at least five turnings. Unless these criteria are met, the resulting product is not—in the eyes of the National Organic Program—considered compost. Rather, it is simply a pile of raw materials. If one of those raw materials is manure, it can make a big difference in how it may be used in crop production.

Raw livestock manure can carry pathogens that pose a danger to human health. According to the NOP's rules, raw manure can be applied at will to crops not intended for human consumption, cannot be applied to a crop within 120 days of harvest if the edible portion has direct soil contact, and cannot be applied to a crop within 90 days of harvest when the edible portions have contact with the soil.

area that is later used for in-ground production, leached fish emulsion or other products can build up soil nutrients to levels exceeding crop needs.

SEEDLING MIXES FOR STARTING TRANSPLANTS

The following list was adapted from M. Wander in *Organic Potting Mix Basics* (2010).

Potting Mix—Quiet Creek CSA

Compost (pasteurized) 1½ buckets
 Vermiculite ¾ bucket
 Perlite ¾ bucket
 Peat ¾ bucket
 Greensand 1 scoop
 Dried Blood 1 scoop
 Bonemeal ½ scoop
 Lime ½ scoop
 Rock phosphate ½ scoop
 *scoop is a 1-lb butter dish, bucket is a 5-gallon bucket

Seed Mix—Standard Soilless

50–75 percent sphagnum peat
 25–50 percent vermiculite
 5 lbs of ground or superfine dolomitic lime per cubic yard of mix
 Blood meal, rock phosphate, and greensand at 5–10 lbs per cubic yard

Soilless Potting Mix

1 part compost
 1 part vermiculite
 1 part peat moss
 Screened with ¼-inch screen to mix together
 Per 1 gallon mix add:
 0.6 oz blood meal (17.01 grams)
 0.4 oz clay phosphate (11.34 grams)
 0.4 oz greensand (11.34 grams)

Organic Potting Mix

1 part sphagnum peat
 1 part peat humus (short fiber)
 1 part compost
 1 part sharp sand (builder's)
 To every 80 quarts of this add:
 1 cup greensand
 1 cup colloidal phosphate
 1½–2 cups crabmeal or blood meal
 ½ cup lime

Soil Block Mix

3 buckets (standard 10-quart bucket) brown peat
 ½ cup lime (mix well)
 2 buckets coarse sand or perlite
 3 cups base fertilizer (blood meal, colloidal phosphate, and greensand mixed together in equal parts)
 1 bucket soil
 2 buckets compost

Seedling Mix for Soil Blocks or Seedling Flats

2 3-gal. buckets sphagnum peat moss

¼ cup lime

1½ cups fertility mix (below)

1½ buckets vermiculite

1½ buckets compost

Fertility mix:

2 cups colloidal (rock) phosphate

2 cups greensand

2 cups blood meal

½ cup bone meal

¼ cup kelp meal

Directions for mixing:

1. Add peat to cement mixer or mixing barrel.
2. Spread the lime and fertility mix over the peat.
3. Mix these ingredients thoroughly.
4. Add the compost and vermiculite and mix well again.
5. When done, examine the distribution of vermiculite to ensure that it has been mixed in evenly.

Note that all bulk ingredients should be screened through ¼-inch hardware cloth. Well-matured, manure-based compost should be used (avoid poultry manure and woodchip bedding).

REFERENCES

- Grubinger, V. P. *Potting Mixes for Organic Growers*. Brattleboro: University of Vermont Extension, 2007.
- . *Sustainable Vegetable Production from Start up to Market*. Ithaca: National Resource Agricultural Engineering Service (NRAES), 1999.
- Klein, J., and K. Hammer. “Compost-based potting mixes require different management for transplants.” *Growing for Market* (February 2006).
- Leonard, B., and A. Rangarajan. *Organic Transplant Media and Tomato Performance 2007*. Ithaca: Department of Horticulture, Cornell University, 2007.
- Pennsylvania Certified Organic. “PCO Guidance on Manure, Compost, and Compost Tea Products.” 2010. www.paorganic.org/wp-content/uploads/2011/09/CERT-A18-Compost-Manure-Tea-Guidance.pdf.
- Sanchez, E. *Saline Soils and Plant Growth*. University Park: Penn State Cooperative Extension, 2010. extension.psu.edu/vegetable-fruit/fact-sheets.
- Sanchez, E., and T. L. Richard. *Using Organic Nutrient Sources*. University Park: Penn State Cooperative Extension, 2009.
- Wander, M. *Organic Potting Mix Basics*. eXtension.org, 2010. www.extension.org/article/20982.
- Warncke, D. “Recommended Test Procedures for Greenhouse Growth Media.” In J. Thomas Sims and A. Wolf, eds., *Recommended Soil Testing Procedures for the Northeastern United States*, 76–82. Northeast Regional Bulletin #493. Newark: Agricultural Experiment Station, University of Delaware, 1995.

Prepared by S. Tianna DuPont, sustainable agriculture educator, Penn State Extension. Reviewed by Elsa Sanchez, Penn State Horticultural Systems Management, and Debra Brubaker, Pennsylvania Certified Organic.

This publication was supported in part by funding from the Beginning Farmer and Rancher Development Program of the National Institute of Food and Agriculture, USDA, Grant #2009-49400-05869.

extension.psu.edu

An OUTREACH program of the College of Agricultural Sciences

Penn State College of Agricultural Sciences research and extension programs are funded in part by Pennsylvania counties, the Commonwealth of Pennsylvania, and the U.S. Department of Agriculture.

This publication is available from the Publications Distribution Center, The Pennsylvania State University, 112 Agricultural Administration Building, University Park, PA 16802. For information telephone 814-865-6713.

Where trade names appear, no discrimination is intended, and no endorsement by Penn State Cooperative Extension is implied.

This publication is available in alternative media on request.

The Pennsylvania State University is committed to the policy that all persons shall have equal access to programs, facilities, admission, and employment without regard to personal characteristics not related to ability, performance, or qualifications as determined by University policy or by state or federal authorities. It is the policy of the University to maintain an academic and work environment free of discrimination, including harassment. The Pennsylvania State University prohibits discrimination and harassment against any person because of age, ancestry, color, disability or handicap, genetic information, national origin, race, religious creed, sex, sexual orientation, gender identity, or veteran status and retaliation due to the reporting of discrimination or harassment. Discrimination, harassment, or retaliation against faculty, staff, or students will not be tolerated at The Pennsylvania State University. Direct all inquiries regarding the nondiscrimination policy to the Affirmative Action Director, The Pennsylvania State University, 328 Boucke Building, University Park, PA 16802-5901; Tel 814-865-4700/V, 814-863-0471/TTY.

Produced by Ag Communications and Marketing

© The Pennsylvania State University 2012

CODE # EE0037 5M6/12payne5131

