

the peat-perlite medium but subsequent root growth is still superior on those plants rooted in the peat-expanded shale medium. Another benefit in using the expanded shale product is its cost and handling features. Based on 1985 prices, we are saving about \$11.00 per cubic yard of raw material purchased. In addition, we do not have the dust problem in handling the product as we do with perlite and we do not need special storage facilities. The expanded shale product is brought in by tractor-trailer and stored outside in our media mixing area until needed.

In summary, development of a soilless medium necessitates the understanding of media properties and your crop needs. Each grower will have access to potential media ingredients that warrant consideration for use based on specific savings, availability, and specific characteristics they afford a growing medium. For our production system(s), the expanded shale product shows considerable promise.

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#### ROOTING MEDIA USED AT APPALACHIAN NURSERIES

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At Appalachian Nurseries, we produce a wide range of hardy ornamentals for sale as potted liners. At last count, our propagation schedule included 52 genera with 217 species and named cultivars. Because of this, we use four different media

for cutting propagation. I will review these today, including costs and how much each medium is used in our propagation program.

## PERLITE AND VERMICULITE

The first medium, and the one we use the most, is composed of perlite and vermiculite. This is used in the ratio of  $\frac{2}{3}$  perlite and  $\frac{1}{3}$  vermiculite in a layered configuration. We use this medium in our greenhouses with raised benches, which are 6 in. deep. Over a permanent gravel base, we place 2 in. of perlite, then 2 in. of vermiculite, and then another 2 in. of perlite on top. We use this medium for one year, starting in June with softwood cuttings and finishing in the winter with evergreen cuttings that are lifted in May. After one year's use, the medium is removed and the benches are disinfected and refilled. The theory behind using this medium is that the base of the cutting is stuck in the vermiculite, which retains more moisture and provides an ideal environment for new roots to form at the base of the cutting. The area above and below the roots stays moist but well drained, which under misting eliminates soggy or overly wet spots in the propagation bench. This is especially important, we feel, when doing softwood cuttings. This medium does become mixed over the course of its use, because of lifting rooted cuttings and releveling; however, the vermiculite level does retain some of its presence. This mixing is to our benefit when we come to sticking evergreen cuttings. The moist layer is then not as important, whereas a more homogenized mix works well for the hardwood evergreens.

Even after one year's use of this medium, we have experienced no disease problems. In the past, samples were sent to our state lab to culture for pathogens, all of which proved negative.

Cost for this medium was \$0.002 per cutting. This is based on 1985 prices for perlite of \$3.66 per 4-cubic foot bag and vermiculite at \$5.47 per 4-cubic foot bag, divided by the total amount of cuttings stuck from May to November. Major genera we root in this medium, starting from first to last, are:

Viburnum	Forsythia
Picea	Ilex
Euonymus	Rhododendron
Acer	Juniper
Berberis	Taxus
Cotoneaster	Thuja
Pyracantha	Chamaecyparis

Although the initial cost per yard may be high for perlite and vermiculite, when the cost is spread over a year's use the cost per cutting becomes very reasonable. In addition to being easy to handle inside the greenhouses, perlite and vermiculite provide a dependable medium which is sterile and uniform.

### PEAT, STYROFOAM, AND PERLITE

The second medium we use is a Canadian peat, styrofoam, and perlite mix at the ratio of 8 parts peat, 2 parts styrofoam and 1 part perlite. Captan and Aqua-Gro are added, the medium is mixed, and flats are filled for our evergreen azalea production. We stick approximately 60 cuttings per flat and place the flats on the greenhouse floor under mist. This works well for us, providing a good medium for rooting and growing on, since we do not lift these cuttings after rooting. The azaleas are sold the following spring in the same flat in which they were rooted. We root about 150,000 evergreen azaleas each year with this medium.

Based on our own tests, we switched to this mixture from a 50/50 peat and perlite mixture, since it proved to be far superior for rooting and is much less expensive. Cost for this medium per cutting was \$0.004 for 1985, based on peat cost of \$3.00 for a 3-cubic foot bale, styrofoam at \$4.16 per 8-cubic foot bag, and \$3.66 for 4-cubic feet of perlite.

### PEAT AND PERLITE

Our third medium is another peat-based one and consists of the following ingredients: 50% Canadian peat and 50% perlite. Captan and Aqua-Gro are added, and flats are filled for use in our outside mist area. We stick an average of 175 cuttings per flat in this mix. Genera rooted in this medium include: *Berberis*, *Cornus*, *Euonymus*, *Ilex* (Japanese holly cultivars), *Prunus* and *Viburnum*. After rooting, these cuttings are lifted and potted, which makes this medium a short-term, once only mix. Cost per cutting for this medium was \$0.002, based on 1985 prices for Canadian peat of \$3.00 per 3-cubic foot bales and \$3.66 for a 4-cubic foot bag of perlite.

### SAND AND PERLITE

The fourth medium we use at Appalachian Nurseries is a sand and perlite mixture (1:1,v/v) which is used in our 6 in. deep greenhouse benches. Hardwood evergreen cuttings are rooted in this medium over the winter after being stuck in November and December, and are lifted in May for potting or as rooted cuttings. We mix perlite with sand, because the locally available sand alone is not coarse enough for good

drainage and root formation. We incorporate just enough additional perlite each year to level the benches before sticking.

A drench of Dexon and Terrachlor at recommended rates is applied each year before cuttings are stuck in this mix. Since we do not replace this medium each year, the one-time replacement cost could be spread over approximately 5 years of useage, which makes the cost per cutting insignificant. We stick about 200,000 evergreen cuttings in this mix each year. Genera rooted in this medium are: *Chamaecyparis*, *Juniperus*, *Thuja*, and *Taxus*.

To summarize the media discussed above provide us with the necessary variations to accommodate the specific needs of the many genera of plants we are rooting. It is obvious from these figures that the number of cuttings stuck in each medium and/or the number of times the medium can be used will directly affect the unit or cost per cutting for each mix.

## **IMPORTANCE OF PROPER AERATION IN SOFTWOOD CUTTING PROPAGATION MEDIA**

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I would like to share some observations I have made at Zelenka Nursery over the past several years as our propagation medium has evolved. Several years ago, the basic requirements of a medium were that it be inexpensive and reusable, as long as no major problems occurred. Our system originally consisted of ground beds under poly, using coarse sand as a medium. At that time, we were sticking about 750,000 softwood cuttings per year and space was not a problem. To reuse the beds the next year, we would mix in some perlite and fumigate. This system gave us acceptable results until we ran out of room to expand. Each year since 1979, our softwood rooting propagation has increased by an average of 750,000 cuttings per year. Therefore, a method had to be developed to increase our production in the same amount of space. We adopted a heavy plastic flat, figuring to get at least two crops of cuttings rooted under the existing mist lines. However, the weight of the flats with the sand medium was a major problem. Each flat weighed over 90 pounds, which made careful handling almost impossible. I also observed that the rooting medium in a flat held more water than in a bed, and this