

Creating the Urban Forest: *The Bare Root Method*



*Cornell University
Ithaca, New York*

The video “Creating an Urban Forest: *The Bare Root Tree Planting Method*” and this publication are joint projects of Cornell University’s Urban Horticulture Institute (UHI) and the Ithaca City Forestry Department. This method works for us but success depends on many factors and each situation will be unique. For more information contact:

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To order more copies of the bare root transplanting video, contact the Urban Horticulture Institute at the above address. This and all UHI publications are available on-line at the UHI web site:

<<http://www.hort.cornell.edu/department/faculty/bassuk/uhi>>.

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We thank Rose Marrabitt and Eric Woodward for their dedication to Ithaca’s urban forest.

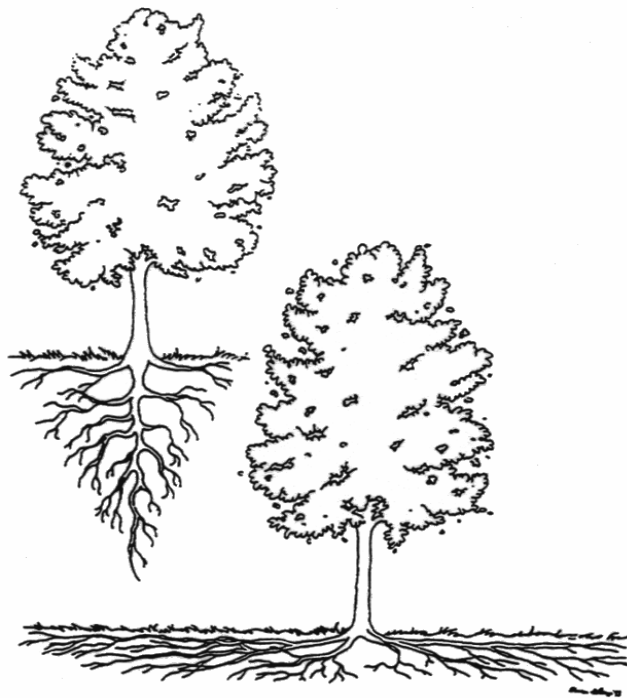
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Why Transplanting is Traumatic

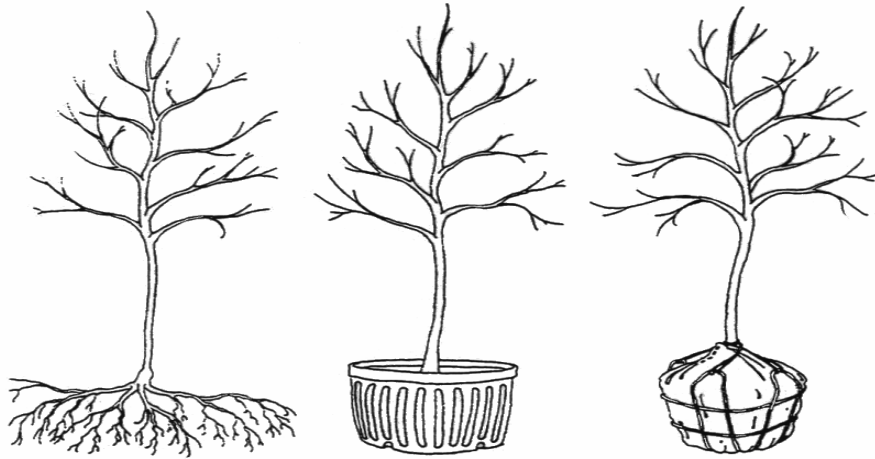
Whether from a nursery field to the city tree lawn or just from one place in your yard to another, it's the roots that suffer when trees are transplanted. Consider this: Shade tree roots are found primarily in the top 12 inches of soil. Tiny absorbing roots, responsible for most of the tree's intake of water and nutrients, are in the top several inches of soil. Roots not only grow horizontally beyond the dripline, there often is a higher percentage of them beyond the dripline than within it.

An unbelievable 90% of tree roots are routinely left behind in the nursery at the time of harvest. The fine absorbing roots that are harvested are easily broken off, damaged and desiccated. Water stress, resulting in part from the tremendous reduction in root mass, is the main reason transplanted trees fail.



Far left: The incorrect “mirror of the canopy” version of how tree roots grow.

Near left: The correct depiction: tree roots are close to the surface, laterally spreading, and spread significantly beyond the dripline of the tree.



The three principal nursery production methods, left to right: **Bare root**, **Container grown**, **Balled and burlapped (B&B)**.

Why Bare Root?

The three main nursery production methods are balled and burlapped (B&B), bare root, and container grown. Container nurseries are less common in the northern U.S. where low winter temperatures restrict their use to smaller sized plant material. Container grown trees are generally the most expensive of the three methods and are subject to circling roots that can reduce a tree's vigor. While the lightweight media used in containers is useful for free drainage out of pots, once in the ground the medium may lose its water too readily to the surrounding native soil.

Conventional wisdom says that B&B production is superior to bare root because a protective ball of soil surrounds the roots at harvest. However, we find that for many species the positive attributes of bare root planting outweigh the perceived B&B edge. The three best arguments for the bare root method:

1. ***You can plant more trees more cheaply.*** Bare root trees are one-third to one-half less expensive than B&B trees. Because they are so much lighter and many more can fit on the bed of a truck, they are cheaper to ship. Planting a bare root tree costs virtually nothing when done by volunteers with shovels. The cost of planting a B&B tree, by contrast, is markedly higher because the sheer weight of the ball requires machinery and machinery operators to load the tree, unload it, and to get it in the ground.
2. ***You will take more roots along.*** A simple study was done at Cornell to compare the amount of roots in a B&B ball with the root mass on a bare root harvested tree of the same size and species. The bare root trees had 200% more roots. The reason for this? The harvesting machinery for bare root trees digs a much larger root system than the tree spade used for B&B digging.
3. ***You'll avoid the deadly planting-too-deep syndrome.*** Frequently when a newly transplanted B&B tree dies, it is because it was planted too deep. When the fine absorbing roots are buried too far down, they can't access oxygen and the tree suffocates. Trees should be planted so that

their root flare begins just at the soil line. With B&B trees, the soil may be mounded on the trunk, making it difficult to see the buried root flare. On the other hand, the root flare of bare root trees is obvious and the proper planting depth easy to determine.

Need more persuasion? When you plant bare root you can spot girdling roots and remove them before you plant; with B&B trees girdled roots can be buried. With bare root trees you won't rob nurseries of their valuable field soil and there is no ball of nursery soil meeting the city soil with potential "interface" problems in terms of water movement.

For municipalities with limited tree budgets, the low cost of the bare root method is the most critical factor. With a budget of \$500, volunteers can plant ten trees a year.

So why hasn't everyone switched to bare root planting? With municipal tree planting there is an inevitable holding period between digging the trees and planting them. During this period, *root desiccation* is the most critical disadvantage to planting bare root trees. In the past, people put wet straw around the roots or coated them in a mud slurry. These methods did not prove satisfactory or practical; the straw did not protect fine roots adequately and the mud slurry tended to dry out and chip off.

We use a synthetic, non-toxic product called *hydrogel* to solve the desiccation problem for that critical time between digging and replanting. Hydrogels are polymers that look like table sugar when dry, but can hold several hundred times their weight in water. There are fine grades and coarse grades available; be sure to use the fine grades because they give much better coverage of the absorbing roots. We dip tree roots in a hydrogel slurry and immediately bag them in plastic to protect the roots from drying out until the tree is planted no more than a week later.

Getting Started

At Least Three Months Before Planting Day

- Contact your local *wholesale* nursery growers. Find out who does bare root digging and request that they let you set up a dipping operation the day the trees are dug. Some nurseries, such as Schichtel's in Buffalo, are equipped to do the dipping themselves. Our hope is that consumer-driven demand will prompt more nurseries to offer this service.
- Place an order for 1 ½ - 2 inch caliper trees that are good bare root prospects (see Appendix). Caliper size greater than 2 inch is not recommended for bare root transplanting. Even a 2 inch tree will be more difficult to transplant than a 1.5 or 1.75 inch tree, so the smaller the caliper, the better. The digging should be one during the dormant season for your area. In Ithaca, we fetch dormant bare root trees in late October or early November for fall planting, mid-April for spring planting. Trees should not be leafed out — in fall most dormant trees have lost their leaves; in spring dormant trees have not yet broken bud.
- Order and gather the supplies: fine-grade hydrogel, plastic bags, tree tags, shovels (manufacturers listed in Appendix). Consider investing in tree irrigator bags (illustrated on page 11). They hold 20 gallons of water and slowly release it to the roots, saving watering time and aiding in tree establishment. Tree irrigator bags also keep the mowers and string trimmers away from young trunks, where just one wound can cause serious damage.

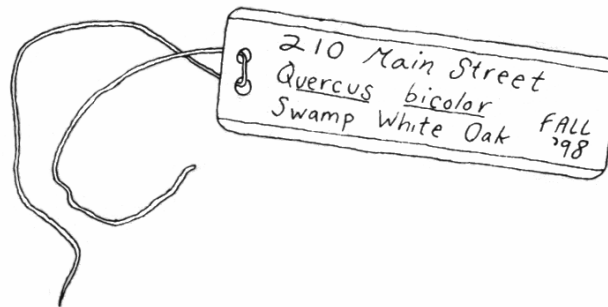
Urban Trees: Site Assessment, Selection for Stress Tolerance, Planting, edited by Nina L. Bassuk and published by the Urban Horticulture Institute (UHI) at Cornell, contains lists of tough urban trees, detailed instructions on how to conduct a site assessment, and transplanting guidelines. See the UHI web site at: <http://www.hort.cornell.edu/departments/faculty/bassuk/uhi>.

- Assess available planting sites. The more comprehensive your site assessment, the better your tree will be matched and will thrive in its location. If overhead wires are present, consider planting a small species, one that matures no taller than 30 feet. Make sure there is adequate soil volume for the mature tree size. Note drainage problems, soil texture and pH. Note how windy or hot the site is. Will snow removal mean deicing salts get deposited on tree roots? Match the conditions of the site with the strengths of the tree species.
- Cluster sites for ease of planting. Select 20% more sites than you need, since some sites will not work out. Write or speak to the property owners near the sites (including those near the alternate sites) and get their OK. Inform them of what's going to happen and invite their participation.
- Galvanize your volunteer crew and plan the dipping day and planting day.

The Week Before Planting Day

- Make a call to have underground utilities marked for the sites you plan to use. Call directory assistance and ask for your state's "underground locating service." In New York State it is the Underground Facilities Protective Organization (1-800-962-7962). In New York City and Long Island, the number is 1-800-272-4480. In New York you must call at least two but not more than ten working days ahead of the day you wish to plant. Ask them if they'd like you to mark your proposed planting site ahead of time (usually with a white spray paint circle) and about the legal distances you need to maintain once the underground utilities are located and painted for you. Be prepared to adjust your planting site to accommodate utilities.
- Prepare aluminum marking tags for your trees (see supplies). Label each tree with its intended address before it gets dipped and bagged so that when volunteers pick up the trees to plant, they can simply go to the address on the label. You may also want to label the tree's scientific name, its common name, and the date of planting.

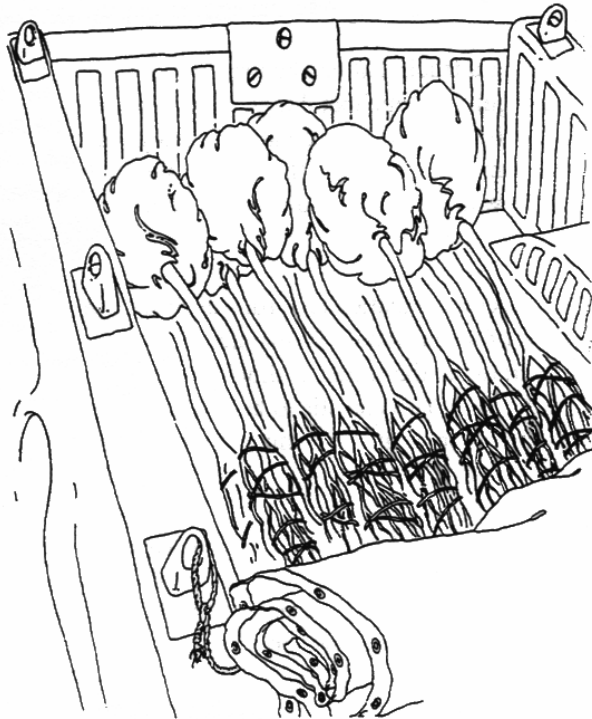
- Work with the nursery to have your trees dug within 24 hours of your arrival. If they absolutely must be dug earlier, they should be kept in a cool, dark place and watered frequently. Bare roots should never be allowed to dry out! Verify that the nursery will tie the branches with twine to prevent breakage in transit.



Dipping Day at the Nursery

- Take an enclosed truck or a truck that can be tarped to transport the trees after dipping. Bring hydrogel, buckets, metal tags, plastic bags. If the nursery can't supply a large (50-100 gallon) plastic vat for mixing the hydrogel and water, bring a vat and something to stir with. The vat should be much wider than tall to allow for the widespreading root system of bare root trees. We use durable plastic horse troughs.
- Follow manufacturer's recommendations for root dips; we use about 15 oz of hydrogel per 25 gallons of water. Allow 30 minutes to an hour for the hydrogel to become fully hydrated in the water; it should be the consistency of thick gravy when you start dipping. You can stir to hasten the hydration process; while you're waiting, attach pre-marked aluminum tags loosely to a lateral branch of each tree.
- Dip the root system in the slurry. Don't shake the hydrogel off the roots — you want to leave as much coating on the roots as possible. Immediately slip the roots into a large, pleated plastic bag. Pleated, or gusseted, bags are important — if you use non-pleated bags the roots will poke through the sides. Knot the bag around the trunk to hold in moisture.

Dipping and bagging at the nursery. Make sure all roots are covered in the hydrogel slurry.



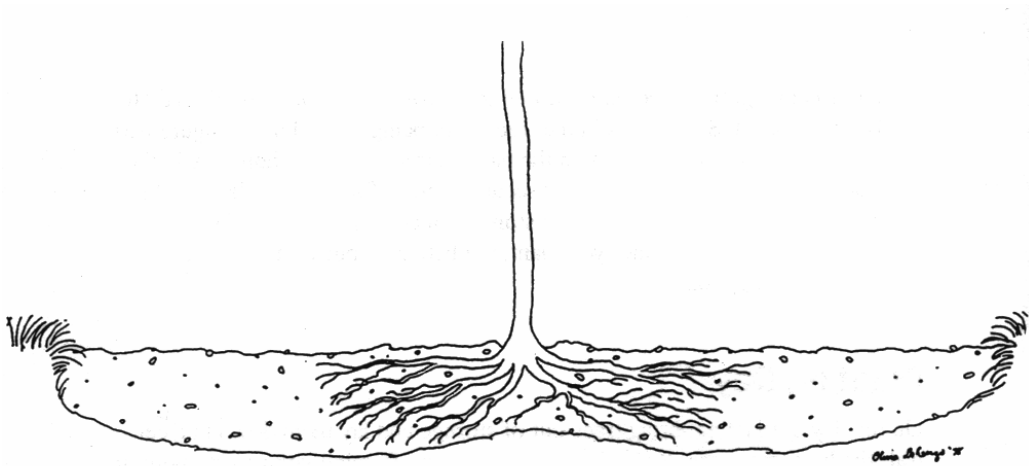
Dipped and bagged trees ready to be tarped and transported. A tarp is essential to keep the wind from desiccating tree tops and roots.

- After bagging, trees should be stored in a cool, shaded place until ready to be transported. Stack trees in the truck bed, being careful not to injure bark or break branches. Water down the bagged trees to create humidity in the truck bed. Close the truck bed or securely tarp it for your trip back to the city. Upon arrival trees should be stored in a cool, shaded building until ready to plant. The sooner you plant, the better — but wait no more than a week after dipping.

Planting Day

On the day of planting, bring trees out of storage and lay them down in a central, shady staging area. Keep them out of the sun. Remind volunteers about underground utility considerations, and instruct them on proper planting.

- Carry the tree, with roots still bagged, to the planting site. Lay the tree on its side and remove all string and nursery plastic flags. Leave only the aluminum marking tag and make sure it is attached loosely to prevent girdling.
- Prune only dead or broken branches. At this stage the tree needs all the potential leaves it can get.
- Dig the planting hole wide and shallow. Do not loosen the soil that will be underneath the root system; instead concentrate on creating loose soil horizontally for the spreading roots. The hole should be 2-3 times wider in all directions than the root spread. A hint for loosening soil: use the hole you are digging as a “bowl” to first break up the soil clods, then shovel the loosened soil out.
- Turf surrounding the tree should be completely removed so it doesn’t compete with the newly planted tree for water.
- Remove the tree from the plastic bag and stand it upright in the hole. Plant the tree so that the beginning of the root flare is visible at soil level. It is critical not to plant the tree too deep. Lay your shovel across the hole to see where the shovel meets the root flare and adjust the planting depth

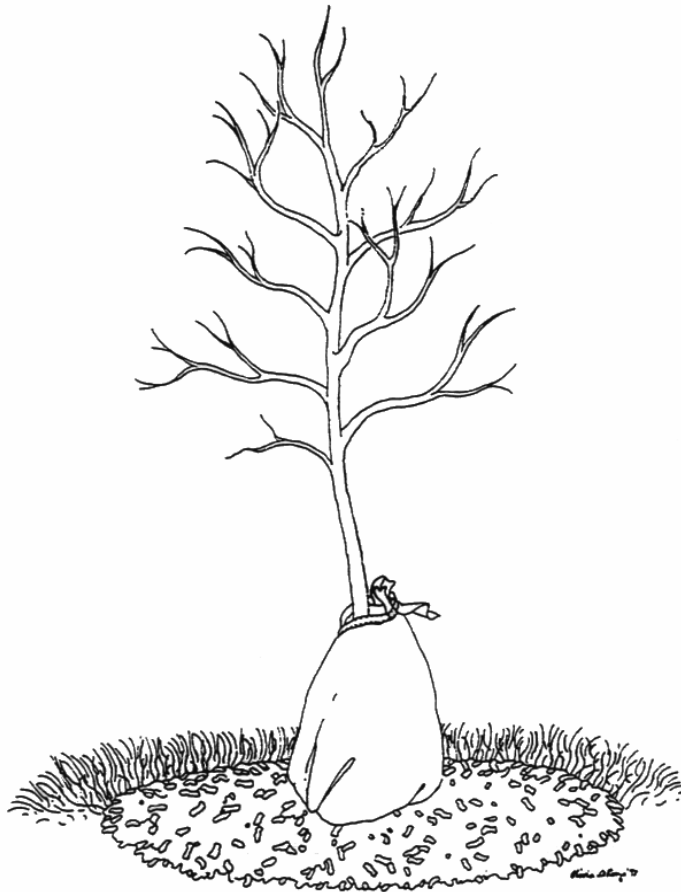


Dig the planting hole shallow and wide, at least three times the diameter of the tree roots. The beginning of the root flare should be at soil level.

accordingly. If you anticipate settling of the soil, plant a little high. *It is better to plant too high than too deep.*

- Check to see that the tree is plumb, then backfill with the native soil that you have removed. Do not use amendments in the planting hole. When you've replaced half of the backfill, water the hole to help collapse air pockets. Alternatively, use the opposite, wood end of your shovel to gently poke out air pockets. Finish backfilling, and gently firm soil. Make sure the soil is not mounded against the trunk and that the beginning of the root flare is showing above ground.
- Mulch over the entire rooting area with 2-4" of wood chips or shredded bark mulch. The farther out you mulch, the better. Don't let mulch mound against the trunk since this could create a favorable environment for fungi.
- Attach a tree irrigator bag, making sure the tape has been removed from all trickle holes. Fill bags at least once a week during dry spells. Fertilizer is *not* recommended for newly planted trees.

- Staking is not necessary and can even be detrimental for most young trees. The exceptions: an extremely windy site, a tree with an unusually small root system, an unusually large sail/canopy relative to a tree's root system, or a tree whose trunk is seriously bowed. A final reason to stake is to protect trees in high traffic areas where vandalism is feared. Young trees are less likely to be victimized when staked.
- Initial maintenance: Mulch should be maintained at a depth of 2-4". If you employ stakes or guy wires, remove these devices after 1-2 years to prevent girdling of the tree. Start training trees one full year after they are planted.



Appendix

These lists are based on the experiences of UHI and Ithaca's urban forestry program. Success may vary from city to city.

Trees Easy to Plant Bare Root

Scientific Name	Common Name
<i>Acer buergeranum</i>	Trident Maple
<i>Acer campestre</i>	Hedge Maple
<i>Acer x fremanii</i>	Freeman Maple
<i>Acer platanoides</i>	Norway Maple
<i>Acer pseudoplatanus</i>	Sycamore Maple
<i>Acer rubrum</i>	Red Maple
<i>Acer saccharum</i>	Sugar Maple
<i>Acer truncatum</i>	Shantung Maple
<i>Amelanchier</i> spp.	Serviceberry
<i>Catalpa speciosa</i>	Cigar Tree
<i>Cercidiphyllum japonicum</i>	Katsura Tree
<i>Cladrastis kentukea</i>	Yellowwood
<i>Cornus mas</i>	Cornelian Cherry Dogwood
<i>Cornus racemosa</i>	Gray Dogwood
<i>Fraxinus</i> spp.	Ash
<i>Gleditsia triacanthos</i>	Honeylocust
<i>Gymnocladus dioica</i>	Kentucky Coffee Tree
<i>Malus</i> spp.	Crabapple
<i>Parrotia persica</i>	Persian Parrotia
<i>Platanus x acerifolia</i>	London Plane Tree
<i>Prunus</i> 'Accolade'	Accolade Flowering Cherry
<i>Prunus virginiana</i> 'Canada Red'	Chokecherry
<i>Pyrus calleryana</i>	Callery Pear
<i>Pyrus ussuriensis</i>	Pear
<i>Quercus bicolor</i>	Swamp White Oak
<i>Quercus rubra</i>	Northern Red Oak
<i>Robinia pseudoacacia</i> cultivars: 'Purple Robe,' 'Pyramidalis,' 'Globosum,' 'Bessoniana,' 'Twisty Baby'	Black Locust

<i>Sorbus intermedia</i>	European Mountain Ash
<i>Syringa reticulata</i>	Japanese Tree Lilac
<i>Tilia cordata</i>	Littleleaf Linden
<i>Ulmus americana</i> and elm hybrids except 'Frontier'	Elm
<i>Zelkova serrata</i>	Japanese Zelkova

Trees Moderately Difficult to Transplant Bare Root

(Note: With the remaining species, we have better success transplanting in fall.)

Scientific Name	Common Name
<i>Alnus glutinosa</i>	European Alder
<i>Betula</i> spp.	Birch
<i>Celtis occidentalis</i>	Hackberry
<i>Cercis canadensis</i>	Redbud
<i>Corylus colurna</i>	Turkish Filbert
<i>Crataegus crus-galli inermis</i>	Thornless Cockspur Hawthorn
<i>Crataegus viridis</i> 'Winter King'	Winter King Hawthorn
<i>Prunus subhirtella</i> var. <i>autumnalis</i>	Flowering Cherry
<i>Quercus robur</i>	English Oak
<i>Quercus velutina</i>	Black Oak
<i>Tilia tomentosa</i>	Silver Linden

Trees Difficult to Transplant Bare Root

Scientific Name	Common Name
<i>Carpinus</i> spp.	Hornbeam
<i>Crataegus phaenopyrum</i>	Washington Hawthorn
<i>Ginkgo biloba</i>	Ginkgo
<i>Liriodendron tulipifera</i>	Tulip Tree
<i>Ostrya virginiana</i>	American Hophornbeam
<i>Quercus coccinea</i>	Scarlet Oak
<i>Quercus imbricaria</i>	Shingle Oak
<i>Quercus macrocarpa</i>	Bur Oak
<i>Quercus prinus</i>	Chestnut Oak
<i>Taxodium distichum</i>	Baldcypress
<i>Ulmus</i> 'Frontier'	Frontier Elm

List of Manufacturers

This list is not meant as an endorsement of particular companies but rather is provided for the convenience of the reader. It is not a complete list of the manufacturers that supply products for bare root tree planting.

Hydrogel

Tips: Be sure to ask for the *fine* grade of hydrogel. Size may be given in microns; use particle size 1000 microns or less. Be sure you're buying the synthetic cross-linked polymer hydrogel, not starch-based hydrogel. The latter can break down too quickly.

Soil Moist
JRM Chemical Inc.
15663 Neo Parkway
Cleveland, OH 44128
1-800-962-4010

Viterra Root Dip
Amereq Inc.
19 Squadron Blvd
New City, NY 10956
1-800-832-8788

Terra-Sorb
Plant Health Care, Inc.
440 William Pitt Way
Pittsburgh, PA 15238
1-800-421-9051

Plastic Bags

Tip: Use *gusseted* bags; the ones we use are 42" x 30" x 70"

Consolidated Plastics Company, Inc.
8181 Darrow Road
Twinsburg, OH 44087
1-800-362-1000

National Bag Company, Inc.
2233 Old Mill Road
Hudson, OH 44236
1-800-247-6000

Aluminum Marking Tags

Ben Meadows Company
3589 Broad Street
Atlanta, GA 30341
1-800-241-6401

Gempler's
100 Countryside Drive
PO Box 270
Belleville, WI 53508
1-800-382-8473

Tree Irrigator Bags

American Arborist Supplies, Inc.
882 S. Matlack Unit A
Westchester, PA 19382
1-800-441-8381

Gempler's
100 Countryside Drive
PO Box 270
Belleville, WI 53508
1-800-382-8473

Northern Nurseries, Inc.
8633 US Route 11
PO Box 1480
Cicero, NY 13039
1-315-699-3999

Notes

