noted that container depth directly affects the percent of the growth medium that is filled with air at container capacity. A growth medium for plants grown in a greenhouse, where control of the moisture level is possible, can have a greater water-holding capacity than a medium for plants exposed to natural rainfall distribution. During Florida's rainy season, plants may receive an average of one-half inch of rainfall per day for 30 days, which dictates using container media with exceptional drainage. Unfortunately, a medium with exceptional drainage also has relatively low water-holding capacities which requires frequent irrigation during drier conditions. This means that a container medium must be designed to reduce stress during the most severe conditions expected for a given environment. This directly influences the required management intensity.

The first consideration in the formulation of a growth medium is the appropriate balance between water-holding capacity and aeration. A more porous medium is required for a shallow container, such as for propagation, than for deeper containers typical of those used in the production phase. For outdoor production of woody crops, a drainable pore space equal to 20 to 30 percent of the volume provides the drainage buffer required for an extended rainy period. The corresponding water-holding capacity ranges from 30 to 50 percent. Greenhouse crops can be grown effectively in media with 10 to 15 percent drainable pore space and a much higher water-holding capacity. More intense management of the moisture relations is possible when rainfall effects are eliminated.

Once the desired characteristics have been determined and the available components selected, a medium can be formulated to meet those characteristics. At the present time the only method for determining the correct formulation is by trial and error, although researchers are in the process of developing computer assisted models to predict the medium characteristics based on measured characteristics of individual components.

A grower experienced with particular components knows the approximate component ratio required. For example, a woody plant grower in north Florida has available pine bark, peat and sand. Generally for outdoor production, a medium consisting of 15 to 25 percent by volume of a coarse sand or fine gravel is required to have the weight necessary to keep the containers upright when placed on open production beds. The percentage of pine bark and peat required to formulate a container medium with 25 percent air space depends most upon the particle size distribution of the bark. If the bark is composed primarily of particles in the range of 1/4 to 1/8-inch (0.63 to 0.32 cm) diameter with few fine particles, a medium of 60 percent pine bark, 25 percent peat and 15 percent sand would be an appropriate medium to start testing. If significant small particles are present in the bark source, less peat may be required. Once a sample of the test medium has been prepared, water-holding capacity and air space after irrigation and drainage must be determined in the container size for which the medium is being formulated. Step-by-step procedures for these determinations have been presented in Florida Extension Circular 556, Nursery Laboratory Development and Operation.

If water-holding and air space characteristics of a given medium are within the desired ranges, record this formulation in an appropriate record book and make plans to prepare the volume required for current needs. In most cases, the characteristics of the first trial medium will be outside the desired range. If the air space is too low, then more larger particles must be added to the formulation. In the above example, more pine bark and possibly less peat would be mixed in the next trial medium. Keeping good, permanent records of these procedures will reduce the need for future trials and ensure the medium will be formulated consistently with the desired characteristics. If trial medium air space is too high, then more small particles should be added to the next mixture. Peat or sand can be added to reduce the size and possibly the number of the larger pore spaces.

Such trial and error procedures should be repeated until the desired characteristics of media for various container sizes are achieved. The number of different media prepared for a particular nursery should be minimized. Only one growth medium formulation may be required for nurseries without tremendous diversity in container sizes, environmental conditions or plants. If a variety of container sizes, ranging from small to very large, and/or different environments exist within a single operation, media for the different production systems must be formulated.

Make sure the medium prepared in one batch has the same water-holding and pore space characteristics as the next batch mixed from a different load of components. The particle size distribution of each load of components should be tested. If the particle size distribution is the same as the load from which the medium was formulated, then the grower can confidently prepare the next batch using the same formula. However, if the particle size distribution is different on subsequent loads, the formula should be tested and adjustments made as required.