HAWAII COOPERATIVE EXTENSION SERVICE
College of Tropical Agriculture and Human Resources
University of Hawaii
GENERAL HOME GARDEN SERIES No. 10

BASIC CHARACTERISTICS OF MEDIA FOR CONTAINER-GROWN PLANTS

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Plants require support, nutrients, and moisture from the media in which they are grown. The cheapest medium for plants is soil. However, many soils are not ideal for growing plants and require adjusting to provide "ideal" conditions.

Why Use Soil Amendments?

In Hawaii, the major problems with using only soil for growing media are: first, the limited supply of soil and, second, the variability of the soil that is available. Due to this variability, it is difficult to produce media of uniform characteristics and therefore plants of uniform quality. However, media with uniform characteristics can be produced in Hawaii by proper use of soil amendments to obtain the desired conditions for plant growth. Generally, amendments are materials used to adjust the physical and/or chemical properties of the media to provide "ideal" growing conditions for the plants.

Basic Characteristics of Media

The physical and chemical characteristics that should be considered for media are: drainage, aeration, water-holding capacity, available water, weight (bulk density), cation exchange capacity, reaction (pH), soluble salts, need for special treatment (such as extra nitrogen for some organic residues), and rate of organic matter decomposition.

Drainage and *aeration* are important, as it is necessary for excess water to drain from the media as fast as possible to allow proper aeration for plant growth. Generally speaking, if a medium remains waterlogged for a period of 24 hours, the potential growth of most plants will be reduced by 50 percent. *Water-holding capacity* is the total water retained in the soil against drainage. *Available water* is water that the plant can extract for its use. *Weight, or bulk density*, is important, as it reduces breakage or other damage to plants due to tipping. *Cation exchange capacity* indicates the nutrient-holding capacity of the medium, or its ability to retain plant nutrients against leaching when the excess water drains from the medium. *Reaction, or pH*, is a measure of the acidity or alkalinity of the media. Each plant has an optimum pH range at which the plant makes its best growth, and the pH of the media should be adjusted to provide for the particular plant to be grown. *Soluble salts* are sometimes found in soils or soil amendments used for growing media. This is especially true where the same medium is used for more than one crop. The most common source of soluble salts in containers is the fertilizer materials used. When organic amendments low in nitrogen are used, there will be a *need for special treatment*; nitrogen deficiency is present in plants grown in such a medium unless a source of readily available nitrogen is added to meet plant requirements. *Rate of organic matter decomposition* is important, because decomposition reduces the particle size of the organic matter and changes its effect upon aeration, drainage, water-holding capacity, and cation exchange capacity of the medium.

Amendments for Physical Properties

Materials generally used to improve the physical properties of media are inert materials, such as sand, vermiculite, perlite, volcanic cinders, and coarse organic residues. These inert materials improve drainage and aeration in the media.

In Hawaii, the most available inert material is coral *sand* (white beach sand). This sand is calcium carbonate (agricultural lime) and should not be used where high pH is undesirable or where plants remain in the containers for long periods, because the sand dissolves and results in poor aeration. *Vermiculite* is good for short-term use, but eventually it collapses and causes poor aeration in the media. *Perlite* is a good material with considerable porosity within each particle. However, the use of perlite is limited due to its light weight. *Volcanic cinders* are an excellent amendment in Hawaii, as they are relatively heavy and have high porosity within each particle. Cinders should be screened to remove cinders larger than ¼ inch in diameter, as these larger materials

cause excessive drainage in the mixture. Cinders should be washed thoroughly before use, to reduce high pH due to the presence of soluble calcium, magnesium, and sodium. The presence of large amounts of fine material, such as pumice, in cinders will cause poor aeration in the media by filling the large pore spaces and thus reducing drainage. Coarse organic residues, such as bagasse and redwood bark, generally hold more than their own weight of water, most of which is available, and increase the water-holding capacity of the mixture.

Amendments for Chemical Properties

Materials used to improve the chemical properties of media are peats, clays, and chemicals such as lime and sulfur. *Peats* increase the availability of water of mixtures by as much as 35 to 50 percent by volume and also possess high cation exchange capacity, thereby increasing the nutrient-holding capacity of the mixtures. The best peat is the sphagnum moss type. Many peats are decomposed to a varying degree. The more highly decomposed the peat, the lower its water-holding capacity and the more difficult it will be to rewet the dry material. Cation exchange capacity will be about the same after decomposition, depending upon the type of plants from which it has been derived. *Clays* are often added to media as part of the material used in the media. In Hawaii, there are three types of clays found in the soil: kaolinite, montmorillonite, and oxides. Most soils will contain varying proportions of these clays. Montmorillonite is an expanding type of clay and causes poor physical condition in mixtures and should be avoided where possible. The pH of media may be adjusted by the use of *chemicals*, such as lime to raise it or sulfur to lower it. Where coral sand is used in the mixture, lime will not be needed, as this material is a liming material. Use lime or sulfur as recommended, after a soil test has been made.

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Reprinted June, 1980—2M