PERFECTING THE POTTING MIX

By Janet Wallace

Greenhouse operators and many market gardeners rely on high quality potting mixes to grow healthy seedlings for their expanding markets.

For certified organic growers, a potting mix must meet both the organic standards and the needs of the seedlings in terms of nutrients, water retention and porosity. At the same time, it should be affordable and environmentally sustainable. Most commercial potting mixes are unsuitable for organic growers because they contain prohibited ingredients, such as synthetic fertilizers and wetting agents. Seeing the need for organically acceptable potting mixes, Organic Science Cluster (OSC) researchers are evaluating potential ingredients for organic potting mixes.

Peat moss

A common ingredient in potting mixes is peat moss. Peat moss holds water and air better than most other materials, is lightweight and doesn't decompose quickly. However, it doesn't contain nutrients. It is acidic and so a buffer, such as lime, must be added to balance the pH. Peat also tends to repel water. Consequently, wetting agents, which are prohibited by organic standards, are often added to peat moss. Organic farmers must use untreated peat moss and soak it in warm water several hours before using it.

Beyond these logistical difficulties, there are environmental consequences of using peat. Peat moss is harvested or mined from wetlands, which are sensitive and often threatened ecosystems. Peat accumulates at a meagre rate of about a millimetre per year—so it is not renewable within the short term. Canadian sphagnum peat moss is often considered more sustainable than American peat made from sedges. Sedges are found in endangered ecosystems, unlike the more common Canadian sphagnum bogs. All peat acts as a sink for carbon dioxide; therefore, harvesting peat may contribute to global warming.

Coconut husk fibre called coir is often sold as an ecological alternative to peat. However, given the environmental costs of shipping this material from the tropics, it is questionable whether this is an ecologically responsible choice for Canadians. Researchers are evaluating local alternatives to peat moss, such as composted waste from the forestry industry.

Drs. Derek Lynch and Gopal Bhatta from the Nova Scotia Agricultural College grew tomato seedlings in 12 potting mixes.[1] One was 100% peat moss. The others contained 40–60% peat moss, 20% compost, 0–30% perlite, 0–10% pulp fibre and 10–40% aged softwood bark. Lime was added to adjust the pH, and organic liquid fertilizers were applied.

Tomatoes grown in pure peat moss performed better than those grown in the blends. The peat-grown seedlings were larger and took up more nitrogen, compared to the mixes with forestry byproducts. The primary challenge in using wood-based products may be related to the immobilization of nitrogen caused by these carbon-rich materials.

Compost

Compost can be used to replace some or all of the peat moss in potting mixes. It can be made on-farm

A sheepish seedling mix

Although hydroponics is not permitted in organic agriculture, growers might be interested in a study that grew cucumbers in a soil-less system[2]. Plants were grown in slabs of peat, coconut fibre, perlite, rockwool and dirty sheep's wool. The results? The plants performed best in the wool. Perhaps waste wool can be a local, sustainable ingredient in potting mixes.

Plants grown in a study incorporating biochar in the potting mix.

using manure and bedding, or simply from plant material. For potting mixes, the amount of compost used often "ranges from 20% to 33%...Compost is seldom used alone as a potting medium because it is too porous and frequently the soluble salt levels are too high."[3]

Compost provides major and micro-nutrients. In a study using compost made from straw and seaweed, seedlings grew best in a mix of compost and organic commercial seedling mix at a ratio of 2:1 (wet weight), compared to seedlings grown in compost alone, or in mixes with less compost.[4] Other studies found that organic vegetable seedlings grew better in compost alone or compost mixed with peat, bark and sand, than in commercial peat-based mixes.[5, 6]

To enhance the ability of a compost to suppress disease:

- keep the outside of the pile moist,
- turn the pile, and
- incorporate a small amount of bark into the pile.

The benefits of compost go beyond NPK. Unsterilized compost contains beneficial microorganisms that may improve nutrient uptake by seedlings. One study found organic melon seedlings grew better in seedling mixes containing 30–50% compost, compared to mixes made of peat, coconut fibre and perlite.[7] The seedlings were fertilized and not lacking in nutrients, which suggests that the microbial life in compost provides other benefits.

For decades, organic growers have been told that potting mixes must be sterilized. Growers have heat-treated compost under plastic in the sun or in kitchen ovens with the goal of killing all microbial life. Many ignored the advice and used compost complete with worms and microbes. And it worked.

Unsterilized mature compost can suppress many soil-borne diseases, including damping off, root rot and wilt. The effect seems to come from microorganisms, particularly fungi and actinomycetes, that proliferate in the compost during the curing stage.[8, 9] Compost produced in open areas near a forest is more likely to suppress disease better than compost produced in an enclosed facility.[10]

Vermicompost

In vermicomposting, worms digest organic matter and excrete castings. Vermicompost differs from compost because it is made at moderate temperatures, whereas composting goes through a hot stage. As a result, mature vermicompost and compost have different microbial communities.

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Vermicompost is valuable in a potting mix because it:

- contains a diverse population of microorganisms;
- holds moisture well;
- contains nutrients such as N, K, P, Ca and Mg in forms readily taken up by plants;
- contains plant growth hormones and humic acids which can act as plant growth regulators;[11]
- provides a greater potential for disease suppression than does regular compost;[11]
- can reduce damage by pests, including mealy bugs, aphids, spider mites, cabbage white caterpillars, tomato hornworms and cucumber beetles.[12]

Vermicompost, in general, "whether used as soil additives or

A number of recipes, including ones for soil blocks, can be found at www.extension.org/pages/20982/organic-potting-mix-basics.[17] A few are reprinted below (with permission from the eXtension eOrganic Community of Practice).

Recipes

The ideal recipe for a potting mix will vary—depending on the type and growth stage of the plants, the availability of the materials, and the farmers' time, budget and methods. Ideally, organic growers should test their compost before using it and ensure that all ingredients comply with the Canadian Organic Standard. Sending on-farm compost or seedling mixes to a lab can provide information on nutrient availability. To get a sense of nutrient availability and other characteristics, growers can plant a flat of seedlings ahead of time. If the seedlings have an acceptable germination rate and appear vigorous, the mix will likely be suitable for other crops.

Cornell soil-based mix

- 1/3 mature compost or leaf mold, screened
- 1/3 garden topsoil
- 1/3 sharp sand

Organic fertilizer [including lime] can be added to this base.

Cornell soil-less mix

- 1/2 cubic yard sphagnum peat
- 1/2 cubic yard vermiculite
- 10 pounds bone meal
- 5 pounds ground limestone
- 5 pounds blood meal

The following three recipes are adapted from Eliot Coleman's book ***The New Organic Grower***. [For details on making and using soil blocks, see Coleman's books.]

*Coleman's base fertilizer is blood meal, colloidal phosphate and greensand mixed together in equal parts. Check with certifying bodies for approval; there are restrictions on the use of blood meal.

Blocking mix recipe

- 3 buckets (standard 10-quart bucket) brown peat
- 1/2 cup lime (mix well)
- 2 buckets coarse sand or perlite
- 3 cups base fertilizer*
- 1 bucket soil
- 2 buckets compost

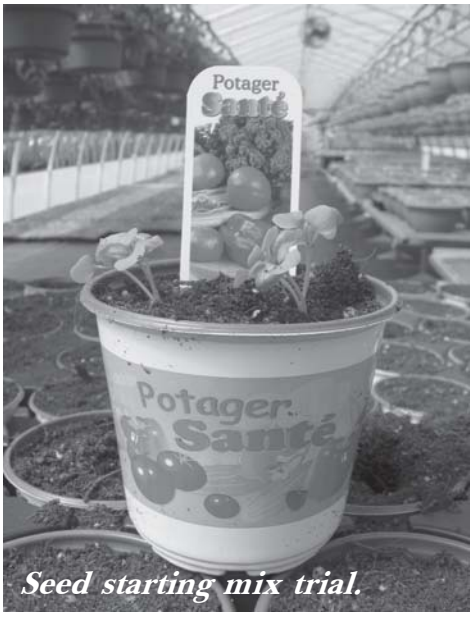
Blocking mix recipe for larger quantities

- 30 units brown peat
- 1/8 unit lime
- 20 units coarse sand or perlite
- 3/4 unit base fertilizer*
- 10 units soil
- 20 units compost

Mini-block recipe

- 16 parts brown peat
- 1/4 part colloidal phosphate
- 1/4 part greensand
- 4 parts compost (well decomposed)

Note: If greensand is unavailable, leave it out. Do not substitute a dried seaweed product in this mix.



Seed starting mix trial.

as components of horticultural media, improved seed germination and enhanced rates of seedling growth and development."[11]

Nutrient sources

Although the initial germination medium does not require nutrients, once seedlings are potted up, they require either solid or liquid fertilizers. Preliminary results from an OSC study conducted by Drs. Martine Dorais, Valérie Gravel and colleagues at l'Université Laval found that organic pepper transplants performed best when given both liquid and solid fertilizers, as compared to seedlings given only one type of fertilizer.[13] The solid fertilizers used in the potting mix were shrimp and kelp meal.

Another study by the team found that using only half of the recommended concentration of solid fertilizer produced high quality vegetable transplants.[14] In this case, the solid fertilizer was a mix of crab meal, kelp meal, compost, bat guano and feather meal. Sweet pepper plants were more affected by the type of fertilizer than were tomatoes or cucumbers, possibly because of the longer time it takes for peppers to develop. There are, it seems, viable organic alternatives for

Greenhouse full of experimental potting mixes for transplant production.

nutrients to support the growth of transplants and potted plants.

Inoculants

Recent interest in soil microbial life has encouraged growers (and suppliers of potting soil) to add microbial inoculants to the soil with the goal of improving nutrient uptake, suppressing disease and promoting plant growth. The inoculants include fungi such as *Trichoderma* spp. and the mycorrhizal fungi *Glomus* spp. While seedlings of some species (e.g., cabbage) benefit from the inoculants, others (e.g., lettuce) may be affected negatively. In general, the effects of microbial additives on seedlings are not consistent.[15]

At l'Université Laval, OSC researchers found that although a species of *Trichoderma* sold under the brand name Rootshield increased the biological activity of potting mix, it did not affect the growth of sweet pepper transplants.[13]

Biochar can be added to soil to stimulate microbial activity and increase the availability of nutrients. Its role in potting mixes is, at this point, unclear. After analyzing preliminary results of a study using biochar in potting mixes, Valérie Gravel states, "Depending on plant species, high biochar amendment (1:1; v:v) had positive, none or negative effects on growth."[16]

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