GROWERTALKS

Features

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The Right Ingredients

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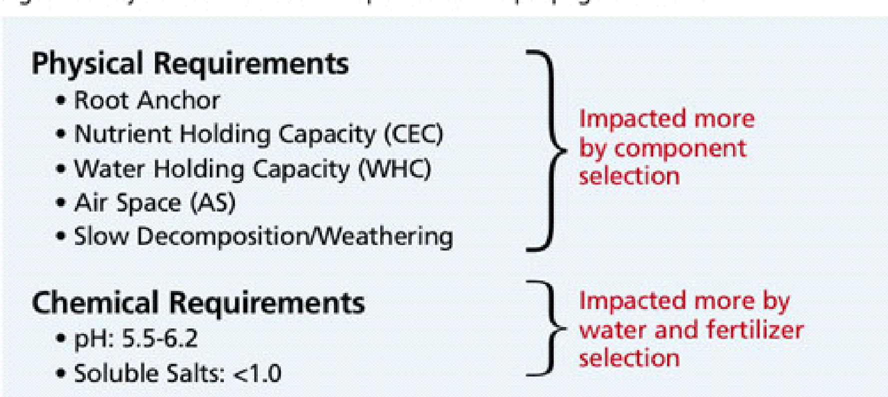
Whenever growers select a medium for growing or propagation, they're selecting a group of various components to provide them with the desired physical and chemical properties for the crops they're producing. What's really needed in a growing or propagation medium? You need to hold up the plant, as well as hold and provide air, water and nutrients. Specifically, in propagation, the medium must provide part of the environment for initiation and development of the heart and soul of the plant—the root system.

In this article, we'll review the major components available for use in propagation media, along with the physical and chemical impact these components can have on successfully producing a high-quality crop.

Requirements of a growing medium—physical and chemical properties

The overall requirements of a good propagation medium include both physical and chemical properties. Physical requirements include root anchoring, air space, slow decomposition/weathering, as well as water and nutrient holding. General chemical requirements include low soluble salts and moderate pH. The main components selected will impact the physical properties of the mix more than the chemical properties of the mix, which will be impacted more by water quality and fertilizer selection (Figure 1).

Figure 1. Physical and chemical requirements of propagation media



Particle size of components will have the greatest impact on air space and water/nutrient holding of the final medium. Media comprised of larger particles (coarse texture) will have a greater percentage of air pore space, while a mix comprised of smaller particles (fine texture) will have a greater percentage of water pore space (hold more water).

Propagation media tend to be comprised mainly of finer particles due to the smaller cell size in propagation. In addition to particle size, the height of a container plays a major role in the water-holding capacity of a growing medium. As container/cell height increases, air space in the same medium will have increased air pore space and, correspondingly, decreased water pore space.

Although the main components combined to make a propagation medium do impart some chemical properties, the main impact on chemical properties of a mix will be water quality and fertilizer selection. Additives, such as lime, will impact pH, but will still be greatly impacted by a grower's water and fertility regimen.

Major propagation media components
The most common components combined to make up a propagation medium include sphagnum peat moss ("peat"), perlite, vermiculite and coconut coir pith ("coir"). Lesser-used components would include rice hulls, bark and vermicompost. These lesser-used components would be more common in growing on mixes or in natural and organic mixes. Table 1 shows the common properties of these components.

Table 1. Typical Characteristics of common propagation media components.

Component	Total Porosity	Water Holding Capacity	Air Capacity	pH	CEC (me/cc)
Peat	89-94	74-77	12-20	3.0-5.0	7.0-13.0
Coir	92-94	82-83	9-12	6.5-7	6.1
Perlite	68	36-40	28-32	7.0-7.5	0.15
Vermiculite	78-80	70-72	6-10	6.3-7.8	1.9-2.7

Sphagnum peat is the partially decomposed plant material derived from the sphagnum moss plant. It's the most common component used in making propagation media. Typical characteristics include low pH, low soluble salts, high water-holding capacity and moderate air space. Because of the conditions under which peat develops, it's considered "essentially sterile." In North America, peat is generally vacuum harvested then processed into mixes or as a standalone product. It can be compressed and will expand back to original volume once the compressed bale is broken up.

Coconut coir pith ("coir") is a by-product of the coconut fiber industry. It's the "dust" produced during the processing of coconut fiber. It had long been considered a waste product. Major sources of this product are located in India, Sri Lanka, Indonesia, The Philippines and Mexico. Typical characteristics include moderate pH and soluble salts, very high water-holding capacity and moderate to high air space. It's often used as a partial substitute for peat moss. It can be high in sodium if not processed correctly. The common sources found in the U.S. have been processed adequately to remove much of the sodium.

Perlite is derived from crushed volcanic rock, which is expanded at high temperatures. It's a sterile product with high pore and air space and very low water and nutrient holding. It's used in media to add air space and reduce overall bulk density. It's relatively resistant to breakdown when used in media.

Vermiculite is derived from vermiculite ore, which is then heated in a furnace, causing it to expand. Typical characteristics include moderate to high pH, low soluble salts, high air space, moderate to high water-holding capacity and low bulk density. It's commonly added to media to increase air initial air space and lower bulk density. It's not as resistant to breakdown as perlite.

Composted bark, a lesser-used component in propagation media, is derived from the bark of various softwood species. It's composted to a stable stage prior to use as a media amendment. Typical characteristics include moderate pH, high air space and low water and nutrient-holding capacities. Finely screened bark is sometimes used in small quantities in propagation media.

Par-boiled rice hulls can be used as a perlite substitute, but like bark, are more common in growing on media. A comparison of rice hulls versus perlite is shown in Table 2.

Table 2. Comparison of perlite and par-boiled rice hulls.

Physical Properties	Perlite	Par-Boiled Rice Hulls
Dry Bulk Density (lbs/cf)	6 – 7	6 – 7
Water Holding Capacity (% v/v)	20	12
Air space	54	69
Total Pore Space	74	82

Vermicompost—more commonly used in growing-on mixes, but sometimes used in propagation—is the stabile end-product of the decomposition of organic materials by earth worms and microorganisms. The source of organic materials will have a great impact on the properties of the vermicompost. It can be a rich source of nutrients. It's high in bulk density, and has high water and nutrient-holding capacities. If used in media, it's incorporated at a rate of 5% to 10%. It's more common in natural and organic mixes.

Other components and some tips

The components described above are combined in a mix in large quantities, generally measured as a percentage of the overall volume. In addition to these components, additional products are added to a mix to moderate pH, add nutrients and improve water uptake. Another group of additives would be control products, such as bio-control agents (RootShield, as an example). These last two groups are incorporated into a mix in smaller quantities, commonly measured in pounds per cubic yard.

Organic mixes are made much the same way, but only components that are approved for organic production can be used. The same main components are generally used, but additives—such as fertilizers and wetting agents—are different. Therefore, physical properties will be the same, but chemical properties may be slightly different.

The newest additive that's being researched extensively and showing promising results for growing and propagating is silicon. Trials have shown increased and faster rooting in a number of different plant species, including both vegetable and flower seeds and vegetative cuttings. Addition of silicon to mixes as part of a fertility program is possible, but the silicon source (usually potassium silicate) is difficult to dissolve and cannot be combined with other fertilizers. Incorporation into media is a patented process, presently available in Sun Gro Resilience mixes.

Table 3. Impact of modifying media components.

Mix	Main Components	Total Porosity	Water Holding Capacity	Air Capacity	CEC (Nutrient Holding)
Standard Mix	80% Peat 20% Perlite	84.8	69.6	15.0	9.7
Grower A	60% Peat 20% Coir 20% Perlite	85.6	70.6	14.4	8.5
Grower B	80% Peat 15% Perlite 5% Vermiculite	85.3	71.2	13.9	9.7

When making or selecting a growing mix for propagation, it's best to keep things simple. Mix companies that have been blending propagation mixes for years have done extensive research and developed what should work best in most situations. Ideally, keep the component blend to two or three components (preferably two). One of the most popular mixes is a blend of fine peat and fine perlite, which works well in a variety of plug tray sizes. Perlite will tend to hold up better than vermiculite to the continuous application of water.

Finally, "tweaking" mixes in the hopes of dramatically improving physical properties can be difficult, costly and frustrating. Growers will often request increasing or decreasing a component by an additional 5% to attain what they think might be a better mix. They may, at times, actually attain the opposite of what they're looking to do or achieve their goal at the cost of other physical properties.

Table 3 shows the impact of changing some components in a mix and their actual impact on media physical properties. Grower A wanted to modify a standard plug mix to increase total porosity and water holding. That's been achieved, but at the cost of decreased air space and nutrient holding (CEC). Grower B insisted on adding vermiculite because they felt it could improve nutrient holding and air space. In fact, there was no improvement in nutrient holding and a large decrease in air capacity.

In summary, propagation is a very specialized part of plant production and is often less forgiving to issues in water quality, media properties or nutritional regimes. It's best to keep it simple and control our inputs the best we can. Starting with a simple and quality propagation medium is key. **GT**

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