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A Nursery for all Purposes

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A Nursery for all Purposes

Title: **A Nursery for all Purposes**

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Date: **March 2005**

Abstract:

The nursery at the Morris Arboretum is not the traditional growing nursery of the commercial realm. Of course there are similarities, there are trees, soil, weeds and pests. But the purpose of each is quite distinct. The commercial nursery has for its goal the quick turnover of useful planting space. At the Morris Arboretum, the nursery has several roles. It is a place to “R&R” plants rescued from down stream after a violent storm, a place where plants sit year after year for evaluation and selection and a place to plant out material too large for pots while they wait for a permanent location in the Arboretum.

This paper is intended to be a utilitarian nursery manual for the Morris Arboretum nursery manager. The manual takes into account standard nursery practices as well as the special needs of the Arboretum nursery. Plant spacing and a light handed naturalistic approach to pruning are subjects discussed specific to the Arboretum’s nursery. Several aspects of weed control are considered, from the more benign approach of planting cover crops and mulching, to the use of pre- and post-emergence chemicals. The current method of irrigation is reviewed, followed by a proposed plan for drip irrigation. Digging times and technique are discussed along with related issues of staking and tree bark protection. A section on pest scouting is included with links to helpful information.

This is intended to be a user-friendly manual organized by season. My goal was to put enough useful information under one cover to get the nursery manager/propagation intern started. For further information or greater detail, I have included a list of sources.

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NURSERY PROJECT INTRODUCTION

The nursery of the Morris Arboretum serves many purposes, making it distinct from the usual commercial nursery. A commercial nursery would typically line out hundreds of the same species or cultivars, fertilize for rapid growth, prune for customer appeal and harvest for sale as quickly as possible. Thus, opening row space to repeat the process again. By contrast, the Morris Arboretum nursery isn't growing plants for quick turnover, and the plants are there for several reasons. Some are being grown on because they are too large for, or don't do well in pots. There are plants being held while their place in the Arboretum is under construction or being repaired after storm damage. And several trees have been growing in the nursery for years being evaluated for various characteristics. In the end, some plants find a place in the Arboretum, some are given away and some are removed.

The two blocks of nursery area at Morris Arboretum, 50'x 103', and 60'x 100', are known as EN and X 44 respectively. It's no small irony that the names sound like top-secret government areas with restricted entry and unpublished location. The fact is, the nursery is out of sight, and too often out of mind. Given the physical, logistical and financial realities of running an arboretum, it is an acknowledged fate that all things are not equal. Accepting that fact leads me to the goal of this project, to create a user-friendly nursery manual that prompts and directs the nursery manager. This manual will be arranged by season, spring through winter, so that an individual may pick it up at any point in the year and reference timely maintenance and duties.

SPRING

- **COVER CROPS**
- **WEED CONTROL**
- **PLANTING AND DIGGING**
- **MULCHING**

COVER CROPS

The development of a cover crop in the nursery would be a benefit to the soil, the nursery stock and to the nursery manager. Cultivation of a low maintenance cover crop in the low maintenance nursery would be a match made in heaven. A permanent cover crop planted between the rows could accomplish all of the following:

- Limit soil erosion
- Limit weed growth
- Allow a reduction in the amount of herbicide applied
- Provide a firm surface to walk and work on
- Prevent soil compaction
- Add organic matter to the soil, supporting beneficial organisms
- Maintain or improve soil structure
- Promote water penetration rather than runoff

The following information on cover crops comes from a paper I received from Larry J. Kuhns regarding cover crops for Christmas tree plantings. The information is based on research conducted in Pennsylvania nurseries. So, rather than trying to reinvent the wheel, I have excerpted portions appropriate to the Morris Arboretum nursery.

Of the cover crops studied, the fine fescues have proven to be the best for use between tree rows. The fine fescues include creeping red fescue, chewings fescue, sheep fescue and hard fescue. All of the fine fescues are drought and pH tolerant and will grow in acidic, infertile soils and a wide variety of soil textures (clay or sandy soils). They tolerate shade and grow well in full sun. They develop a deep, extensive root system that adds organic matter to the soil and helps build its structure, while forming a dense sod that stops erosion, reduces pesticide runoff, and provides support for foot or vehicular traffic. The fine fescues may have allelopathic effects on other vegetation. This means they are extremely competitive with weeds and may reduce the use of herbicides. However, if kept away from the base of trees, they have little impact on their growth.

The fine fescues are tolerant of selective broadleaved weed killers and are even resistant to the selective grass killers Fusilade, Vantage, and Envoy. This means weeds of all types can be selectively removed from fine fescue plantings without damaging them. Fine fescues require little mowing in low maintenance situations. The only reasons to mow fine fescues in fields are to increase the density of the planting and to cut weeds growing in them.

Though similar in many ways, there are several distinctions between the fine fescue species.

Creeping red fescue is distinct from the other fine fescues in that it spreads by small, short rhizomes. It has a medium establishment rate and will provide a cover faster than hard or sheep fescue.

Chewings fescue is very similar to creeping red fescue except that it lacks rhizomes. It can be used in the same way creeping red fescue would be used.

Hard fescue has a bunch-type growth habit and excellent tolerance to drought, heat, and low fertility. It has a slow growth rate and does not mat as much as chewings or creeping red fescue. It forms a dense low sod that, if mowed, is nice for walking on. It's establishment rate is slower than that of red or chewings fescue, though early fall seedlings establish well by the following spring.

Sheep fescue is a bunch-type grass that germinates and establishes at about the same rate as hard fescue, but grows slower and remains lower. For this reason it is a bit more susceptible to weed invasion than the other fine fescues. It is not recommended as a cover crop.

Establishing a Cover Crop

Hard fescue, *Festuca longifolia*, is the most successful cover crop grown in Pennsylvania in the last 15 years. It provides all of the advantages of cover crops and of fine fescues listed above. As a bunch-type grass it does not spread laterally very fast, so it is relatively easy to keep out of the tree rows. Mowing two or three times a year will encourage it to fill in and make it nicer to walk on. In very low maintenance situations, not mowing is an option. It never grows tall.

Seeding Rate

If the site is adequately prepared, 20 pounds per acre will provide a good cover in less than one year. If 20 pounds of seed per acre is applied to a well-prepared field in September, the cover should be well established by the following May. If the site is not well prepared, or a faster cover is desired, 40 to 60 pounds per acre can be applied.

Seeding Method

Successful plantings can be established by simply dropping seed onto soil that has been loosened with a rototiller. A 30 to 36 inch wide drop spreader can be used.

Seeding Method

Both spring (April/May) and fall (August/September) seedings have produced acceptable ground covers. Many studies have shown that fall seeding is preferred over other seeding times for cool season grasses. Temperature and moisture conditions in late summer and early fall are most favorable for germination and growth of cool season grasses. Spring seedings are subject to greater annual weed competition than fall seedings. Hard fescue has very small seed (600,000 per pound) that is very susceptible to even low rates of pre-emergence herbicides.

Managing Weeds During Cover Crop Establishment

Because hard fescue is so shade tolerant, it is very tolerant of weed competition during establishment. If weed competition becomes a problem, simply mowing them before they get too large will take care of the problem. Herbicides can be used to eliminate weeds from a hard fescue cover crop. The fine fescues are resistant to 2,4-D and Stinger, which will kill most broadleaf weeds. They are also resistant to Fusilade and Vantage, which kill most grasses. So almost all weeds can be selectively removed from hard fescue, even during the seedling stage of growth.

WEED CONTROL

In order to ensure a healthy growing environment for trees and shrubs in the nursery, it is necessary to implement a weed control program. Weeds are insidious and must be eliminated, or, at the very least, suppressed. Weeds directly compete with nursery stock for light, moisture, and nutrients. Weeds also can be breeding grounds for rodents and insects that can damage stock. Air movement may be effected by the presence of weeds, which could contribute to foliar diseases or frost damage.

It is important to know where the weeds are coming from when developing a control program. Look at the surrounding area. Weed control inside an area enclosed by an open fence surrounded by fields of tall grasses and weeds is futile. Weeds also come in on equipment, in soil and mulch and on plants being added to the nursery.

Know the enemy. Weeds must be identified to ensure that the appropriate herbicides are being used. There are winter and summer annuals as well as perennial weeds. Grasses, sedges and broad leaf weeds all have different defense mechanisms and accordingly, require different control. Selective herbicides are very specific.

Pre-emergence Herbicides

Know the arsenal. Effective weed control requires timely and proper use of the appropriate chemical. Pre-emergence herbicides are most effective at, and shortly after germination, and have little value in the control of perennial weeds. They are best applied to moist soil, although excessive moisture can reduce effectiveness (Treflan). Soil temperature can affect pre-emergence chemicals. For example, Casoron, Eptam and Treflan, all work better at higher temperatures. Light is another factor that can inhibit or enhance pre-emergence chemicals. Most are more effective and last longer when placed under an organic mulch (Casoron, Treflan, Devrinol), others need light to be active (Goal, Ronstar). Soil type should also be a consideration when choosing the appropriate chemical. Casoron works better in heavy, clay soils, while Treflan is better in light, sandy soils. In general, soils high in organic material will require higher application rates to control weeds because organic matter reacts with and absorbs herbicides. A light cultivation, 1"-1.5", can aid in the distribution and effectiveness after the application of some pre-emergence (Casoron, Devrinol, Pennant, Kerb, Princep, Ronstar, Surflan, Treflan), although Dacthal's effectiveness is reduced. Cultivating deeper than 2" will adversely effect all herbicides. If a cover crop is planned, be sure to choose a pre-emergence herbicide with a short residual period (Dacthol, Lasso, Pennant) that will not hinder the desired germination.

As with all herbicides, vary the program to avoid developing resistant weeds.

READ THE LABEL – MEASURE ACCURATELY – KEEP A LOG

PRE-EMERGENCE: BROADLEAF CONTROL

CHEMICAL	TRADE NAME	CONTROL +	CONTROL -	NOTES
Atrazine	Aatrex	Most broadleaf weeds some annual grasses	Short time control of annual grasses	Restricted use product
Isoxaben	Gallery	Most broadleaf weeds some annual grasses	No velvetleaf,mallow,morning glory,evening primrose,nutsedge	Apply under mulch
Oxyfluorfen	Goal 2XL	Excellent for most broad leaf & many grasses from seed to 4", controls mile-a-minute weed	Annual grasses first to return to treated area	Apply over mulch Do not cultivate after application
Simazine	Princep (liquid, DF, 4L, (Caliber 90), Simazine, Simtrol	Most broadleaf, some annual grasses, annual broadleaf in dormant rosette stage	Short term control of annual grasses, *resistant weeds may develop	Apply under or over mulch, under is better
Oxidiazon	Ronstar	Most broadleaf, and annual grasses	No spurge or chickweed	Apply over mulch, Do not cultivate after application

PRE-EMERGENCE: GRASS CONTROL

CHEMICAL	TRADE NAME	CONTROL +	CONTROL -	NOTES
Prodiamine	Barricade, Endurance, RegalKade	Most annual grasses, Some broadleaf	Little broadleaf control	Apply under mulch, cultivate or irrigate
Napropamide	Devrinol, Hurdle	Annual grasses, some broadleaf, chickweed	Narrow spectrum of annual broadleaf	Apply under mulch, water ASAP after applying
Dithiopyr	Dimension	Several annual grasses and small-seeded broadleaf	Narrow spectrum of annual broadleaf	Apply over mulch, *do not apply another herbicide within 4 weeks
Pendimethalin	Pendulum, Corral	Most annual grasses, some broadleaf	Few annual broadleaf	Apply over or under mulch, under better
Metolachlor	Pennant Magnum	Best preemergence for yellow nutsedge, many annual grasses, some broadleaf	Few annual broadleaf	Apply over or under mulch, do not apply more than twice a year
Oryzalin	Surflan	Annual grasses, some broadleaf	Few annual broadleaf	Apply over or under mulch, better under, do not use on soils with >3% O.M.
Trifluralin	Treflan	Most annual grasses, some broadleaf	Few annual broadleaf	Apply under mulch, irrigate ASAP
Oryzalin & Benefin	XL	Most annual grasses, some broadleaf	Few annual broadleaf	Do not use on cool season turf grasses

PRE-EMERGENCE: NUTSEGE CONTROL

CHEMICAL	TRADE NAME	CONTROL+	CONTROL -	NOTES
Metolachlor	Pennant Magnum	Best preemergence for yellow nutsedge, many annual grasses, some broadleaf	Few annual broadleaf	Apply over or under mulch, do not apply more than twice a year

PRE-EMERGENCE: PERENNIAL WEED CONTROL

CHEMICAL	TRADE NAME	CONTROL +	CONTROL -	NOTES
Dichlobenil	Casoron, Norosac, Dyclomec, Barrier	Annual & perennial broadleaf, grassy weeds, including established winter annuals & perennials	Short control period	Apply under mulch, danger to evergreens established <2 year
Pronamide	Kerb	Pre & early post of winter annual and perennial grasses	Short control period	Apply over mulch
Metolachlor	Pennant Magnum	Best preemergence for Yellow nutsedge, many annual grasses, some broadleaf	Few annual broadleaf	Apply over or under mulch, do not apply more than twice a year

PRE-EMERGENCE: CHEMICAL COMBOS

CHEMICAL	TRADE NAME	CONTROL +	CONTROL -	NOTES
Oxyfluorfen & Pendimethalin	Ornamental Herbicide II (OH2) (Goal & Pendulum)	Most annual weeds	Few	Apply over mulch
Oxyfluorfen & Oxadiazon	Regal O-O (Goal & Ronstar)	Annual grasses and Broadleaf	2% granular on nursery stock leaves can cause phytotoxicity (Oxadiazon)	Breaking chemical barrier on soil will reduce effectiveness
Oxyfluorfen & Oryzalin	Rout (Goal & Surflan)	Most annual weeds	Needs ½” of water After application for activation	Apply over mulch, do not apply within 2 months of using another herbicide, not > twice a season
Isoxaben & Trifluralin	Snapshot (Gallery & Treflan)	Most annual broadleaf, and grasses	Few grasses	Apply under mulch
Oxidiazon & Proflumicet	RegalStar G (Ronstar & Barricade)	Annual grasses and broadleaf	2% granular on nursery stock leaves can cause phytotoxicity (Oxadiazon)	Apply over mulch, breaking chemical barrier will reduce effectiveness

PLANTING AND DIGGING

For commercial nurseries this springtime activity is the reason for being and often lasts for months. At the Morris Arboretum nursery planting and digging usually lasts only a few days. In my discussions with local nursery people I heard the usual; not when the soil is too wet or frozen, flowering trees first, no prunus or pyrus in leaf, hold off on evergreens until July or August when the new growth is hardened off. But Carl Miller, from Londongrove Nursery mentioned two additional things, the first emphatically. Make sure to flush cut roots when digging. Flush cutting roots has a distinct affect on the roots ability to sprout new growth from the cut point. Secondly, he recommends the use of Bioplex, a liquid treatment to reduce transplant shock. He suggests trenching around the plant, watering and after the water has been absorbed treat with Bioplex according to the label and finish digging several hours or a day latter.

MULCHING

Everybody seems to have their favorite mulch. The two things that are generally agreed upon about mulch are depth (3"-4") and the coarser the better, which translates into having to mulch less often. The mulch with the greatest longevity is hardwood bark gotten directly from the sawmill debarker before it is hammered or shredded. This product is best procured in late winter or very early spring before it is shipped to the shredder. A tractor-trailer load costs between \$700 and \$1000, depending on weight.

SUMMER

- **IRRIGATION**
- **WEED CONTROL**
- **SECOND PRUNING**
- **CONIFER DIGGING**
- **PEST SCOUTING**

IRRIGATION

Last summer, 2004, there was no need to water the nursery at all. The sprinkler towers sat in the corner, moved around only during string trimming. But the weather is trending towards drier summers, so an irrigation plan is a good idea.

In the past, sprinklers on towers were run manually off four hoses. This method is capable of a thorough soaking, but has several drawbacks. Because sprinklers water everything, there is higher water consumption, weeds benefit and there is an increased risk of foliar diseases, to name a few. An alternative would be trickle, or drip irrigation.

Advantages of Drip Irrigation

- Water use is 1/3 to 1/2 that of sprinklers
- Plants supplied with more precise amounts of water
- Disease risk is less, foliage remains dry
- Erosion and leaching reduced
- Can irrigate in various field conditions, i.e., wind
- Irrigation doesn't interfere with work
- Watering directly to root zone, not in rows where weeds might develop

Disadvantages of Drip Irrigation

- Initial cost may be higher than other options
- Human, animal, machine damage potential to system
- Filtration usually necessary
- Compared to sprinklers, water distribution in soil is restricted

These points made, I recognize that a simple drip irrigation system would be a practical and beneficial alternative to the sprinkler system for the nursery. I contacted Dave Cook at Trickl-eez, Biglerville, PA, a company in the irrigation business for 25 years. We discussed various options with longevity, simplicity and cost in mind. The following represents what I believe to be a possibility.

The system consists of a 100' (width of nursery), 1" diameter header line, at a cost of \$16.00 per 100'. With pressure compensating tubing running down each row (12) at plant base, placed under the mulch. The pressure compensating tubing is connected to the header line and has built-in emitters at regular intervals, \$75.00 per 250'. At each attachment point to the header line a saddle clamp is necessary, \$1.85 each. A filter is recommended between the water source and the header line, \$17.96. If a timer is desired, in addition, a solenoid would be necessary for each zone. A six zone, indoor timer costs \$140.20, outdoor timer \$165.60, solenoids are \$17.96 each.

The expected lifetime of the tubing is twenty years and because the emitters are built into the tubing, there is less danger of damage. The only part of the system that needs to be winterized is the 100' of header line. Filter maintenance would be periodic brushing. This is a relatively simple system with low maintenance requirements.

WEED CONTROL

Post-emergence Herbicides

Pre-emergence herbicides can be very effective in reducing the volume of weeds that might occur in the growing season, but be certain, there will never be no weeds. For the control of weeds that survive your first efforts, there are post-emergence herbicides. These are selective and nonselective chemicals that translocate through the plant and interrupt its life sustaining activities. Most post-emergence herbicides are absorbed through the foliage. It is best to have intact, actively growing plants, therefore, do not mow for at least two weeks before application and one week following. The results of your efforts may take up to two weeks before they become visible. Herbicide concentration will vary according to the type of weed being controlled; stronger mixes are necessary for perennial weeds.

Extreme caution should be exercised when using post-emergence herbicides among nursery plants: only spray on still, windless days to reduce the possibility of spray drift that could damage nursery stock. Also, choose a slightly overcast day rather than a hot sunny day when the plants stomates would be closed and uptake of the herbicide would be reduced. Be particularly careful around conifers, young trees and shrubs with green bark tissue. Until the bark becomes dark with maturity, these plants are exceedingly vulnerable to damage from herbicide spray.

Again, as with any weed control plan, vary the chemicals being used. The amount of seeds produced and the relatively short life cycle of weed plants incline them towards a natural selection for chemical resistance.

READ THE LABEL – MEASURE ACCURATELY – KEEP A LOG

POST-EMERGENCE: BROADLEAF WEED CONTROL

CHEMICAL	TRADE NAME	CONTROL +	CONTROL -	NOTES
Bentazon	Basagram T/O	Annual sedges, yellow nutsedge, some broadleaf, suppresses Canada thistle	No grasses, few broadleaf weeds	Avoid contact with conifers, Allow 8 hrs. before rain
Triclopyr	Garlon 3A & 4E	Hard to control herbaceous annual & perennial broadleaf, <u>woody species</u> i.e. poison ivy	No grasses or sedges	Avoid conifers, Allow 4 hrs. before rain
Clopyralid	Lontrel	Selective broadleaf, esp. legume (clover) & composite (Canada thistle)	No grasses or sedges, nor many broadleaf	Apply before weeds are fully developed, Allow 6 hrs. before rain

POSTEMERGENCE: GRASS CONTROL

Fenoxaprop-p-ethyl	Acclaim Extra	Most annual and a few perennial grasses	No broadleaf, sedges, or some perennial grasses	Addition of surfactant improves coverage
Clethodim	Envoy	Most annual and perennial grasses	No sedges, broadleaf weeds, or fine fescues	7-14 days required for control of grasses
Fluazifop-p-Butyl	Fusillade II, Ornamec	Annual and perennial grasses	No broadleaf, sedges, rushes and other nongrasses	Apply to grasses 2-8", before tillering or heading
Sethoxydim	Vantage	Annual and perennial grasses	No broadleaf, sedges, or fine fescues	7-14 days for injury symptoms

POSTEMERGENCE: NUTSEdge CONTROL

Bentazon	Basagram T/O	Annual sedges, yellow Nutsedge, some broadleaf, Canada thistle suppressed	No grasses, few broadleaf	Avoid contact with conifers
Halosulfuron	Manage	Yellow nutsedge, horsetail	Only yellow nutsedge and horsetail	Used at extremely low rates, <u>measure!</u>

SUMMER PRUNING

The structural pruning of winter will by now have pushed growth in the direction of the buds favored by the cuts that were made then. This is the time, when the plant is in full leaf, to make a second set of decisions about the form of the specimen. Summer pruning is an opportunity to improve the health and form of the plant by selectively removing actively growing portions at an early stage, while still small.

CONIFER DIGGING

Because the growth pattern of conifers is different than deciduous plants, it is best to dig them when new growth has hardened off, mid to late summer.

PEST SCOUTING

There are many times more beneficial than destructive insects to be found in the nursery. Just because an insect is found in proximity to plant damage, it is not necessarily guilty by association. It is very important to carefully identify which insect you have found. Once identified, if the insect is destructive, it is necessary to determine its eating method and life cycle. Eating habits help determine which type of control method to use. For example, piercing-sucking insects feed below the leaf surface and thereby avoid the chemical control that would be used for leaf chewing pests. The life cycle is important to understand so that the timing of the pesticide application coincides with the stage at which the insect is most vulnerable.

An affective way of reducing the time involved for pest scouting is the use of phenological indicators. As described in the Penn State IPM Fact Sheet #9:

Phenology is the study of the synchronization of developmental stages of plants and animals with the weather. The timing of these events depends on factors like temperature, moisture, and day length. Easily observable plant phenological events, such as bud break or leaf out, can be correlated with growing degree-days. Less easily observed events like the hatching of insect eggs can be associated with the appearance of certain stages of plant development. These correlations can then be used to predict when an insect pest will appear in the landscape, and when it may be most susceptible to effective management tactics.

Donald A. Orton of the Illinois Department of Agriculture has developed an accurate and very useful system that combines phenology and growing degree-days, to be used in the field by land managers for pest scouting. This system is detailed in his book, Coincide: The Orton System of Pest Management. Also, Penn State's *Woody Ornamental Insect, Mite, and Disease Management* booklet is a helpful resource. This booklet lists pests, and diseases, by host plant. The Ornamentals Hotline is a bulletin published weekly by the Southeastern Pennsylvania IPM Research Group. This is a particularly useful source considering how current and nearby the research. Information about subscribing to this bulletin can be found by calling (610) 489-4315.

FALL

- **DIGGING AND PLANTING**
- **STAKING**
- **TREE TRUNK PROTECTION**
- **FALL HAZARD LIST**
- **COVER CROP**
- **WEED CONTROL**

DIGGING AND PLANTING

Fall is a very good time for moving many plant species. The threat of heat and drought stress is greatly reduced in southeastern Pennsylvania, and the season is usually long enough to allow the plants to become established in their new site. It is best to begin digging after fall leaf drop. If, after digging, the dry leaves are held by the plant, it is best to remove them by hand.

STAKING

It is generally agreed that staking should only be done when necessary. If a young tree must be trained straight, a tall, rigid stake should be placed close to the trunk and tied at several points. If the root ball of a transplanted tree is small for the height of the plant, a loose, three-point staking should be used. It is best for the development of the plant to allow it to move in the wind, thus increasing caliper and trunk strength. For weak trunked trees, calcium nitrate can be used to improve strength. Water the tree first, wait two hours, then apply calcium nitrate at 15 ounces per 5 gallons of water. This procedure can be repeated three times during the active growing period in summer.

TREE TRUNK PROTECTION

Placing a protective material around the tree trunk can decrease the risk of damage from weed trimmers, deer, rabbits and rodents. Be sure to select a material that has openings to allow light and air circulation, and is light colored. Material that is closed and dark colored can promote disease, fungus, rodent nesting and premature foliage.

FALL HAZARD LIST

There are certain trees that are not recommended for fall digging due to potential risk in getting established before dormancy. The following list is compiled from information received from Princeton and Tuckahoe Nurseries.

<i>Acer burgerianum</i>	<i>Koelruteria paniculata</i>
<i>Betula varieties</i>	<i>Liquidambar varieties</i>
<i>Carpinus varieties</i>	<i>Liriodendron varieties</i>
<i>Cedrus deodara</i>	<i>Malus – in leaf</i>
<i>Celtis varieties</i>	<i>Nyssa sylvatica</i>
<i>Cercis Canadensis</i>	<i>Ostrya</i>
<i>Crataegus varieties</i>	<i>Prunus – all stone fruits</i>
<i>Cupressocyparis leylandii</i>	<i>Pyrus varieties</i>
<i>Fagus varieties</i>	<i>Quercus – all oaks except Q. palustris</i>
<i>Halesia varieties</i>	<i>Salix – weeping varieties</i>
<i>Ilex x fosterii</i>	<i>Sorbus varieties</i>
<i>Ilex ‘Nellie Stevens’</i>	<i>Tilia tomentosa varieties</i>
<i>Ilex opaca’ Greenleaf’</i>	<i>Ulmus parviflora varieties</i>
<i>Juniperus virginiana</i>	<i>Zelkova varieties</i>

COVER CROP

Fall is a good time to begin getting a cover crop established, warm soil temperature, cooler air temperature and increased moisture all contribute to a quicker germination. See **SPRING** section for establishing a cover crop. If a cover crop already exists but is patchy, over-seed after loosening the soil in the bare areas.

WEED CONTROL

A fall application of pre-emergence herbicide is important to prevent the germination of winter annuals. Mid-September to late October while the ground is still pliable would be the best time for this application. To kill weeds within the cover crop, a half-strength solution of RoundUp can be sprayed without damaging the hard fescue.

WINTER

- **FORMATIVE PRUNING**
- **ROOT PRUNING**
- **WINTERIZE WATER LINES**

FORMATIVE PRUNING

The nursery trees and shrubs are being grown for possible planting out in the Arboretum, not for commercial purposes, the type of formative pruning reflects this intention. Therefore, the pruning in this nursery is to maintain the natural form of the tree so that they faithfully represent the species, making cut decisions based on the health of the plant. Crossing and touching branches should be removed. In the case of trees, co- dominant leaders should be reduced by subordinate pruning or removed. Lower branches and branches with unusual form that enhance the character of the specimen should be saved. After pruning, remove all debris from the nursery to reduce the risk of disease or accidents.

ROOT PRUNING

This may be a perfect-world scenario, but root pruning every two years would benefit the plant and make transplanting considerably easier. Roots spread out several feet from the trunk, when dug; a root ball typically contains 20 to 30 percent of those roots. Root pruning would stimulate a more concentrated mass of fibrous roots that would help hold the root ball together. The simplest way to root prune would be to go out two thirds of the drip line from the trunk. On even years dig the north and south quarter and on odd years the east and west quarter, twelve to eighteen inches deep. The expensive way to root prune would be to have a tree spade drop its blade half depth around the plant. The best time to do this work is late summer to early fall when leaf growth has slowed, and the need for water uptake is reduced. Pruning at this time allows for enough root growth in fall to support the flush of spring growth.

WINTERIZE WATER LINES

If an irrigation system is used, all lines that might be damaged by freezing should be drained and stored. At this time, periodic system maintenance should be performed so that it is ready for next season's use.

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Mead, T. Tuchahoe Nursery. N. J. 609 780-5157

Miller, C. Stonetree. Oxford, PA. 484 645-6943

Plyler, J. Natural Landscapes. Jennersville, PA.

Tickle, P. Ticklewood Nursery. Jennersville, PA. 610 869-8086

Wells, D. Wells and Associates, Inc. West Grove, PA. 610 869-3883

PRODUCT SOURCES

ADPI Landscape and Nursery Products. Philadelphia, PA. 800 621-0275
Tree Bark Protectors

Rain Bird, Lee Rain, Inc. Vineland, N. J. 856 691-4030
Irrigation Supplies

Trickl-Eez Co. Biglerville, PA. 800 672-4700
Drip Irrigation Systems