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Turfseed breeders embrace endophytes

■ They're so tiny you need a powerful microscope to see them, but they're a big hit with turfseed buyers.

Virtually all seed producers are accelerating efforts to put endophytes into as many varieties as they can.

The result: even more varieties of endophyte-enhanced turfseed coming to market, which seems to be fine with turfseed end users.

Turfseed-buying professionals have evidently taken to the idea that endophytic fungi—barely known just a decade ago—provide turfgrass with enhanced insect resistance (above-ground insects) and, more recently discovered, disease resistance. Turfgrass experts feel this translates into reduced use of traditional chemical controls, and hardier turfgrass.

"The seed companies aren't driving the end users," says Eric K. Nelson, research director for Medalist America. "The demand is coming from the customers. This is something they want. Its time has come."

Adds Dr. Fred Ledebor of Turf Merchants, Inc., "All new germplasm of tall fescue, perennial ryegrass, and fine fescues that enter our breeding program is screened immediately for endophytes.

"Plants that do not contain endophytes are channelled into a branch of the program to introduce endophytes, while endophyte-infected plants are moved immediately into the breeding program."

Suichang Sun, a researcher who came to Jacklin Seed this past March after six years at Rutgers University, says

endophyte-infected varieties originate from naturally infected plants that were selected from a nursery. Or breeders select good looking plants that are then artificially inoculated.

He says researchers are studying an *Acremonium* endophyte that will be artificially inoculated into fine fescues. But studies at Rutgers have shown an inhibition to *Acremonium* endophyte in Kentucky bluegrass varieties.

To develop a variety of Kentucky bluegrass containing endophytes, researchers will either have to find a type of endophyte that will not be rejected by Kentucky bluegrass, or cross endophyte-infected plants of neighboring *Poa* species with Kentucky bluegrass.

Actually, it's not the endophyte itself that provides insect resistance, it's the alkaloids that the endophyte produces, the reason why endophytes are undesirable in forage grasses.

—Ron Hall

'Topping' trees is a likely mistake

■ Tree "topping" occurs when the crown of a tree is cut. It's not only aesthetically unpleasant, it can cause the tree to become infected or die.

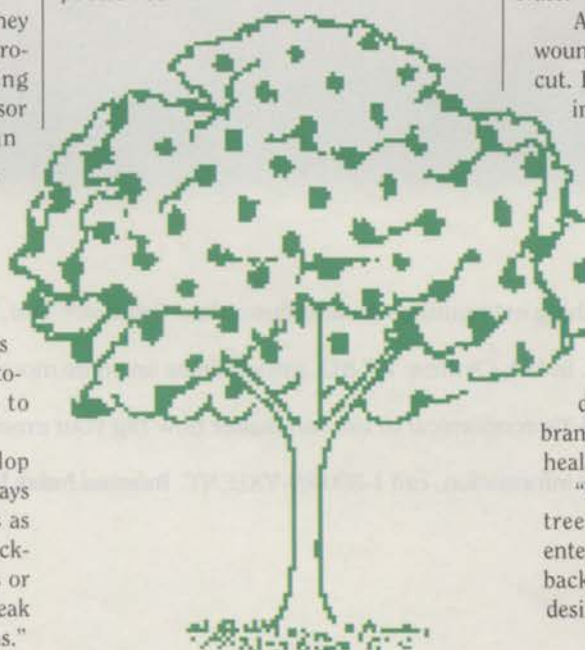
"Many homeowners assume that if they top a large tree, it will compensate by producing a new, healthy, lower-growing crown," says Dr. J. Robert Nuss, professor of ornamental horticulture in Penn State's College of Agricultural Sciences.

According to Nuss, removing the central trunk and the tops of main branches permanently destroys a tree's form and causes unnatural growth.

Removing too many leaves weakens the tree. Without enough leaves to photosynthesize, the tree slowly starves to death.

When trees are topped, they develop bristling "water sprouts," or suckers," says Nuss. "To the untrained eye, this looks as though the tree is rejuvenating, but suckers don't develop into substantial limbs or produce enough leaves. They remain weak and spindly, and snap off easily in storms."

Nuss says a topped tree might develop a double leader, or trunk. This new trunk often is weaker than the original and is prone to



splitting. The massive root system also is weakened because it no longer receives adequate nourishment from the crown. Trees in this condition are more likely to split or blow over in a storm.

"A mature tree with a healthy root system is much less likely to blow over than a weak one with damaged roots," advises Nuss.

A topped tree also causes large wounds where the crown and limbs are cut. It takes years for these to heal, and in the meantime can invite insects, disease and decay.

Before you prune a tree, Nuss says, consider what you want to accomplish.

Consider the tree's natural form, growth habit, growth rate, height and spread.

"Pruning is meant to remove dead, damaged or insect-infested branches and keep the rest of the tree healthy," says Nuss.

"It's also used to open the center of a tree and allow more air and light to enter. All pruning cuts should be made back to side branches pointing in the desired direction."

**LANDSCAPE
MANAGEMENT**

'WE KNOW YOUR TURF'

A decorative flourish in shades of purple and blue, featuring a stylized flower and swirling lines, positioned to the left of the title.

GUIDE TO
ORNAMENTALS

- * bed preparation
- * tree planting & care
- * wildflowers in urban areas
- * favorite annuals/perennials

Selection, planting and care of Annuals

Flowering annuals or bedding plants are homeowner favorites. They are inexpensive and produce an abundance of brightly colored flowers from spring to frost. Some are even winter-hardy if protected by a light mulch.

Annuals complete their growing cycle within one growing season. They are usually purchased in early spring and planted as soon as the last frost is past. Several annuals, such as pansy, snapdragon, stocks and calendula, will withstand a light frost and can be planted earlier for establishment during cool weather.

The annuals industry has grown tremendously in the last several years. The impatiens is the most popular since it is so versatile, offering brilliant summer-to-fall bloom in shady beds, borders and containers.

Other leading annuals are geraniums from cuttings and seed, petunia, marigolds and fibrous begonias.

Where they grow—Annuals grow best when the soil in the planting site has been prepared beforehand to receive the transplants. Planting sites should be well-drained and in full sun or moderate shade, depending on plant species preference. Plant roots fail to thrive in wet soil so drainage is very important.

Adjust the soil to a pH of 6.3 to 6.7 for best growth.

Highly organic soils can range from pH 5.7 to 6.0. Amend the soil with high quality peat. At planting, break apart soil root masses slightly to prevent "root balling." This procedure will ensure rapid



Begonias are among the most popular annuals.

root expansion into surrounding soil.

Water plants after planting to hasten root establishment.

Before planting—After healthy plants have been purchased, plant them immediately. Water and fertilize on a regular basis.

Transplants, if held for a few days before planting, must be kept watered, since the small cell-packs dry readily. Place plants under the shade of trees and remove dead flowers as needed to prevent decay if planting is delayed.

Don't store plant material in a shop where gas engines are started. Build-up of ethylene gas, a product of combustion, can cause leaf drop and flower injury. High temperatures and low-light conditions will also lead to rapid deterioration of plants.

As plants grow and flower, it is necessary to pay some attention to small details of fertilization and dead flower removal.

Fertilize at time of planting by using a controlled release fertilizer product that will feed all season or use a liquid with 20-20-20, 23-19-17 or a similar fertilizer bi-weekly.

Remove dead flowers and broken branches weekly. This reduces botrytis fungus build-up and keeps plants healthy. Avoid overhead watering by using a soaker hose to wet the soil and not the foliage.

—Source: Dr. Charles T. Behnke, extension agent, horticulture, Ohio State University

Site selection



Impatiens: for shade or partial shade areas.

Moist locations: Angel trumpet; forget-me-not; hibiscus

Poor soil: California poppy; celosia; clarkia; cosmos; snow-on-the-mountain

Sunny locations: Aster; baby's breath; bachelor button; calendula; castor bean; celosia; celosia; cosmos; dianthus; flowering cabbage; gazania; geranium; larkspur; marigold; morning glory; moss rose; nasturtium; pansy; petunia; poppy; salvia; snapdragon; statice; strawflower; verbena; zinnia.

Shade or partial shade: Annual phlox; balsam; begonia; bellflower; calendula; clarkia; coleus; dwarf lobelia; forget-me-not; four o'clock; flowering tobacco; godetia; impatiens; larkspur; nasturtium; pansy; sweet alyssum; verbena; wallflower; wishbone plant

Arid locations: Ageratum; California poppy; cockscomb; coreopsis; cosmos; four o'clock; moss rose; petunia; statice; swan river daisy; verbena; zinnia.

Petunias: best in arid locales.



Perennial favorites

SPRING

Lungwort (*Pulmonaria* spp.)—Several varieties; oval leaves with metallic spots; flowers that turn from pink to blue; 5 inches tall; excellent ground cover.

Bloodroot (*Sanguinaria canadensis*)—Huge, rounded leaves through spring and summer; daisylike white flowers are 8 inches tall; a native; self-seeds and spreads rapidly.

Ferns—Many varieties, including maidenhair (*Adiantum* spp.), Goldie's (*Dryopteris Goldiana*), royal (*Osmunda regalis*), Christmas (*Polystichum acrostichoides*) and Japanese painted (*Athyrium niponicum* var. *pictum*); 1 to 4 feet tall; lovely foliage plants.

Daylilies (*Hermerocallis* spp.)—Early-blooming varieties 6 inches to 4 feet tall.

Oriental poppies (*Papaver orientale*)—Hairy lobed leaves; huge white, pink, red or orange flowers, 3 feet tall; dies back in summer.

Peonies (*Paeonia* spp.)—Many varieties; deeply lobed, leathery foliage; white to red single and double flowers; 1 foot to 4 feet tall.

SUMMER

Hostas (*Hosta* spp.)—Many varieties; huge rosettes of oval leaves in many textures and colors, white to lavender bell-like flowers, some fragrant; 6 inches to 4 feet tall.

Daylilies (*Hemerocallis* spp.)—Many varieties; flower colors may be less vivid on shaded plants.

Balloon flowers (*Platycodon grandiflorus*)—Small oval leaves; white, pink or blue single and double flowers on wands; 2 feet to 3 feet tall. Buds look like balloons.

Heliopsis (*Heliopsis* spp.)—Many varieties; nondescript foliage; daisylike yellow to orange flowers; 4 feet tall; among the longest flowering perennials.

Phlox (*Phlox paniculata*)—Nondescript foliage; fragrant white to purple flowers until frost; 3 feet tall; visited by hummingbirds.

Coneflowers (*Rudbeckia* spp.)—Several varieties; nondescript foliage; daisylike pink or white flowers with brown metallic centers; 2 feet to 3 feet tall; a native.

Astilbes (*Astilbe* spp.)—Many varieties; ferny, leathery foliage; flowers in plumes of white, pink, lavender and red; 6 inches to 5 feet tall.

Purple loosestrife (*Lythrum Scalicaria*)—Several varieties; nondescript foliage; wandlike flower clusters in pink to purple; 3 feet to 4 feet tall; invasive.

FALL

Hostas (*Hosta* spp.)—Many varieties; huge rosettes of oval leaves in many textures and colors, white to lavender bell-like flowers, some fragrant; 6 inches to 4 feet tall.

Daylilies (*Hemerocallis* spp.)—Many varieties; flower colors may be less vivid on shaded plants.

Balloon flowers (*Platycodon grandiflorus*)—Small oval leaves; white, pink or blue single and double flowers on wands; 2 feet to 3 feet tall; buds look like balloons.

Blue mist shrub (*Caryopteris x clandonensis*)—Gray-green delicate foliage; blue misty flowers from August on; 3 feet tall.

Asters (*Aster* spp.)—Many varieties; nondescript foliage; daisylike flowers in white, yellow, blue, pink, red and purple; 6 inches to 5 feet tall. Some are natives.

Hardy chrysanthemums (spp.)—Many varieties; much-branched compact plants with daisylike flowers from white to red; 1 foot to 3 feet tall. A good cultivar is *C. x rubellum* 'Clara Curtis'.

Hibiscus (*Hibiscus* spp.)—Several varieties; huge heart-shaped leaves; plate-sized single flowers from white to red; 4 feet to 6 feet tall.

Ferns—Many varieties; attractive foliage; 1 foot to 4 feet tall.

SHADE

SUN

WET SOIL

Virginia bluebells (*Mertensia virginica*)—Oval leaves die back in summer; flowers start pink and turn blue, on graceful stalks; 1 foot tall.

Common primroses (*Primula vulgaris*)—Crinkled, straplike foliage; pale yellow flowers; 8 inches tall.

Iris Kaempferi and *I. Pseudacorus*—Lance-shaped blue-green leaves; huge flat flowers; three feet tall.

Perennials are charted in order of flowering or their most attractive season. Chart author Nancy Carney says these species all thrive in crowded gardens. Carney lists plants that are easy to grow and long-blooming, with foliage that stays attractive a long time.

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5 steps to proper garden design

1) Provide a path for the eye. It's "the track the eye rides upon." A path guides the eye through the garden as though the eye were riding on rails. The path must appear to lead somewhere, and the further the better.

2) Build a background, to emphasize the best features of the garden. Fences, walls, shrubs or trees make the best backgrounds; they obscure distracting objects, like telephone poles or tool sheds.

3) Find a focal point. You find it when you follow the path and reach the background. The focal point should be interesting and obvious, such as sculpture, furniture, bird feeders, or a distinctive and colorful plant.

Chrysanthemum variety 'Sophia', new from Yoder Bros., Barberton, Ohio; (216) 745-2143



4) Control color. Divide flowers into two groups: those that are colored red through blue, and those that are yellow through orange. If you plant flowers from only one group, you simplify the color scheme without detracting much from the garden's allure, since the colors in each group generally harmonize.

5) Add texture. Save this for last. Texture includes all the non-flower details: plants, pebbles, rocks, benches, patios. Paving materials should be of the same texture. If the patio's made of brick, so should the wall be brick.

Plants, however, can be of various textures, as long as the most dramatic plants don't overpower the rest of the garden.

—Source: Robert Smaus in *The Best of Fine Gardening: GARDEN DESIGN IDEAS*, published by The Taunton Press (softcover, 96 pages, \$14.95). To order, call The Taunton Press, (800) 888-8286, operator 77.

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st beautiful thing about ned in the top 1" of soil.



Wildflowers for the 'burbs?

■ Wildflowers in residential areas? You bet.

Direct seeding of wildflowers is less expensive than using bedding plants. Wildflowers are hardy and, in many cases, drought tolerant. Wildflowers also offer a casual, natural look—that bit of wilderness so desired by many homeowners today.

Does that mean advising homeowners to turn their properties into a wildflower meadows? Not at all.

Neighbors may not appreciate it. The homeowner may love wildflowers, but neighbors, some anyway, may perceive them as weeds. Also, some communities have laws against allowing lawns to grow too tall. A wildflower area is, admittedly, not a lawn, but these complaints are common enough to be bothersome. Deal with neighbor and local regulatory issues before beginning. Then plan the wildflower areas carefully. Likely residential wildflower sites include a slope in the back of a property or a side yard.

Matching the kind of wildflower mixture with specific site is the next step. How much sun does the area receive? There are wildflowers that grow in sunny, dry areas as well as those which grow in cool, shady spots which get at least one to four hours of sunlight daily. Decide what kind of mixture suits the desires of the homeowner best. All one color? A tall mixture?

A multitude of mixtures are available, even custom blending for larger seeded areas. Most mixtures contain both perennials and annuals. Most annuals will give a brilliant show the first year, but usually don't reseed. They help con-



There are wildflowers that grow in sunny, dry areas as well as those which grow in cool, shady spots which get at least one to four hours of sunlight daily.

trol weeds and add vibrant color to the planting during the first year. Most perennials will bloom from the second year on.

Proper preparation of the planting site is critical for wildflower success. Remove existing vegetation, tilling the soil to a depth of three to four inches. Remove weed seed from the soil, either by repeated tilling or by repeated use of a general herbicide such as Roundup or Kleenup.

Wildflower seeds can be planted in spring, early summer or fall. Typical seeding rates for small areas are one ounce per 250 square feet or one pound to cover 4000 square feet. A one-acre planting will need 5-20 pounds of seed, depending on the site and mixture used.

To make seeding easier, mix the seed with sand or vermiculite. Then spread the mixture by hand or with a small cyclone seeder. The seeds should be covered lightly by raking or by covering with $\frac{1}{2}$ inch of fine peat.

Keep the ground evenly moist until the seedlings become established, usually within 4-6 weeks. This is particularly important if seeds are sown in late spring or early summer. Although it may not be practical to hand-weed large wildflower plantings, it greatly enhances the beauty of the site to remove weeds. Mow, at a height of 4-6 inches, at the end of the growing season.

New hosta cultivars

■ Hostas are one of the best partial sun/full-shade perennials.

"Anything with yellow in it will tolerate more sun," says Debbie Frey, horticulturist with Bailey Nurseries, Inc., St. Paul, Minn. "But as a rule, hostas are suited to part shade or shade."

Light sun for plants means 3 hours or less per day. Full sun is 6-8 hours a day; partial sun is 4-6 hours of direct sunlight.

Frey says there are some new hosta varieties on the market.

"There aren't thousands of cultivars to choose from, but here are some newer varieties on the market to think about."

Here's Frey's list of new hosta choices:

Hosta 'Aspen Gold' is a large specimen plant with gold leaves that are crinkled and cupped.

Hosta 'Francee' is a variegated type with dark forest green leaves

with a bright, crisp white edge. A good choice for potting, it blooms in August with a lavender flower on plants that are 15-to 18 inches tall.

Hosta 'Ginko Craig' is a small-starred plant that's great for edging the garden bed, with long narrow dark green leaves with a narrow white border along the leaf.

Hosta 'Great Expectations' is a large specimen plant; the leaf has a very wide, irregular margin of blue and green surrounding a light yellow-cream center, very puckered.

Hosta 'Patriot' has leaves with forest green centers, accented by a broad, cream colored margin on plants up to 18-inches tall. It likes more sun than the average hosta to retain its color.

Hosta 'Shade Fanfare' is a variegated variety; leaves have a light green to gold center accented by a broad, cream-colored margin on plants up to 18-inches tall. It needs more sun to retain its color.

Bedding plant preparation/fertilization tips

■ Vibrant displays of bedding plants require healthy soil that contain adequate quantities of water, air space and nutrients. Since bedding plants have such small root systems—compared to woody plants—these three requirements must be uniform in the top 8 to 10 inches in the soil.

Unfortunately, not all soils provide good growing conditions for bedding plants. Sub-standard soils can be improved with the addition of soil amendments and nutrients.

For instance, sandy or coarse-textured soils provide pore space for oxygen and drain well. That, of course, means they don't hold water very well. The addition of peat moss, humus, or properly processed compost will allow the soil to hold more water.

Clay soils are comprised of much smaller particles meaning they hold water well. Characteristically these soils compact easily and drain slowly, between 4 to 20 times slower than sandy soils. Additions of pine bark humus or compost (make sure it's fully composted) can improve these soils. For best results incorporate at least 2 inches of the amendment into the top 6 inches of the soil. You can add more amendment, up to about 50 percent. More than that is a waste of time and money.

After adding the amendments a soil test may be in order. It will reveal if phosphorus, potassium, calcium or magnesium are needed.

It will also measure the soil's pH. Or you can make your own preliminary finding with a portable pH meter. The soil pH for bedding plants should be between 5.5-6.5. To raise the pH of the bedding plant soil, use ground limestone; to lower it, elemental sulfur.

Providing bedding plants with the proper nutrients and in the proper amounts isn't just a matter of putting down fertilizer.

For instance, the challenge in applying nitrogen—the element that accelerates plant growth—lies in not applying so much that plants are



Bedding plants provide a more colorful display when properly fertilized.

damaged.

Water-soluble fertilizers, for instance, can generally be applied every 4-8 weeks throughout the plant season, applying no more than 4-6 lbs. N per 1000 sq. ft. of bed area during the growing season. Or, slow-release fertilizer can be incorporated into the bed just before planting. Broadcast a second application about mid-season. Again, 4-6 lbs. of N per 1000 sq. ft. of bed per season should give good results.

Once the bed has been prepared and fertilized and the flowers planted, they must get adequate amounts of water. The nature of the soil, whether it's primarily sand, loam or clay, determines how often the bed should be irrigated. Beds maintained in sandy conditions may need to be watered 2 or 3 times a week whereas a bed that's been established in clay may only need a weekly dosing.

Suggested nitrogen sources, application methods, intervals between applications and application rates for bedding plants in the landscape (Nitrogen recommendations based on seasonal total of 4 lbs. N/1000 sq. ft. bed area)

—by Douglas A. Bailey, Stuart L. Warren, William C. Fonteno, North Carolina State University.

Dry broadcast over bed surface

Weeks between applications, # of apps per season

4 wks.
(5 apps)

6 wks.
(3 apps)

8 wks.
(2 apps)

Liquid 1 quart per sq. ft. of bed area at each application

Weeks between applications, # of apps per season

1 wk.
(18 apps)

2 wks.
(9 apps)

4 wks.
(5 apps)

lbs/1000 sq. ft. for each app.

lbs./100 gallons of solution

Nitrogen source	Effect on soil pH	Dry broadcast over bed surface			Liquid 1 quart per sq. ft. of bed area at each application		
		4 wks. (5 apps)	6 wks. (3 apps)	8 wks. (2 apps)	1 wk. (18 apps)	2 wks. (9 apps)	4 wks. (5 apps)
Ammonium nitrate (33.5-0-0)	mod. acid	2 lbs. 6 oz.	4 lbs.	6 lbs.	4.5 oz.	9 oz.	1 lb.
Ammonium sulfate (20-0-0)	very acid	4 lbs.	6 lbs. 11 oz.	10 lbs.	7 oz.	14 oz.	1 lb. 10 oz.
Calcium nitrate (15.5-0-0)	mod. basic	5 lbs. 3 oz.	8 lb. 10 oz.	12 lbs. 14 oz.	9 oz.	1 lb. 2 oz.	2 lbs. 1 oz.
Potassium nitrate (13-0-44)	slight acid	6 lbs. 2 oz.	10 lbs. 4 oz.	15 lbs. 6 oz.	11 oz.	1 lb. 6 oz.	2 lbs. 7 oz.

New tree planting

Generally, plant trees and shrubs so that they may develop freely without crowding each other, houses or utility lines.

Before selection: determine the mature size of the tree by consulting nursery personnel, catalogs, garden books, or extension publications. Be sure to get the correct information for the specific variety of your tree.

Many shrubs and round-headed trees grow about as wide as they grow tall, so if figures for width are unavailable, estimate from the ultimate height. Ex.: a tree that grows between 10 and 15 feet tall will commonly spread its branches about the same distance, and should be planted about 7-to-8-ft.—or about half its height—away from houses or other structures.

Careful placement can reduce maintenance problems. Place shade trees away from the home or other buildings. Keep in mind that in the years to come, the tree will sometimes lose branches in storms. For this reason, oaks and other strong-wooded shade trees should be placed at least 20 ft. away from buildings and utility lines.

Place soft-wooded trees such as soft maple at an even greater distance. In relation to one another, large shade trees should be placed about 50 ft. from each other for best results.

Medium-sized trees such as red maple or river birch should be spaced about 35 ft. apart. Dogwood, redbud, hawthorn, crab or other small trees may be planted 15-to-20 ft. apart and at least 8 ft. from buildings.

Shrubs, hedges—
Spacing is also a consideration for shrubs and hedges. Shrubs should be spaced about one-half of their ultimate spread from buildings.

Place different varieties of shrubs about one-half the total spread for both plants (ex., an 8-ft. shrub and a 6-ft. shrub should be spaced about 7-ft. apart. Hedges may be spaced closer together to

form a full, dense screen. Low hedge plants (3-to-4 ft. high) should be spaced about 18-inches apart, while tall hedge plants will need to be 3-to-4-ft. apart.

Planting: 8 steps

The best time to plant trees and shrubs is during the dormant season; in fall after leafdrop or early spring before budbreak. Cool weather lets plants establish roots in their new location before spring rains and summer heat stimulate new growth.

However, if the tree has been properly cared for in the nursery or garden center, it's okay to plant throughout the growing season. Proper planting ensures a healthy future for new trees and shrubs.

Proper planting involves an 8-step process:

1) Dig a large planting hole. After locating all utility lines, dig the hole as deep as the root ball and twice as wide.

2) Prune just a little—Check for injury to roots or branches. If any roots are crushed, cut them at a point just in front of the break. On the top, prune only broken branches, making sure to leave the branch collar (swollen area where one branch meets another) intact. Begin corrective pruning after a full season of growth in the new location.

3) Prepare the hole and soil. While some newly transplanted trees may benefit from an application of plant food, it is best not to use fertilizer until the plant is well-established. Good, rich native soil placed in the hole is usually adequate. Never apply high nitrogen fertilizer at planting time; it may burn tender roots.

4) Place the tree at the proper height.

To avoid damage, always lift the tree by the root ball, never by the trunk. Add soil to the hole to raise the tree to its original growing level. (This level is marked by a dark stain on the trunk which indicates the difference between the root and trunk bark.)

5) Fill the hole, gently but firmly. Cut the string and remove whatever burlap you can. If the tree's in a plantable basket,

perforate the sides in four or five places and break off the top rim.

6) Firm the earth around the tree to eliminate air pockets. Settle the soil with water and add soil to the hole until the tree is firmly placed.

Don't use your feet to tamp the ground; it'll cause compaction.

7) Stake the tree if needed. Staking can damage the bark, so avoid it if possible. Use a broad, soft

strapping material such as woven belt fabric or padded wire.

Drive two or three stakes into the ground just outside the perimeter of the planting



hole, an equal distance apart.

For each stake, attach one end of the strapping material to the tree at the lowest practical level to keep it upright; fasten the other end to the stake.

Remove the stakes as soon as the tree is firmly rooted.

8) Mulch with 2-to-4-inches to conserve moisture and protect the newly planted roots from extreme temperatures.

9) Water often. Regular watering helps develop a strong new root system. Water new trees at least once a week if it doesn't rain, more often during hot weather.

—Source: *The International Society of Arboriculture*



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