

## From Propagation to Finish: Container Production at Princeton Nurseries®

**Baldomero Aparicio**

Princeton Nurseries, Inc., P.O. Box 185, Allentown, New Jersey 08501 U.S.A.

### INTRODUCTION

Princeton Nurseries enjoys a rich legacy of improved plant introductions. The nursery introduced some of the most celebrated trees in American horticulture. The seedling program at Princeton Nurseries is the first step on a plant journey to our high-density container and specimen fields. William Flemer III made many of his famous selections in our seedbeds. To name a few: *Ulmus americana* 'Princeton', *Gleditsia triacanthos* var. *inermis* 'Shademaster', *Acer rubrum* 'October Glory', *Tilia cordata* 'Greenspire', *Zelkova serrata* 'Green Vase', and Princeton Nurseries latest introduction, *Acer tataricum* subsp. *ginnala* 'Ruby Slippers'. In the future, it is important to carry on this tradition of excellence.

The propagation department at Princeton Nurseries is responsible for all cuttings propagated, bare-root grafts, potted grafts, and tissue culture transplants.

### SEEDLING PRODUCTION

All seedling production occurs at the Thread Farm. Seventy acres of this farm are used for production. Fifteen acres is used yearly, and the remainder is on a 4-year rotation so the land can be rested between crops. All seed beds are treated with methyl bromide prior to planting to control weed germination and pathogens. Each year approximately 1,400,000 seedlings are produced. Princeton Nurseries uses 30% of the total seedling production, and 70% is used for our selected seedling sales.

The seed is hand-sown to give proper spacing so that all seedlings develop a proper balance between root mass and the plant. All sources are from local or compatible zone-hardy regions, and most of this seed is from our own stock plants. Almost all of the seedlings are harvested in the early spring. The harvested seedlings are then individually graded by caliper and quality. Currently the propagation department is propagating over 50 different genera of seedlings.

### GRAFTS, CUTTINGS, AND TISSUE CULTURE PROPAGATION

The propagation department at Princeton Nurseries is presently propagating over 40 different genera from cuttings, grafts, and tissue culture. Eighty-five percent of all cuttings and scion wood used by the propagation department comes from our own stock blocks, which are at several locations throughout the nursery. Several outside sources produce all tissue culture plants. Under the current production plan, this department is producing 100,000 plants from cuttings, 25,000 plants from tissue culture, 10,000 potted grafts, and 50,000 bare-root grafts.

Asexually propagated material is housed in six 28 ft × 96 ft Jaderloon greenhouses and a 60 ft × 96 ft Cravo retractable-sides-and-roof greenhouse. Several of these houses are equipped with heated floors.

## CONTAINER DEPARTMENT

At Princeton Nurseries we produce three product lines in containers, Prince Trees<sup>®</sup>, Prince Shrubs<sup>™</sup>, and Princess Perennials<sup>™</sup>.

**Prince Shrubs.** Container department produces 115,000 Prince Shrubs in 75 18 ft × 200 ft hoop houses that give us a total of 6 acres of growing bed area. The container department receives small liners from the propagation department. We decide in what size container the plant will be potted according to the final product that will go to the customer; this decision is made based on the growing habit of each plant type. Regularly we use #1 and #2 containers, but nothing bigger than these, to save space and to get a uniform top of the plant and an ideal root mass. We add a slow-release fertilizer to the potting mix: Osmocote Pro 20-4-8. Our potting mix is 9 composted pine bark : 1 sand (v/v) and is pH amended to 5.8 with lime. On this phase, our containers are not spaced but we keep them under control by pruning when necessary and monitoring the roots to avoid problems in the future. To avoid diseases, we watch irrigation closely during the growing season, adjusting it according to individual necessities and weather requirements.

Shade cloth is part of our infrastructure to provide relief to our plants in the hot days of summer, so the plants can reach their maximum growing potential in a short period of time.

Around September our plants are reaching the shape and roots that we are looking for, so we get ready to start the 2nd phase of our production. We shift up our liners to bigger containers, #2, #3, and #5, which constitute the majority of our Prince Shrubs production. Since the roots will be exposed, we pay especial attention to avoid a root-bound condition in the future.

All our shrubs are placed in the houses pot to pot for the winter. In each house we leave a walkway down the center to monitor the pots daily through the winter. Each house will hold about 3,100 shrubs on average. We try to group our plant material by water and light requirements as well as cold hardiness. The more cold hardy plant material will be covered with 50% opacity 5-mil polyfilm. The slightly more sensitive plants, or plants we like to get started early in the spring, are covered using 35% opacity 5-mil polyfilm. Every house has a large hinged door on each end for easy access and ventilation.

The transition between end of the winter and beginning of spring will bring us a challenge; to keep our plants in the perfect conditions we must decide when to uncover our houses. If we take the plastic off the houses too early, the more sensitive plants can suffer damage due to variations in the weather, but if we wait too long, plants can start growing ahead of time, which can cause problems too.

Our shrubs are spaced approximately 2 ft × 2 ft to offer them the necessary space so they can grow freely; at the same time this will facilitate the process of fertilization and pruning. We apply a pre-emergent herbicide and top-dress them one more time before they start growing. Pruning is an important practice in Princeton Nurseries culture; it is done by hand and as many times as necessary to get the desired shape on each plant type. We use an overhead irrigation system with Nelson spinners.

**Prince Trees.** Our propagation department supplies all the understock and seedlings, which are lined out in high-density fields. This material is planted in April and May, depending on ground conditions. All high-density fields are planted with 44-ft-wide sections to accommodate spray equipment. Row length will vary to ac-

commodate crew access and ease of maintenance. All plantings are grouped according to soil conditions, genus requirements, similarity of spraying requirements, and cultural practices. Care and development after planting varies greatly depending on plant type, rate of growth, and harvest size.

The in-ground cycle can vary from 1 to 4 years, depending on growth rate. In the final fall of the in-ground cycle, the trees will be evaluated and allocated to our container division. The trees are harvested and field sorted by grade and by the division to which the product is allocated. The product is immediately sent to our 1-acre storage facility for a final inspection and grading. It is then stored at 38 °F refrigeration and 95% humidity until planting.

While the trees are in this building our crews start the very delicate process of grading and getting only the ones that fit the standard to become a Prince Tree. Our own developed trimming system will vary according to plant type, but the objective will be the same: to provide the customer with a larger, canopy size tree. At the same time we carefully trim the roots to fit into the containers. We pot approximately 20,000 Prince Trees in early spring. We use a soil conveyor with a special end that will reduce spilling and increase production developed by our container department. Potting depth is critical, so our crews pay special attention so the tree will stay in the center of the container. Like our Prince Shrubs, fertilizer is incorporated into the potting mix. We pot around 1500 #20 can trees a day.

**Trellis System.** Our trellis system for growing Prince Trees was created in 1996 during a very windy growing season. We needed a system to hold the trees in place and stop them from blowing over. We were unable to use a pot-in-pot growing system due to the limitation of heavy soil conditions. A steel cord is fastened between two poles and stretched over a 25 ft area. Along the cord are approximately six padded clips, which fasten the trunk of the tree to the trellis and holds the tree securely in place. This arrangement not only saves labor and decreases damage to the trees, but also provides an opportunity for early root development for better plant growth.

All trees are pruned once or twice a year, with the timing of the pruning being dependent on the growth habit of the plants. Our irrigation system is a 150-hp turbine pump, which provides water to our yard. A chlorination and filtration system has been installed to maintain the quality for the drip irrigation. All systems are radio-signal controlled.

In September, when our product is finished and ready to be ship, we use a shipping system also developed by our department that consists of a cardboard cover that fits the top of the container to hold the soil in its place. A triangular cardboard tube will be attached to the trunk to avoid any damage to the bark and make our trees more presentable.

**Cravo Building.** Trees are specially challenging to overwinter simply because of their height. The Cravo building is 18 ft tall at its gutters, which accommodates even our largest #20 gal trees. Prior to the construction of the Cravo building the trees were laid down and covered with a poly tunnel for the winter. This did not allow access to the plants to check for disease, rodent damage, or moisture. It also caused many flowering plant taxa to break bud early on warm winter days. The Cravo building has eliminated all these problems. With a retractable roof and retractable side curtains, we are able to vent the building as well as close it to main-

tain heat. The roof is also left open in the event of snow. Snow on and around the containers helps to insulate the pots and supplies a slow, steady source of moisture. If the containers become too wet, we simply leave the roof closed the next time it rains. If the trees become dry and there is no precipitation in sight, we can irrigate using our frost-free system.

With the high competitive level in the horticultural industry, Princeton Nurseries keeps the legacy of improved plant material at a high level. To get to this standard of excellence, the company makes sure to use the right methods and techniques and at the same time makes an effort to keep the human touch between employees so you, the customer, receive a quality product that follows industry guidelines and makes us really proud.

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## Propagating *Asclepias tuberosa* from Seed: The Process®

### Francisco Castillo

Midwest Groundcovers: St. Charles, Illinois 60174 U.S.A.

### INTRODUCTION

Midwest Groundcovers is a wholesale nursery specializing in the production of groundcovers, ornamental shrubbery, perennials, and natives. A large portion of our perennial stock is propagated through division and softwood cuttings, but others, which cannot be produced in this method, rely on seeds to propagate. *Asclepias tuberosa* is one of those unique plants that is difficult to propagate vegetatively from cuttings but has a high percentage when using seed. In the past we used to buy in divisions, but quickly found that we would lose more than 50% of the crop within 2 to 3 weeks of planting. It was soon decided that an alternative method was needed to produce this plant. Seed propagation seemed the most logical step to take so we began by trialing this technique by directly seeding into 1-gal containers. Immediately we saw great success with 100% of the crop surviving and flourishing. We understand that planting *Asclepias* in this method doesn't produce a large quantity of blooms until the second season, but with careful production timing, anyone can have a beautiful crop in a limited amount of time.

### PROPAGATION METHODS

The following describes our propagation system for producing *A. tuberosa* from seed.

**Seed Propagation.** At Midwest Groundcovers we buy in thousands of *Asclepias* seeds in late fall. Buying at this time guarantees that you will receive fresh seed from the corresponding summer crop. There is no seed treatment necessary for this crop, so it is put into cold storage at 36 °F until the following spring. The seeds are then planted in the middle of April to ensure a successful crop that can be sold that fall (Figs. 1 to 7). With this method, a 1/2-inch hole is dug, filled with twenty to 25 seeds, and covered with vermiculite. This will ensure the seed stays moist while allowing light to penetrate the substrate and therefore allowing the seed to germinate. The plant is immediately covered with 30% shade cloth for 3 to 4 weeks and is misted every hour until germination. After the 3 to 4 weeks of shade cloth, the