

## Propagation Nursery

### Introduction

Propagation nurseries produce pre-finished plant material (liners), such as ornamental trees, shrubs, and grasses, fruit trees, and annual and perennial flowers. Plants are propagated either by seed or by vegetative means, such as by cuttings, grafting, or tissue culture. Some nurseries specialize in growing and selling pre-finished plants to other growers, making propagation their sole business. However, some wholesale nursery operations have their own propagation areas where plants are produced for in-house use.

### Marketing

Liners are typically sold in bulk quantities to other wholesale nurseries, landscape nurseries, or retail nurseries, which grow the plants to a larger size. These sales can, but do not necessarily, involve a contract between the propagation nursery and their customer. Internet and mail-order marketing is commonly used by propagators, allowing businesses to reach national and possibly international markets. Liners of small plants, such as annual flowers, are commonly sold as “plugs” in trays containing small, square cells. Liners of trees and shrubs, however, are typically sold either in containers or as dormant, bare-root plants.

### 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



IN-GROUND PROPAGATION BEDS WITHIN A HIGH TUNNEL.

the State Entomologist. Additionally, shipment of plants or plant parts across state lines can, in many cases, require a Phytosanitary Certificate. A Phytosanitary Certificate is also required for most international shipments of plant material. 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





PROPAGATING PLANTS BY GRAFTING.

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

### *Production methods*

Many plants are propagated by seed, but for selected cultivars that must be reproduced as clones, vegetative propagation methods are used. The most common of these methods include the use of cuttings, grafting, plant division, and tissue culture. The method used depends on the plant species, as well as grower capabilities. Cultivars of woody plant material are most commonly reproduced by cuttings. Parent stock plants used for vegetative propagation must be true-to-type, vigorous, and disease- and insect-free.

In some cases, with proper planning, propagation can be conducted year-round. For example, cuttings of some woody plant species can be taken for propagation almost year-round, while others must be collected during specific seasons or even at a very narrow window of development. Some cuttings can be ready to sell as liners in 10 to 12 weeks.

### *Site selection*

Because a large number of plants can be propagated in a small area, propagation nurseries do not

necessarily require large acreages. Site selection depends on many factors, including production method and crops grown. Plants can be propagated in outdoor beds, propagation frames, various types of greenhouse structures, and tissue culture labs. In addition to these propagation areas, space for parent stock plants, soil preparation, potting, and shipping are needed.

The production of cuttings requires an intermittent mist system, regardless of whether production is outdoors or in an enclosed structure. Bottom heat is needed for fall and winter propagation, and therefore, requires access to electricity. A reliable source of clean, pest-free water must also be available.

Propagation in outdoor beds requires a well-drained, loose soil that is well-aerated. The site should have good air circulation and a slightly sloping topography for excess water run-off. Fields with hardpans, those that could flood periodically, frost pockets, and windy locations should be avoided. Potential growing sites should be tested for soybean cyst nematode infestation as the presence of this pest in the soil could severely limit out-of-state export. Outdoor beds require winter protection in Kentucky.



PLANTS PROPAGATED IN FLATS WITHIN A GREENHOUSE.

A fairly level location should be selected for propagation frames, greenhouses, and high tunnels. If plants are propagated in ground beds, the site should have loose, fertile, well-drained soil. The type of native soil present is less important if plants are propagated in artificial soil substrates on

benches. Greenhouse structures should be built in an east-west orientation for maximum sun exposure during the winter. Ventilation is essential, whether the system is automated or manually operated.

Tissue culture requires a laboratory equipped with an autoclave or sterilizer, refrigeration unit, incubators, and accurate scales for weighing chemicals. Specialized glassware and pre-packaged culture media are also needed. The lab should be operated only by well-trained, experienced personnel.

### *Crop selection*

There are thousands of plants and cultivars propagated for nursery production. These include ornamental trees, shrubs, and grasses, vines and ground covers, tree fruits, woody small fruits, herbaceous perennials, annual flowers, and even aquatic plants. Most propagation nurseries produce a variety of plants with known high market demand, while other nurseries produce specialty crops, such as native plants or uncommon cultivated plants. Specialized production can serve niche markets and is especially well-suited for small production operations.

### *Growing media*

A number of different types of organic and inorganic materials can be used as a rooting medium for cuttings. Mixes of perlite and peat moss are commonly used. Other substrates include ground pine bark, vermiculite, and sand, either alone or in combination with other materials. The medium should be able to support the cutting and have good aeration and water holding capacity. All materials used for propagation should be sterilized, pasteurized, or manufactured under clean, disease-free conditions. Rooting hormones are sometimes used for cuttings, but their effectiveness depends on the plant species.

Tissue culture allows for the mass production of plants from a relatively small sample of parent stock. Plants propagated via tissue culture are grown in a sterile agar medium supplemented with essential micro and macronutrients specifically tailored to the plant being produced. Plantlets are then transferred to containers or field for further development.

### *Pest management*

Potential disease problems vary, depending on the plant species and cultivar. However, the main concerns in a propagation nursery are pathogens causing root and stem decay. Virus-infected stock plants present a significant threat to the operation, so they must be discarded immediately. Insects common to greenhouse production, such as white flies, thrips, and aphids, commonly pose a problem in propagation houses. Weeds need to be managed in ground beds, under greenhouse benches, and in walkways without using herbicides. Weed control in and around the greenhouse structure also reduces insect pests and disease problems.

Use of integrated pest management (IPM) strategies, such as planting resistant cultivars, scouting, managing irrigation times, and practicing best management practices are essential for adequate control of pests. Regardless of the propagation method, a high level of sanitation is critical.

### *Harvest*

Ideally, plants are sold as soon as they are well-rooted and have reached the desired size. However, that is often not possible, and many propagation processes require a time of weaning and acclimation so the plants can survive transplanting and perform well in their new environment. This period varies with plant species, propagation technique, and market. For example, cuttings that have begun to root should be placed under reduced mist and allowed adequate ventilation while they are gradually hardened. Liners are sold in a variety of forms including bare-root, in flats, or in plastic pots.

### *Labor requirements*

Labor and management requirements for propagation nurseries are very high. Activities in a propagation nursery may include preparing flats, seeding, cutting or other propagative techniques, irrigating, controlling weeds, applying pesticides, harvesting, and shipping. In addition, there are peak periods in production when labor demands are especially intensive.

## **Economic Considerations**

Beginning a propagation nursery business requires a large capital investment, even if land does not need to be purchased. Expenses include equipment,

buildings, cold storage, supplies, plant material, grading for drainage, and the installation of an irrigation system. Some type of greenhouse or propagation structure equipped with a mist system will be needed. A tissue culture lab will require an investment in additional equipment and laboratory supplies. Other costs include labor, utilities, insurance, licenses, and inspections.

A grower must be prepared to make substantial investments for several years before realizing any positive returns. 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. In addition, the nursery operator will need to be able to handle the cash flow ups and downs associated with seasonal sales.

### 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/marketingournursery.html>
- Nursery Crop Production (University of Kentucky, 2013)  
<http://www.ca.uky.edu/HLA/Dunwell/Nlgetstart.html>
- Nursery Crops (Win Dunwell's Web page) (University of Kentucky)  
<http://www.ca.uky.edu/HLA/Dunwell/win1.html>
- Soybean Cyst Nematode: A Potential Problem for Nurseries (University of Kentucky, 2011)  
<http://www.ca.uky.edu/agc/pubs/id/id110/id110.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>
- Landscape Plant Propagation Information (University of Florida, 2010)  
<http://hort.ifas.ufl.edu/database/lppi/>
- Nursery Crop Science Commercial Horticulture Information Portal (North Carolina State University)  
<http://www.ces.ncsu.edu/depts/hort/nursery/>
- Preparing Nursery Plants for Winter (North Carolina State University)  
<http://www.ces.ncsu.edu/depts/hort/hil/ag454.html>
- Propagating Deciduous Fruit Plants Common to Georgia (University of Georgia, 2012)  
[http://www.caes.uga.edu/Publications/displayHTML.cfm?pk\\_id=6019](http://www.caes.uga.edu/Publications/displayHTML.cfm?pk_id=6019)
- Propagating Shrubs from Cuttings, B641 (University of Georgia, 1994)  
[http://www.ugaextension.com/stephens/anr/documents/Propagation\\_Schedule\\_for\\_Woody\\_Ornamentals.doc](http://www.ugaextension.com/stephens/anr/documents/Propagation_Schedule_for_Woody_Ornamentals.doc)
- Propagation in the Nursery (University of Florida, 2012)  
<http://hort.ifas.ufl.edu/woody/nursery-propagation.shtml>
- Tissue Culture of Woody Plants (Texas A&M, 1980)  
<http://aggie-horticulture.tamu.edu/tisscult/microprop/woodypl.html>

### *In print*

- Plant Propagation: Principles and Practices, 8<sup>th</sup> ed. H.T. Hartmann, D.E. Kester, F.T. Davis, Jr., and R.L. Geneve. 2010. Prentice Hall: NJ. 928 pp.
- The Reference Manual of Woody Plant Propagation: From Seed to Tissue Culture, 2<sup>nd</sup> ed. Michael A. Dirr and Charles W. Heuser, Jr. Timber Press: Portland, OR. 424 pp.

---

*Reviewed by Win Dunwell, Extension Specialist (Issued 2004, Revised 2009)*

*Reviewed by Sarah Vanek, Extension Associate (Revised 2013)*

*Photos: Dewayne Ingram (pg. 1), Sarah Vanek (pg. 2. grafting), and Robert Geneve (pg. 2. greenhouse), University of Kentucky*

**July 2013**

---

For additional information, contact your local [County Extension](#) agent