GROWING PLANTS IN COMPOSTED HARDWOOD BARK*

David S. Koranski

Producers of ornamental plants continue to need a uniform growing media in which plants thrive and will be economical. Peat, sand, perlite and bark are commonly used for amending soils. Sawdust and pine bark are very popular soil amendments in the south and southeast, while redwood bark, cedar bark and sawdust are widely used as a growing media on the west coast. All of these wood products are from softwood. Although considerable research has been completed on the softwoods, there is very little information the effect of these hardwoods has on growing ornamental crops.

Hardwood is wood produced by broad-leaved trees, such as maple, oak, and ash. Softwood is wood produced by coniferous trees, such as spruce, pine. and cedar.

The objectives of our study were:

1) Determine the effect of bark which was composted from 1 to 12 months on the growth and development of chrysanthemum 'Golden Anne'.

2) Evaluate the physical properties of the medias over time and at the different stages of plant growth.

*Miscellaneous Journal Series Paper No. ____ of the Minnesota Agricultural Experiment Station, University of Minnesota, St. Paul, MN 55108.

3) Compare the root systems of plants grown in bark composted for different time periods.

4) Determine the effect of ancymidol as a drench on retarding plant height.

Methods

The bark mix consisted of approximately 40 percent oak, 30 percent sycamore, 25 percent maple and 5 percent walnut. The bark medium contained approximately 5 percent wood fiber. The bark was hammermilled through 3/4-inch screen and placed in an 8' by 8' pile. The following chemicals were thoroughly mixed into the pile:

5 lbs ammonium nitrate per cubic yard
2 lbs potassium nitrate per cubic yard
5 lbs super phosphate per cubic yard
1 lb magnesium sulphate per cubic yard
1 lb iron sulphate per cubic yard

The moisture level of the pile was maintained at approximately 60 percent. A thermometer was inserted into the middle of the pile and whenever the temperature dropped below 160° the pile was turned with a tracter mounted scoop. A plastic cover over the pile prevented the salts from concentrating at the bottom of the pile. Nine different formulae of media were used in the study and were as follows: bark; bark-peat-perlite, 1:1:1; bark-peat, 2:1; bark-peat, 3:1; bark-soil-perlite, 1:1:1; bark-soil-perlite, 2:1:1; soil-sand-peat, 3:1,5:1; and peat-vermiculite, 1:1, the last two were controls. The peat, soil, sand, and vermiculite were added to the bark at time of potting.

Rooted cuttings of 'Bright Golden Anne' were planted monthly in 6-inch pots (5 cuttings per pot). These plants were fertilized at each watering with a solution containing a 25-5-20 fertilizer made up to 200 ppm of nitrogen. Greenhouse temperatures were maintained at 70°F daytime and 60°F at night. The experiment ran for a full year and data collected from the monthly rotations were date of flower, dry weight, plant height, flower number, and diameter of the total flower display.

1) Bark Only

Plants grown in bark only medium produced the lowest dry weight. Although good plants were produced with bark composted for 4 months or more, the quality of such plants never equalled that of those grown on the medium containing bark and peat.

2) Bark-Peat 1:1, 2:1

Plants growing in bark and peat 1:1 which had been composted for 1 month were saleable. The most attractive plants with maximum dry weight were those which had been grown in bark composted for 4 months. Composting the bark for greater periods had little effect on dry weight. All plants were attractive and saleable.

3) Bark-Peat 3:1

Saleable plants were produced from bark that had been composted for 2 months and peat mixed, but the maximum dry weight was obtained from plants grown on the mixture containing bark which had been composted for 6 months.

Time Needed to Compost

Excellent quality plants can be produced in bark which has been composted from 2 to 12 months. A limiting factor in obtaining premium quality plants with limited composting appears to be the concentration of peat in the medium. Plants grown in bark with peat and composted for more than 3 months have very vigorous root systems and active roots are observed during all stages of growth.

The additional cation exchange capacity contributed by the peat may be a factor which results in vigorous plant growth.

Physical Properties

Bark composted for 4 to 6 months was examined to determine the effects of particle size on plant growth. The particle sizes were divided into 5 groupings and included 1) 0.64 mm or larger; 2) 0.31-0.64 mm; 3) 0.16-0.31 mm; 4) 0.16 mm or less; and 5) control; 56 percent less than 0.5-0.1 mm and 13 percent greater than 2.5-3.0 mm.

Particle size was measured monthly over the 12 month period to determine the rapidity with which the particle size decreased with increasing composting time. At 10 months, 13 percent of the particles in the bark medium were more than 2.5 to 3.0 mm in diameter and 56 percent were less than 0.5 to 1 mm diameter. These results agreed with Slill's work (16). Composting for periods of greater than 6 months did not significantly alter the size distribution of the particles.

Effect of Time on Size

1) Bark composted for 4 months produced the best plants if 13 percent of the particles are greater than 2.5-3.0 mm and 56 percent are less than 0.5-1.0 mm in size.

2) Bark composted for 6 months produced excellent plants with 20 percent of the particle size less than 0.16 mm.

3) Poor growth of plants on bark media composted for less than 4 months may be associated with excessive pore space due to the high percentage of large particles.

4) Bark media containing air porisity of 25 percent will support good plant growth.

Influence of pH, on Ancymidol Interactions in Bark

The growth regulator anycmidol, is used to retard plant height but its activity in bark media is reduced or inhibited. It has been tested as a drench in different media but there is no information on the influence of pH of the media on activity of ancymidol. Data revealed that the activity of ancymidol is reduced at 4.5 and increased at pH 6.5. Plant response to the chemical is essentially the same in all 3 media at the same pH levels. Such results suggest that pH of the medium is probably more important than the physical characteristics of the medium itself in determining activity of ancymidol.

pH of the Bark

Preliminary studies showed that adding lime to hardwood bark resulted in a pH above 7.0 after composting, which is undesirable for growth of most plants; therefore lime is not added to our bark mixes. We then examined the effect of composting time on the pH. Our data indicate that the pH doesn't change appreciably after 6 months of composting. Our studies showed that an initial pH of 1 unit higher can be obtained by eliminating the iron sulfate from the compost pile.

Root Development

Root development was observed on a bi-weekly basis until flowering and was rated on a scale of 1 to 5 (1 best growth, and 5 poorest growth). These observations indicated that the vigor of the root systems of plants grown in the bark-peat mixtures equalled that of the controls if the bark had been composted for as little as 1 month. The root systems were superior to controls in those mixtures where the bark had been composted for at least 3 months. Plants grown in the bark only medium produce a vigorous root system if the bark had been composted for at least 5 months. We also found that keeping quality of the plants grown in the bark or bark-peat mixtures was extended as much as 14 days over the controls.

Summary

Bark is an economical and readily available medium with excellent water holding capacity. It has a naturally neutral or near neutral pH, is well drained and well aerated and contains many of the essential minor elements. Other investigations indicate that bark suppresses the development of many plant pathogens, including nematodes (5, 12).

Bark as a container medium should be composted in a pile 8' high with the moisture content maintained at approximately 60 percent. Whenever the temperature drops to 160°F, the pile should be turned. The bark needs to be supplemented with (on per cubic yard basis) 5 lbs ammonium nitrate, 2 lbs potassium nitrate, 5 lbs super photphate, and 1 lb magnesium sulfate. Prolonging the composting process for a period of time of 6 months or greater probably promotes a better root system.

Other characteristics for production of the best plants include a distribution of particle size of 10 percent of 2.5 to 3.0 mm, 20 percent of 0.5 to 1.0 and 25 percent of less than 0.16 mm with a porosity of 20 to 25 percent. A complete fertilizer of 20-20-20 should be used for growing chrysanthemums in mixtures of hardwood, bark and peat. If peat is added to the bark in preparing the plant growing medium, the composting should be for at least 4 months. At least 9 months composting is necessary if the composted bark is to be used alone as a plant growing medium in order to achieve optimum development of roots and shoots.

* *