UK COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF KENTUCKY — COLLEGE OF AGRICULTURE

Pot-in-Pot Nursery Production

Introduction

"Pot-in-pot" describes a nursery production system that uses containers (production pots) placed inside permanent in-ground containers (socket pots). Pot-in-pot is used for the production of caliper-sized shade trees, flowering trees, and large shrubs. The pot-in-pot system combines many of the benefits of field production with the marketing flexibility of container production. Container-grown plants can be sold at any time of year and with relatively short notice, whereas harvesting of field-grown plants requires more planning and is typically not done during the summer or extremely wet periods. Advantages of pot-in-pot versus above-ground container production include: root protection from extreme hot and cold temperatures, greater pot stability for reduced tipping over, and ability of plants to both grow and overwinter in a single fixed location.

Marketing

Nursery crops are marketed in several different ways:

➤Retailers market directly to the end consumer, typically homeowners. This is most commonly done either through retail nurseries, which produce some or all of their own plant material, or garden centers, which purchase their inventory from a wholesale nursery. These businesses must be conveniently located for consumer access, ideally near urban or high-traffic areas. Retail nurseries additionally require adequate space and facilities for production, either on-site or at a nearby location.

➤Mail-order nurseries also sell directly to the end consumer, but their plants are shipped directly to the customer rather than sold at a retail outlet. This is a great option for nurseries that produce specialty plants and whose customers are plant enthusiasts located across the country or globe. The vast majority of mail-order nurseries sell either bare root or small container-grown plants (1-gallon containers or smaller) due to high shipping costs and difficulties in packaging, but larger plants can also be sold by mail-order nurseries if they are highly valuable.

➤Wholesalers produce plants that are typically sold in large batches at significantly lower prices to landscapers, retailers, or other nurseries that grow and resell the material at a larger size. Wholesale production is most efficient and profitable when a limited number of plants are grown in large numbers.

➤Re-wholesalers purchase large orders of various plants from wholesale producers and resell the plants to landscapers requiring diverse but smaller orders.

➤Landscape nurseries produce plants for their own in-house

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landscaping service, but may have a retail outlet as well.

Licenses and Shipping Regulations

Any business that sells plants capable of overwintering outdoors must obtain a nursery or nursery dealer license. In addition, businesses that sell plants to out-of-state customers should also obtain a license, regardless of the plants' ability to overwinter. In Kentucky, these licenses are obtained from the Office of the State Entomologist. Additionally, shipment of plants or plant parts to other states or countries can, in many cases, require a Phytosanitary Certificate. Nurseries can contact the Office of the State Entomologist to determine if a certificate is needed and how it can be obtained.

Market Outlook

The nursery business is driven by new home construction and healthy consumer spending, which have both been sluggish since 2006. A weak economy and relatively high input costs, especially labor, resulted in another weak, though slightly improved, 2012 marketing season. Demand remains subdued for most green products, particularly trees, shrubs, and sod. Nursery producers will want to develop a business plan that takes into account the potential for a slowing economy and uncertain housing market such as that experienced in 2008.

Economic recovery and recovery of housing starts improve the outlook for the nursery industry. The green industry should see a modest rebound in 2013 as the economy moves toward recovery, at least in terms of housing starts. While nursery firms are continuing fairly conservative business strategies, 35 percent indicated in 2012 that they were planning some capital improvements this year with a view toward future growth.

Production Considerations

Site selection

Internal soil drainage is the primary consideration for pot-in-pot production. Drowning of plants when socket pots fill with water is one of the most common reasons for system failure. Most Kentucky soils do not drain well so a drainage system will need to be installed under the socket pots.

A reliable source of clean, pest-free water is another important consideration in selecting a suitable location. The ideal site will have a slightly sloping topography (1 to 2 percent) and offer water drainage to a pond or retention basin for recycling back to the crop. Avoid fields with hardpans and those that could flood periodically. Sites where cold air accumulates (frost pockets) should only be planted with cold hardy species.

Installation

Installation of socket or in-ground pots requires considerable planning and preparation. The socket pot and production pot need to be compatible units that are manufactured specifically for this purpose. The size of the in-ground pot not only determines the size of the production pot, but also the size of the plants that can be grown.

Holes for the socket pots can be dug individually using the auger method if the soil is well-drained. The trench method is used where sites are poorly drained. In this case, drainage tiles are laid in the bottom of a trench, with socket pots placed directly over the tiles. Regardless of the excavation method, socket pots are permanently buried with only the top rim of the pot extending above ground level. Any weed control fabric that will be used in the planting area is laid after the socket pot installation has been completed. The fabric is stretched over the pots and secured at the edges. An x-shaped cut is made into the fabric prior to placing the production pot into the socket pot. The production pot containing the tree or shrub in a customized soilless growing substrate is then set into its in-ground pot.

Rooting-out (growth of roots through the pot's drainage holes) can be a significant problem in pot-in-pot production. Rooting-out slows harvest by making it very difficult to remove the inner pot from the socket pot. Reducing root escape can be a challenge, and different mechanical and chemical methods have been attempted with varying success. Refer to University of Tennessee handout, *The Pot-in-Pot (PNP) Production System,* for suggested solutions.

Crop selection
The pot-in-pot system can be used for any tree or shrub that can be grown in containers. Because of the labor and expense required for pot-in-pot installation, it is best to select higher value crops that will bring in greater returns. As is true for any outdoor nursery, the selected species and cultivars must be well adapted to local climatic conditions.

Growing media
The most frequently used growing medium for container production is aged pine bark. Peat and sand are common amendments used in varying amounts. It is important that media be well drained. Mixes remaining overly wet for prolonged periods can result in root death from lack of oxygen or root rot. Media that dries out is difficult to re-wet and will also inhibit root development.

Maintenance
Supplemental water is provided via trickle emitter or spray stake irrigation systems that direct water into each individual container. To maximize irrigation efficiency, plants with similar water requirements should be grouped together. Nutrients are generally supplied using a controlled-release fertilizer incorporated into the growing mix.

Woody plants grown for the landscape trade tend to require specialized pruning. Nursery-grown trees and shrubs are pruned to control size, thin canopy, and improve quality. Shade trees are often pruned in both winter and summer to ensure that a central leader is maintained and the shape of the tree canopy is in proper proportion to the trunk. Shrubs are pruned regularly to establish a height and density for the planned market. Trees may need to be staked to maintain a straight trunk.

Pot-in-pot plants do not require winter protection in Kentucky if the pot-in-pot system is installed correctly. Insulating native soil must come up to the brim of the pot, and there must be a tight seal between the two pots, as well as between the socket pot and the ground.

Pest management
Insect and disease pests vary, depending on the plant species and cultivar. Management requires integrated pest management (IPM) strategies, such as planting resistant cultivars, scouting for pests, managing irrigation times, and practicing best management practices.

A vegetation-free area needs to be maintained around trees and shrubs in pot-in-pot production. Landscape fabric may be placed over the production area to reduce weed pressure. Alternate methods of weed control include hand weeding, mowing, mechanical cultivation, mulching, and chemical methods. Strategies for managing weeds between rows (row "middles") include cover cropping (most often with fescue or crimson clover), mowing, mechanical cultivation, and chemical methods.

Algae can be a serious problem in irrigation systems and in ponds serving as sources of water. Two major contributing factors are over-fertilization and over-irrigation, which increase nutrient run-off into ponds. Shallow, stagnant water also increases algal growth in ponds, so shallow areas may need to be dredged and deepened.

Harvest
Pot-in-pot plants are generally sold as finished plants with all the characteristics expected in the market place regarding form, size, branching, and trunk size. Plants in their production pots are lifted from the socket pot and can be quickly harvested any day of the year. The time it takes for plants to reach a saleable size varies depending on the type of plant and growing conditions.

Plants can be grown in a single container for only a limited length of time. Pot-in-pot nursery crops are generally rotated through production on a three-year cycle. Plants must be repotted to a larger container before they outgrow their

current container, otherwise plant quality is greatly reduced and plants become unsalable. Severe root escape can also make removal of the production pot extremely difficult, and costly damage to the pot-in-pot system may become unavoidable.

Labor requirements

Labor is required for potting, pruning, irrigating, controlling weeds, staking, applying pesticides, and harvesting. The level of management for pot-in-pot is intermediate between the low demand of field production and the higher demand of container-grown plants. Approximate per tree labor requirements include 10 minutes for planting, 30 minutes for pruning, 30 minutes for maintenance, and 5 minutes for harvest.

Economic Considerations

Beginning a nursery business requires a large capital investment, even if land does not need to be purchased. The greatest drawback of pot-in-pot production is its significantly higher initial expense compared with other production methods. The main expenses involved in establishing a pot-in-pot site include the drainage system, socket containers, irrigation system, and socket pot hole excavation. Other expenses common to the nursery industry include equipment, buildings, supplies, plant material, irrigation system, labor, utilities, insurance, licenses, and inspections. With the large overhead investment required, a pot-in-pot nursery will usually take 6 or more years to be economically profitable.

Despite the large start-up costs, overall return for pot-in-pot has been reported to be equal to or greater than conventional field or above-ground container production. A grower must be prepared to make substantial investments for several years before realizing any positive returns. Pot-in-pot production is extremely sensitive to sale price. 2008 estimates indicate consistent sale prices below $50 are financially risky for this production system. It can take 2 to 4 years of operation before significant returns can be expected and an additional 3 to 5 years before showing a profit. The nursery operator will need to be able to handle the cash flow ups and downs associated with seasonal sales. Refer to the table, below, for 2012 per acre budget estimates for pot-in-pot production (1,144 red maple trees per acre for a western Kentucky market).

Selected Resources

- Kentucky Office of the State Entomologist (University of Kentucky)
http://www.uky.edu/Ag/NurseryInspection/
- Marketing Your Nursery (University of Kentucky, 2013)
http://www.ca.uky.edu/HLA/Dunwell/marketingyournursery.html
- Nursery Crop Production (University of Kentucky, 2013)
http://www.ca.uky.edu/HLA/Dunwell/Nlgetstart.html
- Nursery Crops (Win Dunwell's page) (University of Kentucky)
http://www.ca.uky.edu/HLA/Dunwell/win1.html

Item	2012 Estimates
Installation costs[1]	$33,350
Planting costs[2]	$22,188
Production costs[3]	$18,542
Harvest costs[4]	$7,087
Returns[5]	$48,915
Return Above Annual Costs (Year after installation)	$10,368

University of Kentucky per acre budget estimates (2012) for pot-in-pot production of 1,144 red maple trees grown in 1 acre for a western Kentucky market.

[1] Includes sockets, fabric, and irrigation system
[2] Includes liner, insert pot, labor, media, and stakes
[3] Includes pesticides, irrigation, and labor for 2 years
[4] Includes labor, etc.
[5] Based on 1,087 trees marketed at $45 per tree

- Physical and Economic Requirements for Pot-in-pot Nursery production (University of Kentucky, 1996) http://www.ca.uky.edu/HLA/Dunwell/PNPMCN.html
- Plant Material Shipments: Federal and State Plant Protection Regulations Relevant to Your Nursery Business (University of Kentucky, 2011) http://www.ca.uky.edu/agc/pubs/ho/ho99/ho99.pdf
- Pot-in-Pot Nursery Production (University of Kentucky, 2011) *video* http://www.youtube.com/watch?v=wNeBurkznIk
- Pot-in-pot Nursery System Cash Flow Worksheet (University of Kentucky, 2009) http://www.uky.edu/Ag/cdbrec/pot_n_pot_2009.xls
- Pot-in-pot Nursery System Cash Flow Worksheet Annual Sales Version (University of Kentucky, 2009) http://www.uky.edu/Ag/cdbrec/pot_n_pot_annualsales_May_2009.xls
- Sustainable Production Systems: Efficient Wholesale Nursery Layout (University of Kentucky, 2013) http://www.ca.uky.edu/agc/pubs/HO/HO109/HO109.pdf
- Trees, Shrubs, Ground Covers and Vines Suitable for Kentucky Landscapes, HO-61 (University of Kentucky, 1997) http://www.ca.uky.edu/agc/pubs/ho/ho61/ho61.pdf
- Best Management Practices: Guide for Producing Nursery Crops (Southern Nursery Association, 2007) http://www.sna.org/Default.aspx?pageId=1140025
- Commercial Nursery Production Information (University of Tennessee) http://www.utextension.utk.edu/mtnpi/handouts.html
- Comparison of Field, Conventional Container, and Pot-n-pot Production (University of Tennessee, 2009) http://www.utextension.utk.edu/mtnpi/handouts/Beginning_in_Nursery/Comparision_of_Production_Systems.pdf
- Economics of Producing Nursery Crops Using the Pot-in-Pot Production System: Two Case Studies (University of Tennessee, University of Florida, Auburn University, 2002) http://www.utextension.utk.edu/mtnpi/handouts/Pot-N-Pot%20Production/Pot-N-Pot_Economics.pdf
- IPM for Select Deciduous Trees in Southeastern US Nursery Production (Southern Nursery IPM Working Group, 2012) http://wiki.bugwood.org/IPM_book
- Nursery Crop Science Commercial Horticulture Information Portal (North Carolina State University) http://www.ces.ncsu.edu/depts/hort/nursery/
- Pot-in-Pot (PNP) Production System (University of Tennessee, 2009) http://www.utextension.utk.edu/mtnpi/handouts/Pot-N-Pot%20Production/Pot-N-Pot.pdf
- Sustainable Small-scale Nursery Production (ATTRA, 2008) http://attra.ncat.org/attra-pub/nursery.html

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