NURSERY PRODUCTION METHODS FOR IMPROVING TREE ROOTS - AN UPDATE

by Bonnie Lee Appleton

Abstract. Tree roots are often heat-killed and/or grow in undesirable circling patterns during nursery production. New alternative nursery production methods that address these production problems are presented including the Geocell™, the CELLUGRO System™, the EFC™ container, and the AGS container. An update is also provided on pot-in-pot, low profile containers, the Soil Sock container, and the use of SpinOut™ to reduce root circling.

One of the best ways to improve tree transplant success is to start with a tree with a well developed, as intact as possible, root system. The nursery industry continues to develop new production methods that encourage the growth of more fibrous roots, preserve more roots at harvest time, prevent root circling in production containers, and prevent root mortality due to thermal heat loading. Three reviews of these methods have been published (1,2,3,), but since that time several new production methods, and results of ongoing research, have become available.

In-ground Production Alternatives

In-ground fabric containers. Nurserymen are constantly striving to develop in-ground production techniques that make tree harvesting easier relative to labor, and that reduce the loss of roots as occurs with conventional field digging. One method that accomplishes both of these objectives involves the use of in-ground fabric containers, originally developed by Reiger and Whitcomb (9).

Several in-ground fabric containers, using various designs and fabrics, have been produced by both of these inventors. All of their fabric in-ground containers are removed from the field at harvest, with the containers not being removed until trees are transplanted.

A new in-ground fabric container is made from Biobarrier™, a product composed of Typar geotextile and Treflan herbicide (Reemay Inc., Old Hickory, TN), known for its use in redirecting tree roots to prevent pavement buckling (6,13) (Figure 1). While this new in-ground fabric container - the Geocell™ - still allows for the lateral exchange of water between the native soil in and surrounding the container, it differs from the previous in-ground fabric containers in that the herbicide keeps the roots from growing through the fabric into the surrounding soil (personal communications). No root loss should occur at harvest with the use of the Geocell™, whereas up to 20% of roots may be lost using the previous in-ground fabric containers (14).

At harvest the Geocell™ container often stays behind in the production hole, or is removed and reinstalled in the hole for up to 10 years repeat use (according to the manufacturer). The Geocell™ is not used, as are the other in-ground fabric containers, for root ball protection and tree shipping/marketing. Root balls of trees grown in the Geocell™ can be shrink or stretch wrapped prior to shipping.

Pot-in-pot. A refinement has been made in the

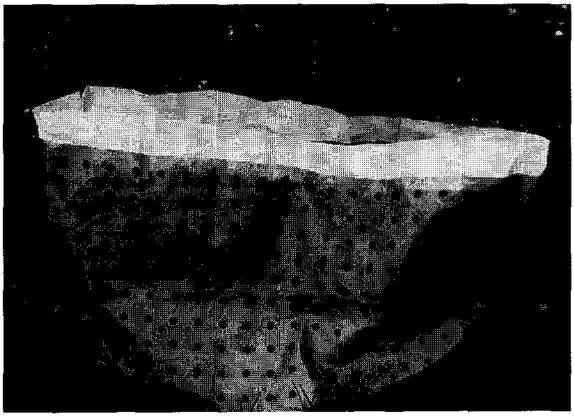

Figure 1. The Geocell™ in-ground production container planted with red maples.

Figure 2. The in-ground pot-in-pot production system.

use of the in-ground, double plastic pot system called "pot-in-pot" (8) (Figure 2). To help prevent root escape through the drain holes of the production (inner) pot, both Biobarrier™ and SpinOut™ (the copper compound used to prevent root circling in containers) have been shown to be effective (7, 10). If roots escape from the production pot they often grow through the drain holes in the holder or socket (outer) pot and into the surrounding soil, making harvest very difficult.

In-ground multi-plant production unit. No in-ground nursery production systems have been commercially available until now to facilitate growing multiple plants in the same production unit. Such a unit - the CELLUGRO System™ - has been developed at Hunter View Nursery, Finksburg, MD, to reduce labor, production space, and water, herbicide and fertilizer use. In addition the unit provides winter cold and summer heat protection (primarily to the root system), helping to extend the growing season and accelerate growth. Blow-over problems, such as occur with container production, are prevented, harvesting is easy, and post-harvest use possibilities are increased (personal communications).

The CELLUGRO System™ unit is installed in the ground in an 8 ft x 20 ft area. Each unit has 561, approximately one gallon size cells, in which trees and other plants can be grown (Figure 3). The author's unit has been in the ground and planted for 6 months (Figure 4). Despite new record setting heat during this period of time

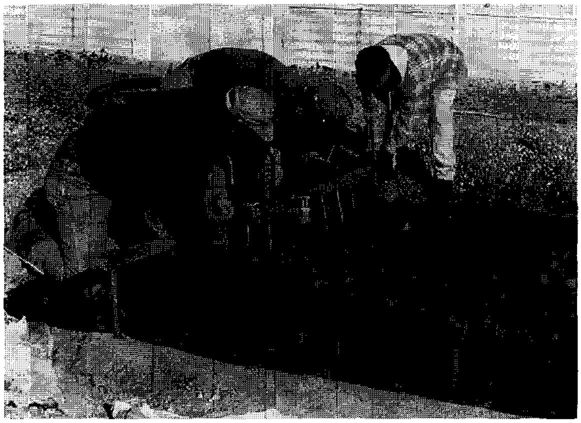

Figure 3. Installation of the production units for the Cellugro™ System.

Figure 4. Planting the Cellugro™ System.

(summer 1995), the unit has been watered only four times with less than 5 in of water, as compared to equivalent-sized pots containing the same plants on a conventional container bed that are irrigated daily with approximately 0.5 in water per irrigation (approximately 50 in of water during the same time period). Several of the species in the CELLUGRO System™ are now taller and/or fuller than the equivalent plants in conventional containers.

Above-ground Production Alternatives

Modified container designs. A relatively new container - the EFC™ (Environmentally Friendly Container) - has drain holes that are approximately 2.25 in up on the side wall above the bottom of the

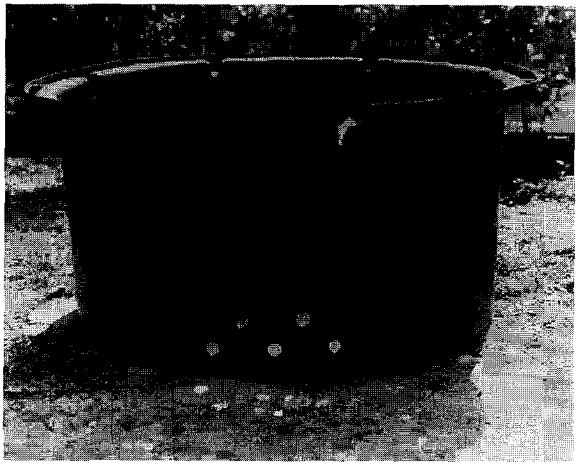

Figure 5. The EFC™ container.

container (Figure 5). This is different from standard containers that have drain holes in the bottom, and at the bottom/side wall interface.

The intent of the higher drain holes is to maintain a water reservoir in the bottom of the containers to improve water use, and possibly also to help acclimated plants that might be transplanted into wetland or poorly drained soil sites. Added advantages that were seen when these containers were tested were accelerated growth, reduced drought stress, reduced nutrient leaching, and root pruning that reduced root circling (12).

Above-ground pot-in-pot. A major problem of producing plants in single plastic pots above ground is thermal heat loading. Temperatures that are lethal to roots (above 104 degrees F) can develop within the medium in the containers due to the sun hitting the containers (5). A new double plastic pot system designed for above-ground use is the AGS - Above Ground System (Figure 6). During the summer the AGS helps to prevent thermal heat loading due to the buffering air space between the two containers, thereby reducing root kill. During the winter temperature buffering occurs that can reduce the need for more costly overwintering measures, and increase root survivability.

An additional problem that the AGS helps to reduce is container blowover, especially of large trees in containers. The AGS has been tested in winds up to 55 mph without blowing over (personal communication), thereby reducing labor to stand containers back up, reducing plant damage, and keeping fertilizers and herbicides that might be top dressed from spilling out of the container.

Figure 6. A single container (foreground) being compared with the AGS double containers.

Low-profile containers. An addition has been made to one of the types of low-profile containers, The Accelerator™ (Figure 7). An "anchor fabric" panel has been added to help eliminate blow-over by allowing small diameter roots to secure themselves in the soil beneath the unit. The fabric panel, which strips off easily at transplant time, serves as a container bottom without impeding downward drainage of water.

Soil Sock containers. The author has been evaluating this interesting above ground production container that is a combination of a wire basket and a foam liner, designed to be planted intact at transplant time (Figure 8). Red maple liners were planted in these containers in the spring, and by fall a mat of very fibrous, air-pruned roots had developed in the medium just behind the liner.

The entire production units were then transplanted to the field (per manufacturer instructions)

Figure 7. The Accelerator™ being used on a pallet.

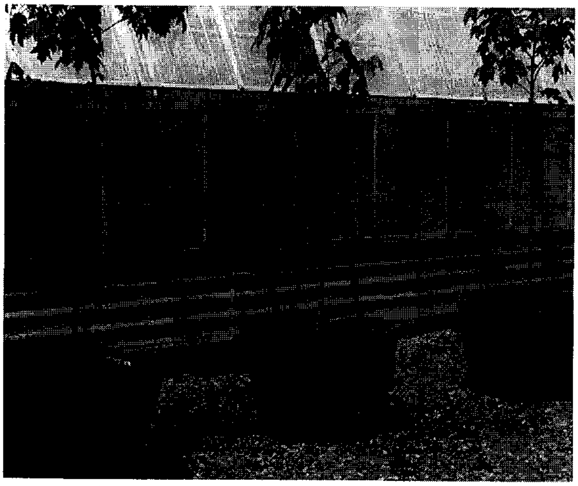

Figure 8. The Soil Sock container.

and allowed to grow for 1.5 years before excavation. Not only had small fibrous roots grown through the foam liner when the trees were dug, but larger diameter (over 3/4") roots as well. Roots had penetrated the surrounding soil to a distance of at least three times the ball diameter and crown spread (Figure 9). This relatively obscure production/marketing/transplanting system deserves far greater attention by the nursery/landscape/tree care industry.

Copper-coated containers. Good results

Figure 9. Roots of the tree transplanted in the Soil Sock have grown several times out beyond the container and the dripline.

Figure 10. Goldenrain tree grown in a container with SpinOut™ (left) and without SpinOut™ (right).

continue to be published (11), and reports received from nurserymen (personal communications) concerning the copper-based product SpinOut™ that is used to treat the interior walls of containers to reduce root circling (Figure 10).

The author developed a concern about the use of SpinOut™, however, after visiting a nursery and observing that in an attempt to reduce costs, the nursery was applying the product only in stripes and not fully coating the container interior. The concern was that the stripes would be ineffective in reducing root circling, and as a result a small research test was initiated.

Figure 11. Roots of Amur maple in many cases grew right across the stripes of SpinOut™ (right), or showed evidence that they soon would (left).

The test, using Amur maple, crape myrtle, and goldenrain tree, conclusively showed that applying only stripes of SpinOut™ is not effective in stopping root circling, with roots of most species growing over the copper stripes either during production or once transplanted to the landscape (4) (Figure 11). It is the author's recommendation that the interior of containers be totally coated with SpinOut™ if the desired effect of stopping root circling is to be obtained.

Significance to the arboricultural industry

Arborists continue to cite poor root systems as a major reason for tree decline and death. New alternative nursery production methods are continuing to improve the root systems of trees by reducing root kill during production, encouraging the production of more fibrous root systems, reducing root circling, and better acclimating roots prior to transplanting to urban conditions. Whenever possible arborists should supply information about these new production alternatives to those who are writing tree planting specifications, and those who are actually purchasing trees for transplanting in order to obtain the best trees and tree roots available.

Sources of Nursery Production Alternatives

GeoCell™ - EaCon Industries, Inc., 7853 South Leewynn Court, Sarasota, FL 34240; (941) 379-7978.

Cellugro™ - ACF Environmental, 1801-A Willis Road, Richmond, VA 23237; 1-800-448-3636

EFC™- IEM Plastics, PO Box 1975, Reidsville, NC 27320-1975; 1-800-222-7564; (919) 342-0356

AGS - Nursery Supplies, Inc., 1415 Orchard Drive, Chambersburg, PA 17201; 1-800-523-8972; (717) 263-7780

The Accelerator™- Hold Em, Inc., 1283 Ranchette Road, West Palm Beach, FL 33415-1439; (407) 683-7626

Soil Sock - BetterBilt Products, PO Box 559, Addison, IL 60101; 1-800-544-4550

SpinOut™- Griffin Corp., PO Box 1847, Valdosta, GA 31603-1847; 1-800-237-1854

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Résumé. Au cours de la période de production en pépinière, les racines d'arbres sont souvent détruites par la chaleur ou encore croissent en cerclant dans les contenants. De nouvelles méthodes alternatives de production qui proposent des solutions à ces problèmes sont présentées incluant le Geocell, le Système CELLUGRO, le contenant EFC et le contenant AGS. Une revue est aussi faite d'autres méthodes de production comme le pot-en-pot, le contenant à profil bas, le contenant Soil Sock et l'emploi de rainures pour diminuer le cerclage des racines.

Zusammenfassung. Während der Baumschulproduktion werden Baumwurzeln häufig durch Temperatureinwirkungen getötet oder sie wachsen mit unerwünschten Würgewurzeln. Hier werden alternative Produktionsmethoden, einschließlich Geocell, CELLUGRO System, der EFC Container und der AGS Container vorgestellt, die diese Probleme ansprechen. Außerdem werden aktualisierte Informationen über die Topf-in-Topf-Methode, die Niedrigprofil-Container, die Soil Sock Container und den Gebrauch von SpinOut, eines Systems zur Reduzierung von Würgewurzelentwicklung geliefert.