Fiber Pots with Spin Out for Nursery Crop Production©

John M. Ruter
University of Georgia, Dept. of Horticulture, Coastal Plain Station, Tifton, GA 31793-0748

INTRODUCTION

Nurseries have been using pots made from recycled paper fiber for years. Fiber pots have been traditionally used in the northern states for short-term crops like chrysanthemums, bare-root material such as roses and fruit trees, and for field-grown shrubs. In the southeast, however, fiber pots quickly deteriorate and were not accepted as a viable alternative for commercial production.

Copper compounds have been used since the 1970s to inhibit root growth in container-grown plants. In the early 1990s, Spin Out (copper hydroxide) was approved for controlling root growth in containers. Copper works by causing a mildly toxic reaction when root tips come in contact with copper-containing surfaces. Since most root tips are not killed, the benefit of coming in contact with copper is increased root branching. Plants grown in pots treated with copper hydroxide do not have malformed root systems or roots matted against the substrate: container interface.

Back in the mid 1980s, copper was first put into fiber pots for the purpose of controlling root growth. An added benefit of this addition has been an increase in the longevity of the pot as well. Fiber pots treated with approximately 3000 mg kg^{-1} (ppm) copper hydroxide have maintained their structural integrity for up to 2 years when placed on woven ground cloth under nursery conditions in south Georgia.

The following are some advantages of growing crops in fiber pots treated with copper:

- Porous fiber allows for exchange of oxygen with the substrate;
- Insulation against temperature extremes;
- Increased survival of sensitive species;
- Pots are biodegradable;
- Increased pot longevity;
- Works with numerous species.

Since fiber pots are porous, they allow for the exchange of oxygen through the walls of the pot.This exchange does not occur with plastic pots and therefore plants which are sensitive to low substrate oxygen levels suffer. High substrate temperatures in the summer also increase the demand for oxygen since root respiration increases. The combination of high substrate temperatures and low substrate oxygen levels is not good for plant growth. Maximum substrate temperatures are often up to $10^{o}C$ ($18^{o}F$) lower in fiber pots compared to conventional black plastic containers. Lower substrate temperatures increase plant survival and quality while increasing the longevity of controlled-release fertilizers.

Fiber pots treated with Spin Out are still biodegradable. Since they contain copper they need to be removed from the root ball at planting. Copper-treated fiber pots should be broken up into small pieces and incorporated into the planting hole at the time of transplanting. Most of the copper in the fiber pots is not biologically active in the soil since it is bound to the organic matter in the pots. Over 8000 #1 containers (3.8 liter) could be composted over an acre of land and this would be equivalent to a season-long application of a 50% metallic copper fungicide applied at the rate of 2 lbs ac^{-1}.

The life span of pots treated with Spin Out increases dramatically. Very little copper leaches from fiber pots treated with Spin Out. We examined the copper concentrations in a #1 fiber pot after several months on a production bed. The lowest copper concentrations were measured on the bottom of the pot (3191 mg kg^{-1}), with the bottom third having 3,484 mg kg^{-1}, the middle had 3679 mg kg^{-1}, and the top rim had 3464 mg kg^{-1} copper. These measurements show that copper migrates upward as water is wicked up through the fiber but very little is lost through leaching. Spin Out-treated fiber pots also hold up better under shipping than do nontreated pots. Plants grown in fiber pots at a nursery in California for several months were stack-shipped 2800 miles across country and arrived in great shape.

The following plants have shown improved growth in my research trials when produced in Spin Out-treated fiber pots:

- *Abelia* ×*grandiflora*
- *Berberis* sp.
- *Buddleja davidii* 'Monite'
- *Chamaecyparis obtusa* 'Crippsii'
- *Coreopsis verticillata* 'Moonbeam'
- *Dendranthema* sp.
- *Hemerocallis*
- *Hosta* sp.
- *Ilex* ×*meserveae* Blue Princess® holly
- *Juniperus* ×*pfitzeriana* 'Gold Star' (syn. *J. chinensis* 'Gold Star')
- *Leucothoe fontanesiana* 'Rainbow'
- *Pieris japonica* 'Mountain Fire'
- *Plumbago auriculata*
- *Prunus laurocerasus* 'Otto Luyken'
- *Syringa* cultivars
- *Thuja occidentalis* 'Little Giant'
- *Viburnum* 'Shasta'
- *Weigela florida*

Some disadvantages of using fiber pots have also been noted:

- Bulky,
- Pots nest together tightly,
- Cost of pots and shipping is increased,
- Not all species appear to benefit.

Fiber pots, having thicker container walls compared with converted plastic containers are bulkier and therefore take up more shipping and storage space. Growers have also noted that the pots tend to nest tightly together during shipping. This makes it difficult to separate the pots when potting. Western Pulp Products (Corvallis, OR) is currently working on the nesting problem.

Since Spin Out treated fiber pots are relatively new the cost of each pot is higher than for plastic containers. The cost of fiber pots will decrease as demand increases. Another cost is associated with shipping. Spin-Out-treated fiber pots are currently manufactured in Corvallis, Oregon. Shipping costs to the eastern United States can be as much as the cost of the pots themselves. On larger pots (#15 or #20s), the cost can actually be lower than for plastic containers due to considerably less wax being used during the manufacturing process. Crop quality and percentage of saleable plants must also be factored into the cost of the pot. If the percentage of salable plant

material increases, as an example from 50% to 90%, you have more than covered the increased cost of a fiber pot.

Not all species we have tested have benefitted from fiber pots. Some plants showing little benefit from production in fiber pots include certain cultivars of barberry, dianthus, juniper, and viburnum. I have not seen as many benefits when plants in fiber pots are grown under conditions of less than 70% light transmittance. This is probably due to the reduced solar radiation load on the pots. Production advantages for plants grown in fiber pots under shade are related more to increased aeration of the substrate. Most of the work conducted to date has been with 18 × 18 cm (7 × 7 inch) (full #1) pots. Growth responses have not been as dramatic in #3 and #7 fiber pots as they have been with #1 pots.

RESULTS

Garden Mums. Three cultivars of garden mums were grown in Spin-Out-treated fiber pots or black plastic containers. Plants grown in fiber pots had increased growth indices of 10% to 21%, increased shoot dry masses of 29% to 42%, increased root dry masses of 36% to 78%, and 30% to 53% more flower buds per plant.

Daylilies. The selections 'Aztec Gold' and 'Stella de Oro' were grown in black plastic or fiber pots. Plants of 'Aztec Gold' grown in fiber pots had 204% more foliage dry mass, 334% more root dry mass, and a 45% increase in fan production. Plants of 'Stella de Oro' had 87% more flowers when grown in fiber pots compared with plastic containers.

Leucothoe. Plants of *Leucothoe fontanesiana* 'Rainbow' grown in fiber pots were 27% larger, had shoot dry masses that increased by 104%, and plant quality ratings that increased by 77%. The percentage of the root ball remaining intact at harvest was 66% for plants grown in fiber pots compared to 22% for plants in plastic containers.

Pieris. Plants of *Pieris japonica* 'Mountain Fire' grown in fiber pots increased 44% in height compared to plants in plastic containers. Percentage of the root ball remaining intact at harvest was 96% for fiber pots compared to 8% for plastic. Few roots emerged from the original liner when plants were grown in plastic containers, while roots grew throughout the substrate when produced in fiber pots.

Lilac. The cultivars 'Angel White' and 'Lavender Lady' were grown in #1 black plastic or fiber pots for several months before being shifted into #3 fiber pots and grown for a season. Plants of 'Lavender Lady' originally grown in fiber pots had 36% more shoot dry mass at the end of the study compared to plants grown in plastic containers. It was noted that three of the four original plants of 'Angel White' grown in plastic containers defoliated soon after shifting due to root rot. Final shoot dry masses for 'Angel White' originally grown in fiber pots were 82% greater at the end of study. Three of the four original plants of 'Angel White' grown in plastic containers had no new root growth at the time of harvest.

Viburnum. The cultivars 'Chesapeake' and 'Shasta' were grown in plastic and fiber pots for 12 months. Container design had little influence on the growth of 'Chesapeake'. When grown in fiber pots the height of 'Shasta' viburnum increased 71%, shoot dry mass increased 89% while root dry mass increased 85%. Root ratings were also higher for 'Shasta' when produced in fiber pots.

Holly. The selection Blue Princess® holly was grown in fiber and plastic pots for several months before harvest. Plants produced in fiber pots had increases of 18% for shoot dry mass and 25% for root dry mass. Growth indices were not influenced by container type, indicating that plants produced in fiber pots had denser canopies. Root : shoot ratio was not influenced by container.

Conifers. The shoot and root dry masses of *Chamaecyparis obtusa* 'Crippsii' increased 76% and 64%, respectively when grown in fiber pots. Plants in fiber pots had roots to the bottom of the container whereas plants in plastic containers only had roots in the upper 5 cm of the substrate. Shoot dry mass of *Juniperus chinensis* 'Gold Star' increased 29% when produced in fiber pots. Root dry mass of 'Gold Star' was not influenced by container. For *Thuja occidentalis* 'Little Giant', root dry mass increased 60% in fiber pots, foliage color was darker green and roots were present throughout the depth of the substrate.

CONCLUSION

Are Spin-Out-treated fiber pots necessary for all crops? The answer is no. However they may be the solution for the 2% to 5% of the crops that you wish you could grow better. Any species sensitive to high substrate temperatures and low oxygen levels may show improved growth and quality when produced in a Spin-Out-treated fiber pot.

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