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Propagation Media used in Nursery/Polyhouse

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SUMMARY

Growing media for use in container production in greenhouses contain a variety of organic and inorganic ingredients. Organic ingredients include peat moss, bark, coconut coir, rice hulls, etc. Inorganic components include perlite, pumice, vermiculite, sand, hydrogel, etc. Field soils are generally unsatisfactory for producing plants in containers because soils do not provide the aeration, drainage and water holding capacity required and they need to be pasteurized or fumigated to prevent diseases and weeds.

INTRODUCTION

The choice of media will depend on the cost, its availability, and plant requirements. Most commercial greenhouse media for container crop production contains 30 to 60 percent peat moss alone or in combination with composted pine bark.. Except for organic growers, there are relatively few commercial operations that directly use soil. Some of these ingredients can be used alone to grow crops, but more often, growing media are made with different portions of various materials, each contributing to the chemical and physical properties of the final product. Other materials such as vermiculite and perlite are added to affect water retention and aeration. Mixtures of organic and inorganic components are popular because these materials have opposite, yet complementary, physical and chemical properties. Growing media are designed to achieve high porosity and water retention while providing adequate aeration. A nutrient charge is added, the pH adjusted, and a wetting agent is generally added to the media to improve initial wetting.

Organic Media Components

Peat

Peat is a main component of most soilless substrate mixes used today. Peat consists of the remains of aquatic, marsh, bog, or swamp vegetation that has been preserved under water in a partially decomposed state. Composition of different peat deposits varies widely, depending upon the vegetation from which it originated, state of decomposition, mineral content, and degree of acidity. Most of peat moss used for horticultural purposes in the U.S. is from Canada or the southeast United States.

Sphagnum Peat Moss

Sphagnum peat moss remains the premier component of greenhouse media because of its high-water holding capacity, adequate air space, high cation exchange capacity, and resistance to decay. Sphagnum peat moss is light brown in color (dark brown when wet), and the sphagnum plant structure is still visible. It has superior properties of stability over time, light weight, and high water and nutrient-holding capacities. Sphagnum peat moss is the most acid of the peats, with a pH level of 3.0 to 4.0, and requires 14 to 35 pounds of finely ground limestone (dolomite) per cubic yard (8 to 20 kg/m3) to bring the pH up to the level that is best for most crops. In areas with alkaline water, the lower rate may be suitable. Due to its naturally low pH, peat moss is free of active pathogenic diseases.


Shredded Bark

Shredded or pulverized softwood bark from redwood, cedar, fir, pine, hemlock, or various hardwood bark species, such as oaks and maples, can be used as an organic component in growing mixes and are frequently substituted for peat moss at a lower cost (See Figure 11.2). Shredded bark functions to improve aeration and reduce the cost of substrate. Bark variability stems from the species and age of tree, method of bark removal and degree of decomposition. Based on the level of decomposition, bark could be categorized as fresh, aged, or composted. Aging is a cheaper process, but aged bark has less humus and a greater nitrogen drawdown in the container than composted bark.

Pine Bark

Pine bark is preferred over hardwood bark since it resists decomposition and contains fewer leachable organic acids. Pine bark is usually stripped from the trees, milled and then screened into various sizes. A good potting medium usually consists of 70 to 80 percent (by volume) of the particles in the 1/42 to 3/8-inch (0.6 to 9.5

mm) range with the remaining particles less than 1/42 inch. If pine bark is too coarse, water retention will not be adequate for plant growth.

Hardwood Bark

Hardwood bark is a commonly used and is an excellent substrate ingredient. Hardwood bark should be mechanically processed to small particles, which will pass through a 1/2-inch (12.7 mm) mesh screen, with 10 percent of the particles larger than 1/8-inch (3.2 mm) diameter and 35 percent less than 1/32-inch (0.8 mm) diameter.

Coir

The substrate coir is derived from the husks of coconut fruit (See Figure 11.3). After most of the fibers are removed, the remaining coir, or coir dust, is marketed for substrate. Chemical and physical properties of the coir are variable, depending largely on the amount of fiber remaining in the material. Its physical and chemical properties are probably closer to peat moss than any other existing substrate material. Coir generally has a higher pH (4.9 to 6.8) than sphagnum peat moss, so it requires less limestone to adjust substrate pH. If not properly processed, the electrical conductivity (EC) of coir-based substrates can exceed the recommended levels for container-grown plants.

Sawdust

Sawdust has characteris tics that make it desirable for use in a growing mix. It has a bulk density slightly less than sphagnum peat moss, has similar water retention but greater air space after drainage than pine bark.

Rice Hulls

Rice hulls used in growing media are parboiled and then dried before use (See Figure 11.4). The primary function of rice hulls is that of drainage and aeration. Large particle sizes of whole parboiled fresh rice hulls can increase the drainage and air-filled pore space in peat-based substrates without causing significant nitrogen immobilization. Rice hulls provide a less expensive substitute for perlite and add a higher level of aeration than gained by an equal amount of perlite in the substrate.

Soil

Soil is used as a part of a medium by some greenhouses. However, topsoil supply, uniformity, and quality are difficult to maintain and soil must be pasteurized or fumigated. Pasteurization of some soils at high temperatures creates additional problems such as manganese toxicity and an imbalance between ammonifying and nitrifying bacteria. The high bulk density of a soil medium increases handling labor and cost of shipping plants. Typically, soil-based root media is amended so that it is relatively lightweight.

Animal Manure Composts

Non-composted animal manure is rarely used in greenhouse production today. Although manures do contain most essential nutrients for plant growth, the concentration of elements varies considerably with the animal, mulching material used (straw, etc.), the technique of manure collection and storage, and manure age. In addition, fresh manures are not pleasant to handle, considering the odor and the high-water content. Some potential dangers in using raw manure include: soluble salt damage from high nutrient content, ammonia damage to roots and foliage, and weed seeds, insects, pathogens and nematodes contained in non-pasteurized or non-fumigated manures.

Inorganic Media Components
Vermiculite

Vermiculite, an aluminum-iron-magnesium silicate, is a mica-like mineral that provides spaces for air and water (See Figure 11.5). When expanded, vermiculite is very light in weight, neutral in reaction with good buffering properties, and insoluble in water. It can absorb large quantities of water—40 to 54 liters per cubic meter (3 to 4 gal per cubic foot). Vermiculite has a relatively high cation-exchange capacity and thus can hold nutrients in reserve for later release. It contains magnesium and potassium, but supplementary amounts are needed from other fertilizer sources. The pH of most of the vermiculite used in horticulture falls within a range of 6.0 to 8.9. One of the major shortcomings of vermiculite is its poor physical stability after wetting. Particles which have been mixed, wetted and compressed do not recover physically. Compression of moist vermiculite causes the expanded particle to collapse and frequently slip apart.

Perlite

Perlite is a volcanic rock that is crushed and heated rapidly to a high temperature forming a white, light-weight aggregate with high pore space. Perlite is utilized extensively for its light weight, physical stability and ability to improve the drainage or aeration. The water-holding capacity of perlite is 3 to 4 times its own. It is chemically inert with almost no CEC or nutrients, and a neutral pH.

Calcined Clay

Aggregates of clay particles are heated to high temperatures (calcined) to form hardened particles, which make them desirable as potting substrates . Calcined clays are essentially indestructible particles, which provide non-capillary pore space to a mix due to the large spaces created between particles and hold water internally within their open-pore particle structure.

Sand

Sand is the most common addition to growing media. The composition of sand varies widely. Sands derived from calcareous sources (such as coral or limestone) are high in calcium carbonate ($CaCO_3$); however, can have dangerously high pH values. Some plants grown in the greenhouse may be adapted to local calcareous soil conditions and may not suffer from the increased pH if the sand is used sparingly. Deep-mined, white mountain sands are mainly silica. These white sands are called sharp or builders' sands because the sand particles have flat sides.

Rockwool

Rockwool is manufactured from a mineral called basalt through a heating and fiber extrusion process . Horticultural-grade rock wool is formulated to a prescribed higher density to provide the air- and water-holding requirements of plants. A distinct characteristic of rock wool is its high air-holding capacity even when fully saturated. Rockwool contains only a very small amounts of nutrients such as calcium, magnesium, sulfur, iron, copper, and zinc. Nutrient availability is dictated by the nutrient solution applied. The pH of rockwool is between 7.0 and 8.5 (often 8.0) but is not buffered. Mixing it with an acid component, such as pine bark or peat moss, will immediately lower the pH level. The pH level of the rockwool will adjust to the nutrient-solution pH level after one application.

Benefits of Propagation Media

- An optimum rooting environment for physical stability
- Storage of air for the roots.
- Water absorption and retention and make availability to the plant when needed.
- Supply of nutrients for the roots.
- Healthy growth of plants.
- Reduced chances of Disease and pest attack.

CONCLUSION

The above study showed that use of different growing media in nursery lead to increase the production and quality whereas the control of nursery diseases can be achieved by the growing media only.

REFERENCES

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