



"Your Outdoor Source"

2442 State Route 27 – North Brunswick, NJ 08902 – (732) 297-1244 – Open Seven Days

Cosmos (Cosmos bipinnatus)



A native of Mexico, also called Mexican Aster, Cosmos is a heat loving annual that provide abundant blooms all summer until frost. This airy plant produces tall, lanky stems with feathery leaves and colorful daisy-like flowers. The plants can grow up to 4-6 ft with dwarf varieties up to 1- 3 ft tall. The blooms come in assorted colors of white, pink, red, lavender and yellow, in single, semi-double and double forms making them an excellent cut flower.

Care

Grow them in full sun in a well drained, dry, poor soil. They thrive on neglect; rich wet soil will produce floppy plants with many leaves and little flowers.

Start them from seeds indoors 6-8 weeks before the last frost date or sow directly outdoors after the last expected frost. To start the seeds indoors: Sow seeds and cover lightly with soil. Germination should take 5-10 days at 70-85 degrees.

Plant

seedlings outdoors 9-24" apart. The taller varieties of Cosmos should be planted in the back of the flowerbed and may need staking. To keep tall varieties from falling over, plant them 9-12" apart, so that they can interweave and support each other. For compact, bushier plants with more flowers pinch them back once or twice before flowers buds begin to show.

Deadhead

spent flowers for continuous bloom and to prevent them from self-seeding. If you want Cosmos to self-seed next year; allow some of the seed heads to remain on the plant at the end of the season. You can also collect dry seed heads for next year's planting.



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Impatiens

Growing Impatiens

From the time they were discovered in East Africa, impatiens have become one of the largest selling annual bedding plant. After 40 years of breeding, Impatiens have come a long way with new varieties introducing a rainbow of colors (except blue), single and double flowers and assorted heights. A favorite shade plant, it provides a non-stop floriferous splash of color to any low light area all season long until a killing frost will finally put it to rest.



Impatiens are one of the easier plants to grow. Given the right conditions, they will provide mounds of brightly colored flowers 1-2 ft. tall from spring to fall. They are great in borders, containers, window boxes and hanging baskets.

Care: Primarily considered a shade/ semi-shade plant, newer varieties (Viva) also tolerate sun.

Because it is a heat-loving, tropical plant, it should be planted after all danger of frost has passed or when the soil temperature is 60F.

Plant 6" to 12" apart in well-drained, rich organic soil in shade/semi-shade. In the North plant them in full sun and in the Southern states in morning sun. In either climate, Impatiens need protection from the hot afternoon sun.

Watering: Impatiens like moist but not wet soil in order to grow well. Be sure they get 1" of water every week and water more often in the heat of summer and if in full sun. If allowed to dry out they will wilt dramatically and sulk dropping its leaves and flowers. Wilting also causes stress and drains energy making them more susceptible to insect or disease damage.

When planting, feed with a slow-release fertilizer or monthly with a balanced fertilizer. Feed more often when container grown or if plants are competing for nutrients such as growing under a tree. Too much fertilizer can cause leggy plants and reduced flowering.

If your Impatiens are tall and leggy by mid summer pinch them back to 6 inches and they should regrow as bushier plants.

Propagation: Softwood cutting taken in late winter, early spring. Seeds-sow indoors 10-12 wks before last frost date. Seeds need light and temperatures of 70-75F to germinate cover with plastic to provide humidity. Germination takes 15-20 days.

Troubleshooting:

Root rot- over-watering, poor drainage

INSV Impatiens necrotic spot virus-leaf & stem ring spots that are yellow, white, gray or brown/black.

TSWV Tomato spotted wilt virus - ring spots on foliage transmitted by thrips

Fungal leaf spots-plant stress

Spider mites, thrips, mealybugs and aphids



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How to Choose the Best Annuals

The secret to picking out annuals for bigger and better blooms.

The garden centers are loaded with rainbow colors of annual flowers. Growers know that color will sell flowers so they feed their annuals with higher doses of phosphorus and potassium to get early bloom on immature plants. Here are a few tips to help you become a smart shopper.

When **picking plants** for your flowers beds, don't be tempted to buy annuals with showy, blooms, pay closer attention to the foliage. The plant should be healthy and vigorous with thick branching stems, dark green foliage (in most cases) and flower buds just starting to show a bit of color. Avoid plants that are either too compact or too spindly. Stay away from yellowing or browning leaves and foliage with spots or brown edges that can be a sign of stress, disease or pests.

In addition, **check the root system** which is just as important. I picked out a flat of begonias at a reputable nursery that had great looking foliage but when it was time to plant, I discovered that the roots were over watered and dying. Needless to say, the plants performed poorly. To check the roots, pop the plant out of its cell pack and inspect the roots; do they fill up the container with a solid white mass or growing out of the bottom of the pot? If so, the plant has been heavily rooted and the roots will need to be trimmed. Is the plant difficult to pop out from the container? Does the soil spill out with the roots? If so, they are under developed and need more time to grow. The best proportion is an even mix of cream colored roots and soil.



Don't be tempted to plant too early. Tender flowers will sit and do nothing if the soil and air temperature are too cold and if a frost hits, then all will be lost. Soil temperatures should be in the 50's for safe planting. Warm weather plants such as impatiens, tomatoes and peppers should be planted when all danger of frost has passed and nighttime temperature are above 60F. If you can't plant right away; water and place the container in the suggested light (sun or shade) during the day when temperatures are warm. Bring indoors/garage at night

As difficult as this may sound, **remove the flowers at planting time**, so the plants can focus their energy on more leaf and root production. Also, pinch back any spindly growth to produce bushier plants (except for asters, arctotis and gazania). You will be rewarded with healthier plants and more flowers all season long.



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Gerbera Daisy

Gerbera daisy (*Gerbera Jamesonii*) also known as African daisy, Barberton Daisy, and Transvaal Daisy originates from South Africa, Madagascar to South American and tropical Asia.

Gerbera daisy is known for its bright vivid colors and large daisy-like flowers that grow on bare stems 10-18 inches tall. It is hardy in zones 9-10 and usually grown as an annual or tender perennial that can be brought inside during the winter. This eye-catching flower attracts bees and butterflies. In a NASA study for indoor air improvement, Gerbera proved effective in removing chemical vapors and toxic gases.*



Culture Gerbera daisy should be planted in rich well-drained soil. As with many plants, they don't like wet, soggy soil. If you have clay soil, one that holds moisture and stays wet, then you will need to amend the soil by adding organic material such as peat moss, compost, etc. to improve drainage. If the soil cannot be amended, then a raised bed or container is suggested. Plant the crowns above the soil level, too deep will invite crown rot.

Plant it in a sunny location protected from the hot afternoon sun. Full sun is best for more flower production. Water early in the day and allow it to dry slightly between watering. Avoid overhead watering. **Improper watering and poor drainage** will lead to problems such as crown rot and poor flower production. Feed monthly with a 1/2 strength balanced fertilizer and every two weeks during the flowering period (spring and summer). Maintain the plant by removing spent flowers and old leaves.

Propagation

Gerbera daisy can be started from seed 10-20 weeks before the last frost. No pretreatment is required. After collection, **seeds** should be germinated within 1-2 months. Plant the seed pointed end down and do not cover completely as they need light to germinate which should take 15-25 days. Once the weather is warm and danger of frost has passed, move them outdoors. They may even reseed themselves during the summer. Keep in mind that plants grown from seed may differ from the parent plant. You can also divide the plant in the spring or take basal cuttings in the summer and dip in rooting hormone.

Not only is Gerbera daisy attractive in the garden or as a potted plant; they are also a favorite in the **cut flower** industry. The **long vase life** of up to 14 days and a myriad of available colors make this a favorite for floral designers. Hybridizers have produced hundreds of varieties with almost every color available except for blue and purple.

*Eco Friendly House Plants/Wolverton



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Deer Resistant Annuals

One of the nemeses of a gardener is the unwanted visits of **deer in your yard**. They feed voraciously in the spring and one visit can devastate a lot of loving care and not to mention turn your flower bed into an expensive deer smorgasbord. I could hardly wait for my lilies to bloom and when blooming time arrived so did my elusive friends. Bit by bit, they plucked off the long awaited flower buds and left me with the unrequited joy that I would never see any color in my flower beds. I maintain a love-hate relationship with these long legged creatures, I love to observe them and realize they also need to eat. I am willing to sacrifice other specimens in the yard for their well-being but **not my flowers!!!!**

Surprisingly, there are a number of annual plants that **do not appeal to deer** (although when hungry, they will eat almost anything).

The following is a list of some deer resistant annuals.

Annuals

Ageratum
Begonia (Wax) not always
Blanket flower (Gailardia pulchella)
Borage (Borago)
Cleome (Cleome Hassierana)
Cosmos
Dahlia
Dianthus
Dusty Miller (Senecia Cineraria)
Foreget-Me-Not (Myosotis sylvatic)
Four-O'Clock (Mirabalis Jalapa)
Geranium (Pelargonium)
Heliotrope (Heliotropium)
Lobelia
Marigold (Tagetes)
Morning Glory (Ipomoea)
Nasturtium (Tropaeolum)
Pansy (Viola)
Petunia
Polka-Dot Plant (Hypoestes)
Salvia (Salvia farinacea)
Snapdragon (Antirrhinum majus)
Sunflower (Helianthus)
Sweet alysum (Lobularia maritime)
Verbena (verbena X hybrida)
Herbs Thyme, rosemary, sage, parsley, basil



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Geranium

Geranium, belongs to the Pelargonium family and unlike its distant cousin (a true geranium and hardy version) is a tender plant grown as an annual in cooler climates and a perennial in zone 10.

Geranium (P. x hortorum) or commonly known as zonal or garden geranium is a favorite for container plantings and flower beds because of its long blooming season and brilliant colors. It bears rounded clusters of individual flowers which are either single or double on a stem which rises above the rounded scalloped leaves. The fuzzy leaves may have zonal markings and emit a "fragrance" when touched.



Care: Geranium requires little care as long as it gets full sun and well-drained, moist soil. In northern climates, they will tolerate light shade but if grown in shade will produce a leggy plant and little flowers. In southern climates, it is best to grow them in partial-sun with afternoon shade. Prolonged hot temperatures will trigger them to stop blooming.

For optimal bloom, feed the plant lightly with a well balanced fertilizer (10-10-10) once a month during the active growing season. Container plants may need to be fed more often (2x month) because the nutrients can leach out from the bottom of the pot when watering. They bloom best when slightly pot bound.

Geraniums need at least 1 inch of water per week. When watering, avoid getting the leaves and flowers wet, which can encourage fungal disease. Container plants may need to be watered more often but should be allowed to dry slightly between watering. Take care not to overwater as it can cause root rot.

Plant your seedlings outdoors, when night temperatures are above 40F or after the last frost date. Setting the plants out too early can cause the leaves to turn red from cool night temperatures.

Maintenance: Remove spent flower stalks and yellowing leaves. Pinching back or trimming some of the stems will encourage more branching and eventually more flowers.

Another Pelargonium worth mentioning is **P.x peltatum** know as ivy geranium. It has smooth leaves and grows in a trailing manner making it ideal for **hanging baskets**



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Morning Glory vine

If you need to cover a trellis or fence in a short amount of time consider planting an annual vine. Annual flowering vines tend to grow vigorously and continue to bloom until frost kills them. They provide a vertical interest to a garden, add privacy and shade, block the wind, and camouflage any unsightly view.

Morning glory vine (*Ipomoea tricolor*) is a fast growing tender vine that can easily climb a trellis or fence by twining itself around the support. The funnel-like flowers open in the morning, hence the name morning glory. The vine can be started from seeds indoors in peat pots 4-5 wks before the last frost date or sown directly into the ground after the soil warms up. Before planting, scrape the black seed coat with sandpaper and soak in water overnight to allow better germination.

Plant in any type of soil but it grows better in poor, infertile soil and blooms best in full sun to light shade.

Once established Morning glory can **self-seed** and spread becoming a weedy plant, smothering plants and difficult to control in the flowerbed. To avoid this problem be sure to remove the seed pods. Grow it in a container or adjacent to a sidewalk where it can be managed. The large flowered cultivars tend to reseed less.



Common Morning Glory (*Ipomoea purpurea*) has large flowers in shades of red, white and blue. "Heavenly Blue" cultivar of (*Ipomoea tricolor*) is a popular blue color.

A compact series with variegated foliage 'Good Morning' and 'Mini Bar Rose' can be grown in baskets and containers. Another vine worth mentioning is **Moon Vine** (*Ipomoea alba*) which produces heart-shaped-leaves and large fragrant white flowers. Because the flowers open from dusk to dawn, this vine can be enjoyed in the evening garden, by the light of the silvery moon.



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Rieger Begonia

Rieger begonia (*Begonia x hiemalis*), Elator hybrids also known as Winter Begonia comes from a huge family of begoniaceae. It is a hybrid cross between tuberous and wax (fibrous) begonia that was developed by Otto Rieger (not Reiger), a German plant breeder. Some consider it a toss plant but with proper care and a little know-how it can bloom up to 6 months indoors and after a rest period be coaxed to rebloom.

Rieger begonia produces a reddish, fleshy stem with glossy, asymmetrical serrated leaves. At the end of each stem, it develops a cluster of 3 double rose shaped flowers; one large showy male and two smaller females. The male flowers will drop off within 2-3 days after opening.



Care:

R. begonia does not grow in hot humid regions. It prefers cool temperatures of 70F during the day and 60-65F @ night with bright indirect sun (east window); that's why it's a popular winter flowering plant. Grow it in well-drained peat/perlite soil mix or African violet soil and feed with 1/2 strength houseplant fertilizer every 2 weeks when actively growing. When watering, let it to dry slightly between watering but not too dry or too wet
Be sure to remove the spent flowers to stimulate new bloom.

Re-blooming Once the plant slows down and stops blooming cut it back to several inches above the soil line and place in a cool, medium light area, keeping on the dry side or place it in the shade outdoors during the summer. When you see new growth, replot the plant to a larger container, move it to bright indirect light and start watering and fertilizing. Rieger begonia responds to short days and cool night temperatures (fall/winter) which stimulates it to bloom again.

Trouble shooting

- Direct sun will scorch the leaves
- Too much light will turn the foliage a copper color, then brown.
- Avoid getting water on the leaves as it can cause powdery mildew problems.
- Too much fertilizer will turn the foliage blue green and curled at the ends.
- Overwatering with low temps causes leaves to wilt and turn brown.
- Keep away from heating vents or cold drafts.



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Spring Gardening Tips

Growing Annuals from Seed

Growing annuals like zinnias, marigolds, and tomatoes from seed is easy and economical. The exact time to start seeds varies with the plant and with your location. In general, it's about six weeks before the date of the average last frost in your area. Seed catalogs and packages usually list the number of weeks needed when starting seeds indoors.

Use a potting mix specially formulated to start seeds; you can find such mixes at almost any garden center or hardware store. The mixes are sterile, provide the drainage that seedlings need, and are sometimes enriched with fertilizer. Fill peat pots or other seed-starting containers with the mix and thoroughly moisten it. Then sow your seeds of choice following the directions on the packet.

Place the containers on a tray in a very sunny window or under a grow light. Never allow them to dry out. As soon as the seedlings develop four leaves, use scissors to thin out your seedlings, leaving just the healthiest looking ones.



After all danger of frost has passed, place the trays of seedlings outdoors in a sheltered place for several days, gradually lengthening the time they are exposed to the sun and wind to prevent scorching the leaves, before transplanting them into the garden.

A little TLC for your perennials

Herbaceous perennials and grasses, a group of diverse and reliable plants that return to the garden year after year, can greatly benefit from a little extra attention in the spring. Here are some tasks that will help your plants get off to a healthy start.

- Remove winter mulch from around the crowns of perennials.
- Cut back any parts of the plant that were left up for winter interest, such as flower stalks and seed heads.
- For evergreen perennials, remove any dead leaves.
- When new growth is about three to four inches tall, dividing and transplanting may be done. For spring-flowering plants, wait till they are finished blooming.
- Begin placing stakes to support the growth of tall or fragile perennials.



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Pruning early-blooming shrubs

Shrubs that bloom early in the year, such as forsythia, form their flower buds the previous year. In the rush of the spring season, there are always so many chores to do it's easy to forget that these early flowering shrubs need pruning immediately after bloom. If you wait too long before getting around to it, you'll cut off next year's flower buds. And if you don't prune at all, these strong growers will quickly turn into giant tangles.



As soon as the last flowers fade, use a pruning saw to cut off one-fourth to one-third of the biggest, oldest stems at ground level. Use pruning shears to shorten all of the stems to two or three feet from the ground. If you wish to greatly limit the shrub's size, you can cut the branches as far back as six inches from the ground. By the end of the growing season, new branches will have formed. These will arch gracefully from the center and will be covered with new flower buds for next year's spring show.



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Summer Gardening Tips

WATER WISE TIPS

Whether it will be a droughty summer or not, lawns and gardens almost always require some supplemental watering. However, there are a few things gardeners can do to reduce the frequency of watering and amount of water needed.

- **Use drought-tolerant plants.**

Many annuals, perennials, ornamental grasses, and shrubs do well with little watering. Check with your local garden centers or Extension service for lists of these plants.

- **Reduce or eliminate use of chemical fertilizers.**

These promote lush growth, which requires more water to support. Instead, use compost and mycorrhizae. Compost adds nutrients very gradually and improves the soil's ability to hold water. Mycorrhizae are tiny, beneficial microorganisms that actually help plants take up water and nutrients. These are available from garden centers and mail-order companies in liquid or powder form.

- **Apply plenty of mulch.**

Don't allow it to touch tree trunks or plant stems, but apply it deeply—up to six inches—in the blank spaces between plants, where the sun would otherwise hit the ground and dry it out. Around trees, angle the slope of the mulch so that water runs toward the tree.

- **Install a drip irrigation system or soaker hoses.**

Because drip irrigation systems and soaker hoses deliver water directly to the root zone, they will do more good and use far less water than sprinklers. If you do use sprinklers, consider installing a timer to minimize waste.

- **Lose the lawn.**

Consider converting some of the lawn to garden beds or plant a drought tolerant native turf grass or groundcover that is not dependent upon weekly (or even more frequent) irrigation. In the West, buffalo grass is a good replacement for conventional turf lawns.





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ORNAMENTAL GRASSES FOR FOUR SEASON INTEREST

Ornamental grasses are tough, low-maintenance plants that provide four seasons of interest in the garden. These grasses emerge in late spring, at which time they are very effective in camouflaging the foliage of spent daffodils and other bulbs. They look full and lush all summer long. Most ornamental grasses are late bloomers, some waiting until October to produce their unique spiky flowers. After they have been hit by frost, their green foliage turns lovely, tawny shades that contrast with the reds of turning leaves and the deep greens of evergreens.

One of the few maintenance chores with ornamental grasses is a yearly shearing back of the dried foliage in early spring. Beyond that, these plants require little care and most are pest and disease free. Just be sure to site them in a sunny spot because most require at least six hours of sunshine.

Some good grasses to try are:

- Big bluestem (*Adropogon gerardii*)
- Fountain grass (*Pennisetum alopecuroides*)
- Prairie dropseed (*Sporobolus heterolepis*)
- Switch grass (*Panicum virgatum*)
- Feather reed grass (*Calamagrostis x acutiflora*)
- River oats (*Chasmanthium latifolium*)

COLORFUL CONTAINERS OF ANNUALS

When you combine annuals in a container, it intensifies their effect. A container also allows you to dress up places where plants don't grow such as patios and balconies. Whether you have a sunny or shady spot, there are annuals to help add sparkle.

For shady places in your garden, choose annuals that prefer to be cool and shady. Among these are coleus, fuchsia, impatiens, begonias, and caladiums. The choices for sun are almost numberless. Geraniums and petunias are classic sun-loving container plants, and are available in a wide array of colors.

To keep your annuals blooming their best all season long, make sure to water often enough to avoid wilting and deadhead spent flowers. An occasional application of slow-release organic fertilizer will help, too.





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Fall Gardening Tips

Deer-resistant Bulbs

If deer are a problem in your area, this autumn you may want to plant bulbs that deer don't find so tasty. These include daffodils, alliums, and lycoris for bulbs.

There are hundreds of wonderful daffodil varieties to choose from. One great naturalizer that is also outstandingly attractive is '**Ceylon**', which grows 15 inches tall, and produces bright golden petals around an orange cup. Among white varieties, graceful 'Thalia' is hard to beat. Late-bloomers like '**Hawera**', an eight-inch tall daffodil with diminutive lemon blossoms, and '**Actaea**', a daffodil with linen-white flowers punctuated by red and yellow coronas, can fill the garden with grace and fragrance.

Alliums—also known as flowering onions—are perennials that come in all sizes, mostly with clusters of starlike flowers in shades of pink and purple. One of the most spectacular is the giant allium, **Allium giganteum** (USDA Hardiness Zones 6-10, AHS Heat Zones 9-5), which produces a ball of bright purple flowers, six inches across, on a stem that can reach four feet. Equally impressive is Schubert's allium, **Allium schubertii** (Zones 4-10, 10-1), a spidery purple flower ball reaching up to 12 inches across on a 15-inch stem.

Lycoris are hardy members of the Amaryllis family that bloom in late summer and early fall. Naked ladies, **Lycoris squamigera** (Zones 6-11, 12-6), so called because their blooms appear long after the leaves have withered away, bear fragrant, pink flowers on strong, two-foot-tall stems in late July and August.

Late-blooming Asters

While many summer flowers have faded away, asters are one group of plants that blooms late in the garden's final season. The aster parade begins in mid-summer and continues until hard frost, with the great majority blooming in August to September.

Aster carolinianus (Zones 4-8, 8-1) is a late bloomer, unique to the genus. In mid-October, this gray-green leaved aster, native to the southeast, will scramble to the top of a six-foot post or trellis and burst into rose pink flowers that turn lilac with age.

Aster 'October Skies', another late-blooming native, bears colors that mirror the clear autumn skies in October. Unlike many asters, 'October Skies' is short and bushy—growing only about two feet tall. Taller, darker, and later-blooming is '**Fanny's Aster**', which matures into a four-foot shrub stitched with dark purple flowers that open in October and remain into November.



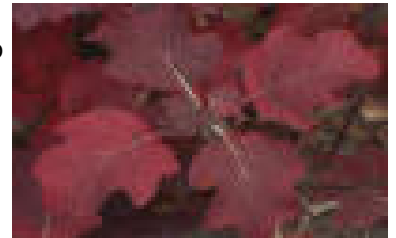
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Fall Color from Shrubs

If you're looking for something to add brilliant fall color at or near ground level in your garden, try the native shrubs Virginia sweetspire, **Itea virginica** (Zones 6-9, 10-7) and oakleaf hydrangea, **Hydrangea quercifolia** (Zones 5-9, 9-5). Both retain their colorful foliage into winter, even when planted in the shade.

The big leathery leaves of oakleaf hydrangea begin turning in October from summer's dark green to myriad tints from bright pink to deep maroon. Oakleaf hydrangeas grow into wider-than-tall colonies with the potential to reach 10 feet in height, but usually topping out at six to eight feet. Their relatively high stature allows them to show off their attractive tawny-colored bark, which can be somewhat hidden along the plant's denser sections by the oaklike leaves.



Virginia sweetspire is shorter, growing three to five feet tall. It grows into a broad mound of arching branches, a habit that makes it useful as a large-scale ground cover. In late spring to early summer, long, white flowers—each composed of hundreds of tiny white bells—appear at the end of the branches. But it is in fall that this shrub is at its best. Some particularly colorful varieties include 'Henry's Garnet', which takes on the deep jewel tones of a garnet; 'Saturnalia', which blends ruby tones with garnets; and 'Little Henry', a lower growing form that peaks at about two feet and bears glowing red leaves.

Improving Your Soil With Autumn's Bounty

At this time of the year, fallen leaves are everywhere—and they're a great, inexpensive source of organic material for enriching your garden soil. Leaves should be shredded to help them break down in the soil more quickly. If you don't have a leaf shredder, rake leaves into long, low piles and then run your lawn mower back and forth over them. Some communities even offer composted leaves to residents free of charge, so check with your local government offices to see if you can take advantage of that wonderful resource.

Japanese Anemones of Note

Ongoing evaluations of Japanese anemone at the Chicago Botanic Garden (CBG) have yielded several promising cultivars. Grown for their mid-autumn blooms, anemones are ideal for borders, woodland, and rock gardens.

The CBG has tested seven cultivars of **Anemone hupehensis** and **A. hupehensis japonica** along with ten cultivars of **A. x hybrida (A. hupehensis x A. vitifolia)**. "The Avant Gardener" newsletter reports that three cultivars of *A. x hybrida* "received top marks": yellow-centered white 'Andrea Atkinson', light pink 'Max Vogel', and pink 'Serenade'.

Of *Anemone hupehensis* and *A. hupehensis japonica* species, four cultivars stood out above the rest: rose pink *A. hupehensis* 'Splendens', double pink *A. hupehensis japonica* 'Prinz Heinrich', light purple *A. hybrida* 'September Charm', and pale pink *A. hybrida* 'Robustissima'.

Fall is the perfect season to enjoy anemones and it is also the season to plant them. Japanese anemones should be planted two inches deep in moist, fertile, humus-rich soil in sun or partial shade. The plants, once established, may sometimes spread by easily removable rhizomes.



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Winter Gardening Tips



How Light Affects Poinsettias

To learn how to get your holiday poinsettia to bloom next year, [click here](#).

Winter is a good time to prune deciduous trees. Once the foliage has dropped, it's easier to get a look at the branching structure and spot any potential problems. Richard Eaton, an arborist with [The Care of Trees](#), an AHS partner and a national tree care company, shares the following tips for pruning small or recently planted deciduous trees:

- Prune out any diseased or broken limbs.
- Remove branches that cross over one another.
- Remove branches that go against the flow of the tree's natural habit (i.e. upward pointing branches on a weeping tree).
- Avoid pruning branches completely flush with the trunk or major limbs; make cuts slightly above the junction point, leaving the branch "collar" intact.
- Don't use wound sealants; trees have a natural ability to heal themselves.
- Try not to disrupt the natural architecture of the tree.
- Be conservative; cut only branches you are confident need to be removed.
- For safety, use tools that allow you to reach up into the canopy, such as pole pruner, rather than climbing up on a ladder. If you need a ladder, says Eaton, it's probably time to call a certified arborist.



Cutting Back Ornamental Grasses

Ornamental grasses such as maiden grass (*Miscanthus* spp.), river oats (*Chasmanthium latifolium*), and fountain grass (*Pennisetum* spp.) often remain attractive in winter, even though they are completely dormant. In winter, their foliage turns from summer greens to shades of wheat and almond. They are especially striking when contrasted with evergreens.

There are two rules regarding when to cut back ornamental grasses. The first is that it is up to the gardener to decide when they are no longer attractive. Snow, sleet, and freezing rain can ruin their effect. Once this happens, the time has come to cut them back to a few inches above the ground.

The second rule for cutting back grasses is that the annual clipping must occur before new growth starts in the spring. And it's a good idea to trim them before plants around them start to awaken so as to avoid trampling the tender shoots of emerging bulbs and perennials.



Forcing branches for winter bouquets

The flowers of some shrubs and trees can be "forced," induced to bloom, indoors while the winter weather outside continues. Some of the easiest to force include pussy willows (*Salix* spp), flowering quince (*Chaenomeles speciosa*), and forsythias (*Forsythia* spp.).

Among the pussy willows, the Japanese pussy willow (*Salix chaenomeloides*), a small tree that reaches about 18 feet,



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has three-inch long, fuzzy pink flowers known as “catkins”. The black pussy willow grows to 10 feet and has purple-black catkins.

Flowering quince is a six to 10 foot shrub with flowers that are usually orange-red. There are also pink and white flowering forms. Forsythias come in many shapes and shades of yellow. One of the earliest to bloom is called early forsythia (*Forsythia ovata*), which blooms from March to April.

To force the branches of any one of these shrubs, cut them in January or February. Submerge the branches in tepid water overnight. The next day, place the branches upright in a container of water, making sure to cut off any buds from the parts of the stem below water in the vase. Leave the branches in a cool, dimly-lit room and change the water daily until the buds start to swell. Then, move them to a brightly-lit room and enjoy the colorful display!

Take Stock of Your Garden’s Design in Late Winter

Winter is the best time to take stock of the permanent elements of your landscape--the lawn, paths, and evergreens. As the backbone of your landscape's design, these parts of the garden interact with deciduous plants during the growing season.

If you find that your yard looks well-stocked, but pretty much the same, winter and summer, you may wish to make room for a small shrub or tree to add excitement with spring or summer flowers. Lilacs (*Syringa* spp), viburnums, and hydrangeas are flowering shrubs that come in many sizes and colors. Stewartias (*Stewartiaspp.*) and the ‘Forest Pansy’ redbud (*Cercis 'Forest Pansy'*) are excellent small flowering trees. Japanese maples (*Acer palmatum*) put on a glorious show in spring when the leaves emerge and in fall when they turn a dazzling scarlet.

After the first killing frost, does your garden seem empty or lacking in definition? Then look first to the lawn--it may be that its size outweighs other elements in your yard. If that is the case, consider adding planting beds--a larger one in front of the house, beds around existing trees to link them together, or a bed around the periphery of your lawn. Incorporate plants that provide winter interest into these beds.

If you don’t have any evergreens, plan to add some this coming spring, keeping their ultimate sizes in mind. The choices are almost limitless, but if deer are a problem in your area, some evergreens they don't eat are plum yew (*Cephalotaxus* spp.) and boxwoods (*Buxus* spp.).





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Wildlife in the Garden

Wildlife adds life and color to a garden that is especially welcome in late winter. Now is the time to take stock of the wildlife-friendly elements already in place in your garden and plan to add more in the next growing season to provide for wildlife throughout the long winter.

Think about adding the sorts of plants that invite wildlife into your garden—generally ones that produce food or shelter. Consider those that go to seed or produce berries at different times to keep edibles at hand throughout the dormant season. Natives such as goldenrods (*Solidago* spp.) and coneflowers (*Echinacea* spp.) have evolved in tandem with the birds and small animals of your region. Allow their seedheads to stand over winter.

Thick or thorny shrubs and evergreens are safe places for cover or nesting. And layers of vegetation—stepping down from trees to shrubs to herbaceous ground covers—provide shelter. Be sure to provide a source of water, too. And, most important of all, try not to use synthetic chemical pesticides, which may harm wildlife.



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Perennial Tips

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What's a Perennial?

A flowering perennial is a non-woody plant that dies to the ground each fall and comes up again each spring. In contrast, an annual plant lives for only one growing season and a new one has to be planted each spring.

Where should Perennials be used?

Perennials can be used in flower beds with evergreens and shrubs, as borders, ground covers, color accents, or to add texture to your landscape design. The accent color may be a single plant, such as a peony, or a mass planting of daylilies. Perennials also make good cut flowers, both fresh and dried, for the home.

Selecting Perennials

First consider the amount of light that the plants will receive and then check the area for the type of soil and drainage. Most perennials prefer a well-drained site, but there are types that will tolerate poorly drained soils as well as dry soils. Elevating the bed can improve the drainage.

Another point to consider is the mature height and width of the perennial. Tag should specify this information.

Sun or Shade

Although many planting areas fall in the range of part sun to part shade, some perennials require full sun or full shade to reach their potential. Don't rule out a plant that you like just because the conditions are not exact. Try experimenting a little bit.

With respect to perennials, the definitions are:

Full Sun - An area that receives at least 6 hours of direct sunlight - including 4 hours in the afternoon.

Full Shade - An area exposed to direct sun for less than 4 hours per day.



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How far apart should perennials be planted?

Most perennials can be planted 12 to 15 inches apart. However, planting them 18 to 24 inches apart will provide better air circulation and keep the larger plants from shading the smaller ones.

What is dead-heading and what does it do?

Dead-heading is the process of removing individual flowers or flower clusters after the blooms are spent, faded, or drooping. Removing them before they begin to seed will encourage the plant to produce more flowers.

When should perennials be cut back?

Perennials should be cut back in the fall or spring to approximately 3-4" in height.



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Grow bearded iris for sparkling color

Few other perennials rival bearded iris for sparkling color

Iris flowers are exotic beauties with three petals called "standards" that reach up and three petals, called "falls" that hang down like ball gown skirts. "Beard" refers to fuzzy hairs on the falls.

Modern iris cultivars are highly bred, originating from crosses made over many years of many species, including *Iris germanica*, *I. pallida* and *I. florentina*.

Today's irises have stronger stems and more blooms over a longer bloom period than older cultivars.

Their ruffled flowers, set off by attractive, sword-like leaves, cover the spectrum from blues, yellows and soft pinks to lustrous whites and almost blacks.

Shades of gold, apricot, orange, russet and dusky burgundy are popular.

Many cultivars have flowers rimmed with yellow or white, or vivid splotches of contrasting color.

How to grow bearded iris

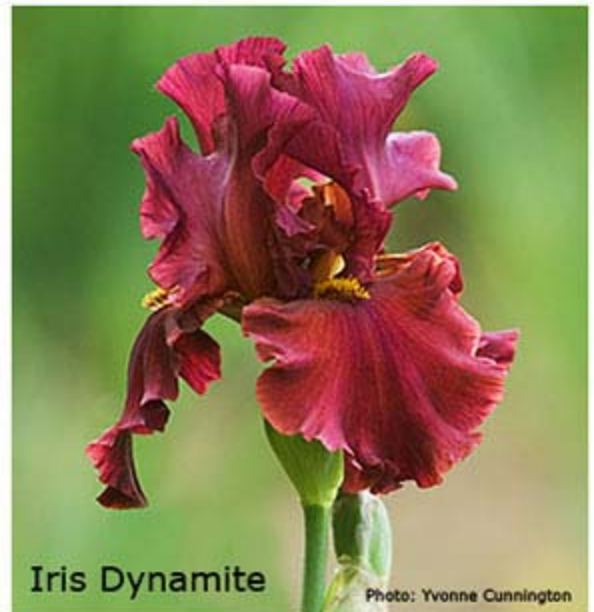
Most bearded iris cultivars are hardy to Zone 3. Plant them in light, well-drained soil and full sun - at least six hours daily.

Avoid heavy clay; well drained clay soil that has been **amended** with coarse sand, compost or manure is fine. (Be sure to use well-aged manure or it could promote rot, to which iris rhizomes susceptible).

The plants grow from thick rhizomes that sit horizontally at or just below ground level, the true roots that penetrate the soil coming out of the rhizome.

Container grown plants are offered in spring, and bare root rhizomes are available in mid- to late summer. Buying bare-root is less expensive, and growers of sought-after new cultivars sell plants this way.

Because bare root irises are planted in summer, they don't have much time to get established, which can make them susceptible to frost-heave in some regions over the winter. To avoid this, plant rhizomes as early as possible, preferably by early to mid-August.





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Step-by-step planting tips:

Spacing: Set rhizomes about 16 to 18 inches (40 to 46 cm) apart for taller types; eight to 10 inches (20 to 25 cm) apart for dwarf iris.

They look best in triangular clumps of three; space clumps 24 inches (60 cm) from other plants for good air circulation.

Pot-grown irises: Remove from pot, being careful not to disturb roots. Plant at same level as iris was growing in pot.

Bare-root: Dig a hole as deep as rhizome's true roots. Inside the hole, make a hill high enough to hold rhizome at ground level or slightly below; cover roots with soil. Don't fertilize until the second season.

To cover rhizome or not: Most planting instructions advise against covering rhizomes. However, professional iris growers in regions that experience frequent freeze/thaw cycles without reliable snow cover recommend covering rhizomes with about an inch (2.5 cm) of soil or sand; this helps prevent frost heaving and root rot. Avoid mulching bearded iris with wood chips or leaves.

Watering: After planting, water well and, depending on rainfall, continue to water every three days for a the first month.



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Daylilies - versatile and easy gaDay Lirden perennials

Gardeners love them for their rainbow of colors (they flower in every shade except blue) and many shapes and sizes.

They make versatile garden plants too: you can have daylilies in bloom from late spring until autumn. A well-established clump produces many buds and new flowers daily for a month or more.

The plants are clump forming, herbaceous perennials with fibrous or somewhat tuberous roots. Grow them in well-drained soil, amended with manure or compost.

For best performance give them full sun, at least six hours of sun a day. If you plant them in too much shade, you'll get more leafy growth with fewer flowers.

How to use Hemerocallis in your perennial garden

Besides serving as specimen plants, these perennials excel at providing splashes of color in shrub borders and perennial flowerbeds.

They also make excellent ground covers on slopes, where they can provide erosion control. They look particularly nice planted against fences, decks or patios, steps and even driveways.

To allow them room to thrive, don't plant them too close to the roots of broad-leafed or evergreen trees.

The plants can range in height from eight inches to five feet, and flower size can be as small as two inches or as large as eight inches. They often bloom the year they are planted, even from a relatively small size, but they will grow rapidly to form dense clumps and they tend to be long-lived.

The scape is a leafless stalk, which bears the flowers. Most have two or more branches, each producing several flower buds.

A re-blooming daylily will have an extended flowering period or more than one bloom season – some bloom early (May or June) and repeat in the fall – others have a succession of bloom periods, one shortly after another for several months. Deadheading or removing the scape (or stalk) will encourage re-bloom.





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New-Look Coneflowers add Pizzazz

Until a few years ago, purple coneflowers, also known by their botanical name, *Echinacea purpurea*, were generally purple or mauve-pink. On occasion, you would see a white cultivar like 'White Swan' too.

The traditional echinaceas are still around - with many improved cultivars on the market. But these days the newest cultivars are appearing in eye-popping shades of mango, orange and gold.

Unique Cone Flowers

Their new-look colors are making them the hottest must-have perennials of the season.

Native to North American prairies, as well as lightly-shaded woodlands, *Echinacea* produces showy, daisy-like flowers in mid-summer into the early fall.

The name "echinacea" comes from the flower's spiky central cone - the Greek *echinos* means hedgehog.

The flowers are large and have big, dark cone-like centers. In the species, the petals often droop or curve back.

When the new-look mango, orange and gold echinaceas - most of them resulting from crosses between *E. paradoxa* and *E. purpurea* - were first introduced, they were in short supply and quite expensive.

That should change now that more varieties are on the market and growers have had time to build up supply.

New Cone Flowers for Your Garden

Echinacea 'Sunrise' boasts fragrant four-inch wide lemon-yellow flowers that are held erect above multi-branched flower stalks. **'Twilight'** has brilliant rose-red flowers.

'Harvest Moon' offers an attractive combination of four-inch wide fragrant flowers that have golden yellow petals surrounding a cone of golden orange.

The Big Sky cultivars are all hardy in USDA Zones 4 to 8. They grow about two to three feet tall, so space them about 15 to 18 inches apart.





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Echinacea 'Paranoia' (shown below) is the result of a cross between the yellow-flowered native *E. paradoxa* and *E. purpurea*.

The name comes from the champion of weird plant names, Tony Avent of Plant Delights Nursery, who made the selection.

The flowers have pale yellow petals that curve down from a dark central cone. The plant is sterile, so its flower-heads will not provide seeds for the birds. Grows 12 inches tall. Hardy in USDA Zones 5-8.



Echinacea Harvest Moon

Echinacea 'Fragrant Angel' is a good choice if you are looking for large fragrant white flowers.

This cultivar boasts double rows of petals that are held upright, not drooping, making the show even better. This cultivar is said to be hardy to USDA Zone 3.

Echinacea 'Doubledecker' (last picture at right) is new twist on the purple coneflower. Its odd two-tiered blooms that are sure to stop traffic.

The plant tends to produce some single blooms in the first season, but develops a high proportion of double-decker blooms in the second year.

Grows about 30 inches tall; hardy from USDA Zones 3 to 9.



Echinacea 'Paranoia'

Caring for Coneflowers

Echinaceas thrive in full sun and most garden soils. They grow two to three feet tall, are easy to care for, and make wonderful butterfly magnets.

To encourage more flowers, deadheaded your coneflower plants regularly. You can also try shearing the plants back by half or two-thirds their height in early summer to encourage bushier growth and more profuse flowering later in the season.

Coneflower seed-heads are a favorite food of migrating and overwintering birds. If you leave the spent flower-heads in place in late fall, you will find that they are very good at attracting

birds to your yard.

Echinacea cultivars are drought-tolerant, but their foliage and flowers can dry up in severe drought. Your plants will look more attractive if you water them regularly during very dry periods.



Echinacea 'Fragrant Angel'



Echinacea 'Doubledecker'



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Fertilizer Options in the Landscape

By Roger C. Funk

Why do urban trees need to be fertilized? Forest trees evolved without the apparent addition of fertilizer, which can give the erroneous impression that trees, in general, do not require fertilizer. In reality, forest trees are being fertilized through the natural process of recycling.

In addition, through the process of natural selection, trees have adapted over the millennia to the existing soil and environmental conditions. Conversely, shade and ornamental trees are often selected and planted for their aesthetic appeal without regard for their horticultural requirements in the urban environment. Thus, they are subjected to unfavorable soil and environmental conditions, which increases the need for nutrient management.

Forest soils are rich in humus, which is replenished by the decay of plant and animal residue. Leaves are relatively high in accumulated nutrients and their decomposition is an important source of returning nutrients to the soil. Forest research has demonstrated that trees obtain more than half of their annual requirements from these sources. Organic matter increases the retention and availability of most plant nutrients and improves the soil structure by "cementing" or aggregating soil particles. In contrast, domestic and street lawns are usually very low in humus and fertility. Leaves are removed, thus interrupting nature's recycling program for nutrients and preventing the accumulation of organic matter. The soil elements, which are absorbed and utilized in the formation of plant tissues, are not returned to the soil and should be replaced with supplemental fertilization.

How do woody plants use the nutrients from the soil?

Woody plants make their own sugar during photosynthesis by combining carbon dioxide from the air with water from the soil, a process driven by energy from the sun. Plants cannot live on sugar alone, however. They must have chlorophyll, proteins, defensive chemicals, and many other compounds and structures in order to maintain their metabolism and react to changes in their environment. Plant cells make these chemicals by combining the sugar provided by leaf tissue with nitrogen and the mineral elements absorbed from the soil. Slightly more than a dozen mineral elements are essential for plant growth and development, although only the ones that are utilized in large amounts are often deficient.

The most common deficiencies are of the three primary macronutrients: nitrogen, phosphorus and potassium. Some plants (called acid loving) require relatively large amounts of micronutrients and these may be deficient in alkaline soils, which "fix" or prevent their absorption by plants. The micronutrients are actually metals such as iron, manganese or zinc and may need to be supplemented when the so-called acid loving plants are growing in alkaline soils or in sandy soils that don't retain minerals.

What is the difference between organic and chemical fertilizers?

Actually, all fertilizers are chemical, including those that are organic. Fertilizers can be grouped into four broad categories, based on whether or not they contain carbon and whether or not they are synthetic.

<i>Organic</i>	<i>Inorganic</i>
Natural	Natural
Synthetic	Synthetic

"Organic" is the chemistry of carbon, not the chemistry of natural. All organic fertilizers have a carbon structure, which can be synthesized by an organism or in a laboratory using the same elements and the same chemical processes. Whether natural or synthetic, the nutrient ions are attached to carbon and it is this structure that determines the characteristics of the organic chemical. Carbon forms covalent bonding that does not readily degrade; thus, the nutrient ions are released slowly. Although organic compounds are often thought of as energy sources for microorganisms (microbial breakdown), some are hydrolyzed by water.

<p>Natural Organic</p> $\begin{array}{c} \text{NH}_2 \\ \\ \text{C}=\text{O} \rightarrow \text{NH}_4^+ \rightarrow \text{NO}_3^- \\ \\ \text{NH}_2 \end{array}$ <p>Urea → Ammonium → Nitrate</p>	<p>Natural Inorganic</p> $\text{NaNO}_3 \rightarrow \text{Na}^+ + \text{NO}_3^-$ <p>Sodium Nitrate → Sodium + Nitrate</p>
<p>Synthetic Organic</p> $\begin{array}{c} \text{O} \\ \\ [\text{CH}_2\text{NHCNH}]_x \end{array} \rightarrow \text{NH}_4^+ \rightarrow \text{NO}_3^-$ <p>Methylene Urea Polymer → Ammonium → Nitrate</p>	<p>Synthetic Inorganic</p> $\text{NH}_4\text{NO}_3 \rightarrow \text{NH}_4^+ + \text{NO}_3^-$ <p>Ammonium Nitrate → Ammonium → Nitrate</p>



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Urea is a natural component of urine and bat guano, and is also commercially synthesized. Urea is an example of both a natural and synthetic organic fertilizer that is hydrolyzed. Two examples of fertilizer that require microbial breakdown are ureaform, a synthetic organic fertilizer, and alfalfa pellets, a natural organic fertilizer.

Organic fertilizers that require microbial decomposition also result in improved soil structure and other plant benefits. As these microorganisms decompose organic matter, they release nutrients and enzymes beneficial to living plants, and glue-like gums and waxes that form soil aggregates, which improve air and water movement in the soil.

Inorganic or mineral fertilizers do not have a carbon structure and can occur naturally or be synthesized with simple ionic bonding. These bonds form nutrient salts that dissociate readily in water, releasing the nutrient ions. Potassium nitrate is an example of an inorganic fertilizer that occurs naturally and is also synthesized. Since they do not contain carbon, inorganic or mineral fertilizers are not used as an energy source by microorganisms and have no beneficial effect on the soil. They are said to "feed the plant, but not the soil". The nutrients are typically more highly concentrated than in an organic fertilizer and are more readily available for plant absorption.

Inorganic or soluble organic fertilizers such as urea can be coated with a plastic or wax resin to slow the nutrient release rate. Although considered a slow release form of nutrients, these fertilizers are hydrolyzed and do not result in soil improvement.

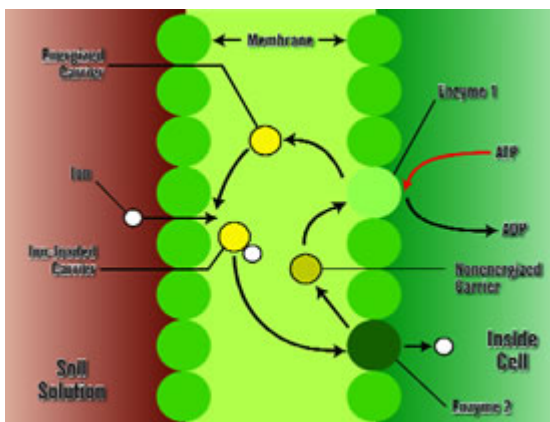
How is fertilizer absorbed?

All fertilizer nutrients, regardless of the source, are absorbed by plant roots as charged atoms or groups of atoms called ions - the nutrient salts. These ions exhibit either a positive or a negative charge, which is essential for root absorption. Fertilizer salts or ions are absorbed through the root membrane by electrical attraction to a carrier. The process primarily responsible for nutrient absorption is called ion exchange.

Inorganic fertilizers form ions readily when dissolved in water and, therefore, are quickly available for root absorption. Organic fertilizers - both natural and synthetic - must be decomposed by soil microorganisms from complex compounds to the same nutrient salts provided by inorganic fertilizers. The rate of decomposition is dependent upon many soil factors such as temperature, moisture and pH.

Absorption is one of the main functions of roots. Without their constant supply of water and nutrients, a tree could not survive. However, absorption is the part of the process that we don't entirely understand.

Until minerals cross a cell membrane, absorption is passive and often on a diffusion gradient (from high nutrient concentrations to lower concentrations). However, the only way for minerals to get past a barrier in the root called the endodermis and into the xylem is through a cell membrane.



One of the jobs of cell membranes is to regulate what goes in and out of a cell. If the membrane was full of holes, the cell would die because its contents would leak out. Yet, there must be some way for materials to get through the cell to give it the ions it needs. Scientists believe there are several mechanisms for minerals to get across the membrane. One is a carrier that transports ions.

The carrier system can be an essentially passive process. Because the cell is constantly using the ions, nutrient concentrations can be higher on the outside than on the inside of the cell. The carrier system then facilitates and speeds uptake. However, when concentrations inside the cell are greater than those outside it, passive uptake is impossible. In some instances, ion concentrations may be 1,000 times greater within the cell. Then, the cell must expend energy to take up the ion. Working with carriers, a substance called ATP undergoes a chemical reaction within the cell to provide that energy.

It is important to understand that the plant expends energy to absorb nutrients. When a plant is in a weakened state, such as from drought, low temperatures or lack of oxygen, it does not accumulate nutrients because energy is not available to take them up.

It is not yet clear whether each specific ion has its own carrier, but it seems that this is likely - at least for nutrients absorbed in large amounts, like nitrate, phosphate and potassium. It is possible that there are dual absorption systems for many ions and that ions with similar properties



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must compete for the same absorption sites. If a soil is high in clay or organic matter, it can retain these ions rather than lose them from leaching. The structure of clay and organic matter creates charged sites that hold the ions on their surface. Both have negatively charged sites that attract positively charged ions (cations). These charged sites relate to a soil's cation exchange capacity (CEC), a measure of the soil's ability to hold cations. If a soil has a high CEC, it has the ability to hold large amounts of cations. Organic matter also has positively charged sites that hold negatively charged ions (anions).

When soil is moist, an active equilibrium develops in the soil solution so that its composition is constantly changing. Cations in the soil solution exchange places with cations at the charged sites. Plants absorb cations and anions from the soil solution. Some anions and cations leach away. Decomposition releases new ions to replace them.

Can fertilizer "burn" plants?

Yes, if there is an excess of soluble or quick-release fertilizer salts in the root zone.

Leaf "burn" is a visible symptom of insufficient water in a plant. Water moves through the root tissues in response to a concentration gradient on the outside of the root and from inside the root tissue. Water moves from a region of low salt concentration to a region of high salt concentration until the concentration on both sides of the root is equal. As water within a plant system is transpired, a higher salt concentration occurs within the root tissue than in the surrounding soil solution. However, if excessive fertilizer salts are in the root zone, water movement into root cells is suppressed. Under extreme conditions, water actually moves from the root tissue into the surrounding soil solution. The movement of water through root tissue is called osmosis.

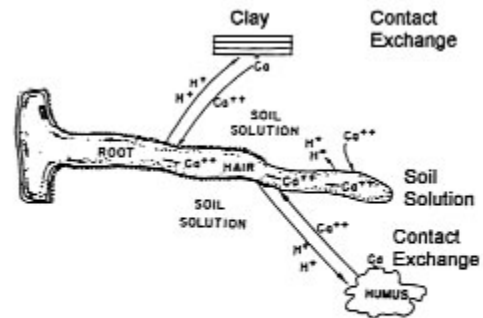
The tendency for a fertilizer to dissolve and release salts when in contact with water is known as the SALT INDEX. The amount of salt released by sodium nitrate is given the arbitrary salt index of 100, and all other fertilizer salt indices are relative to sodium nitrate. The greater the amount of salts released, the greater the salt index and the higher the burn potential. In general, inorganic fertilizers have higher salt indices than organic fertilizers.

How does soil pH affect nutrient absorption?

The term pH expresses the relative concentration of hydrogen (H^+) and hydroxyl ions (OH^-) in solution. A pH of 7 means the hydrogen and hydroxyl ions are equal and the solution is said to be neutral. A pH below 7 means the solution contains more hydrogen ions than hydroxyl ions and is said to be acid. Similarly, a pH above 7 means the solution contains more hydroxyl ions and is alkaline. The soil pH may influence nutrient absorption and plant growth through the effect of the hydrogen ion and through the indirect influence on nutrient availability. In most soils, the latter effect is the most significant.

The presence of an element in the soil is no guarantee that it is in a soluble form available for absorption. The concentration of hydrogen and associated ions affects soil reaction and the formation of soluble and insoluble compounds. All nutrients must be soluble to be available for root absorption. Each nutrient has a pH range of maximum availability simply because within this range it forms a large proportion of soluble compounds.

Plant species differ in their response to the soil acidity because differences in nutrient requirements. For most plants, the conditions of nutrient availability, without toxic amounts are best near pH 6.5. But certain plants - such as rhododendrons, azaleas, pines and camellias - require comparatively large amounts of nutrients that are soluble in acid solution. They are called "acid loving" plants and grow best in soils of about pH 5.5.



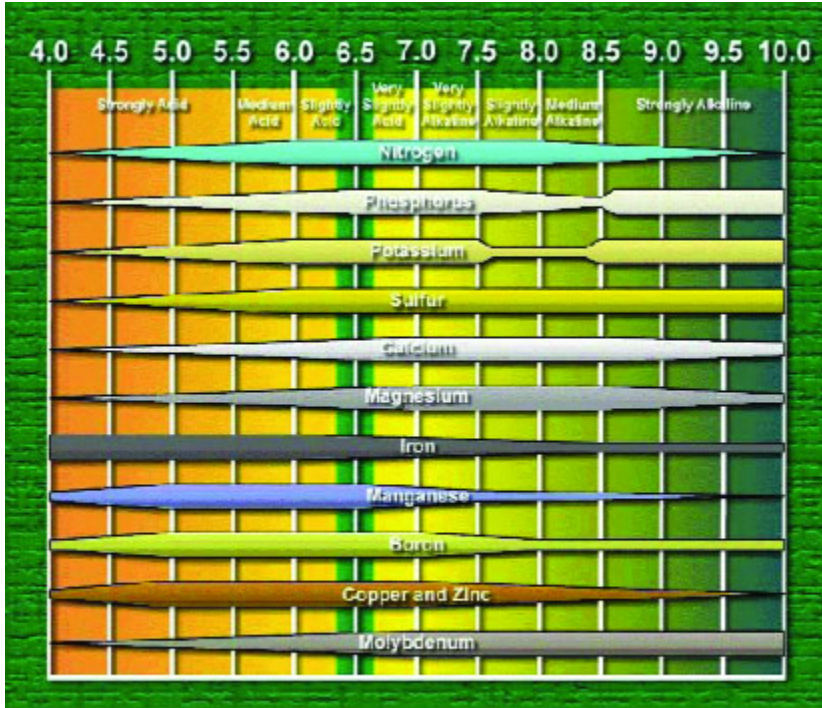
Diagrammatic scheme showing how root hair takes in nutrients from exchangeable ions on a clay crystal and on humus, and from soil.



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Soil acidity, as such, is seldom toxic to plants. But, in soils with pH values below 5.5, certain elements, such as aluminum or manganese, often become soluble to levels toxic to plant growth. Sulfur and agricultural lime are the materials used most frequently to alter the soil reaction or pH. Lime increases the pH (decreases acidity); sulfur lowers the pH (increases acidity).



Bar width indicates the relative availability of each element with a change in soil reaction. The pH for greatest availability for almost all nutrients is about 6.5.

primarily absorbed by plant roots - moves with ground water and rapidly leaches from the root zone. Magnesium, sulfur and potassium are moderately leached, whereas only a trace of phosphorus is lost.

Nitrate leaching is becoming a major concern, particularly as it relates to point source pollution. Several research studies with turfgrass have demonstrated minimal leaching risk from surface-applied nitrogen fertilizers. However, with urban tree fertilization, nitrogen injected below the soil surface would not be "trapped" by the turf. Davey researchers completed a two year study in 2003 to compare leaching of urea, ammonium, and nitrate from soluble and insoluble sources injected into the soil.

In this subsurface fertilization study in which slow release and soluble fertilizer were applied at 3# N (3 pounds of nitrogen) per 1,000 square feet, there was no evidence of any inherent risk to ground water quality due to nitrate, ammonium or urea leaching from either fertilizer applied within the drip-line of sugar maple trees. However, both nitrate and ammonium were detected at the 27-inch depth from soluble nitrogen applied to the field area.

Nitrate levels in samples collected 27 inches below the fertilizer applications beneath the canopy of trees were not significantly different from nitrate levels found in unfertilized control plots. The nitrate readings ranged from 0.10ppm to 1.34ppm from slow release fertilizer and 0.067ppm to 13.1ppm from soluble fertilizer. Nitrate levels in samples collected 27 inches below the soluble fertilizer applications in the field area steadily increased throughout the collection period and were significantly higher at 52 DAT (days after treatment) when compared to the slow release and unfertilized treatments.

Both ammonium and urea levels measured in samples collected 27 inches below slow release and soluble applications in the tree area were not significantly different from the untreated control at either 3 or 7 DAT. However at 3 DAT in the field area, ammonium was significantly higher and remained higher at 7 DAT, although not significant.

Ideally, the pH of soil within the root zone of a plant should be measured every three to five years and, if necessary, adjusted to the most favorable range for that particular species.

What is leaching?

Leaching, primarily, is the removal of materials in solution from the soil. Leaching is caused by percolation or the lateral and downward movement of water through soil. Loss of nutrients due to leaching is proportional to the amounts of water percolated through the soil. Water dissolves minute quantities of minerals and organic materials just as sugar dissolves in coffee. Dissolved substances commonly move with the water.

Since soil and weather conditions vary throughout the United States, leaching affects soils of humid regions more, on the whole, than it does those of dry regions.

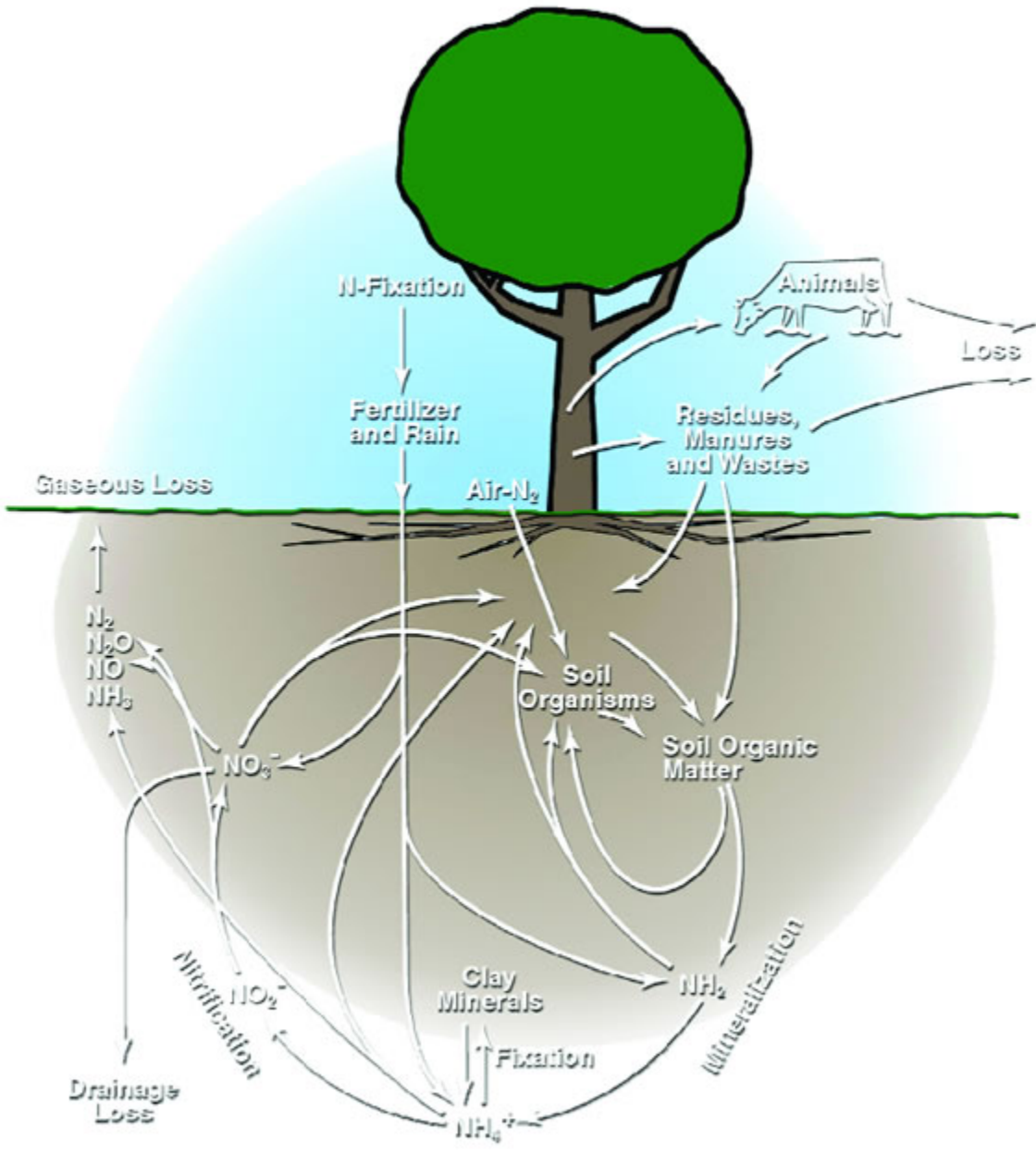
All nutrients are subject to leaching, although not to the same degree. Calcium losses are the greatest of any nutrient known. Nitrate salts - the form of nitrogen



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Although neither slow-release nor soluble nitrogen fertilizer applications resulted in leaching at the 27-inch depth when applied within the root zone of sugar maple trees, soluble fertilizer applied in the field area where no tree roots existed did result in leaching of nitrate and ammonium. Slow release nitrogen provided added assurance that fertilizer injected at a depth of 4 to 12 inches in the soil will not leach, particularly if it is not utilized efficiently.



Further research is planned comparing slow release and soluble fertilizer applied in sandy soils, which have a greater potential for nitrogen leaching than typical landscape soils containing clay.

How can a root/shoot imbalance occur? Unfortunately, specific research with applications of soluble nitrogen alone has mistakenly given the impression that fertilizers, in general, promote shoot growth at the expense of root growth. In fact, proper fertilization is essential to the balanced growth of woody plants in the landscape and is particularly important when trees are under stress or injured.



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Nitrogen and the essential mineral elements are extracted from the soil by the root system and combined with sugar from the leaves to make complex chemicals in the growth and development of woody plants. New cells, including those initiated when the root system is injured, or defense chemicals produced in response to stress, cannot form without these elements. Under natural conditions, the nutrients are recycled during the decay of leaf litter. The decay process, which releases soluble nitrogen slowly, is essential to the proper growth of plants and a key to the proper fertilization of woody plants.

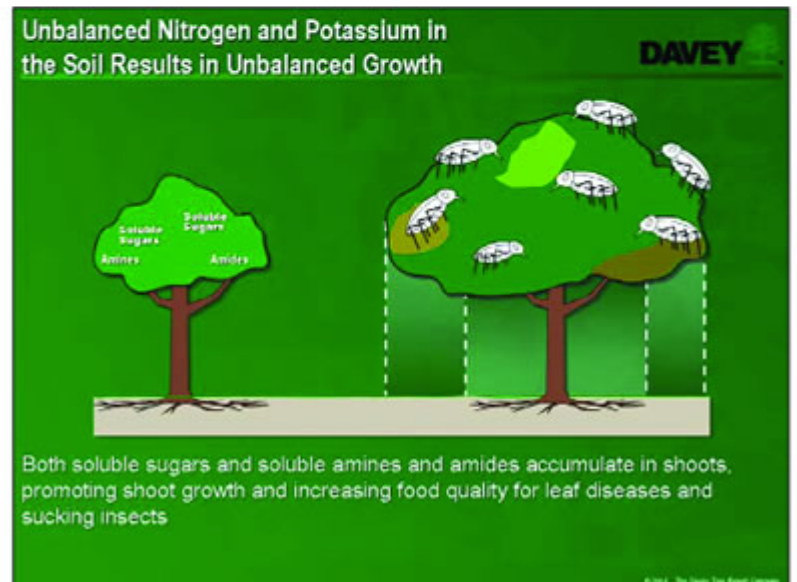
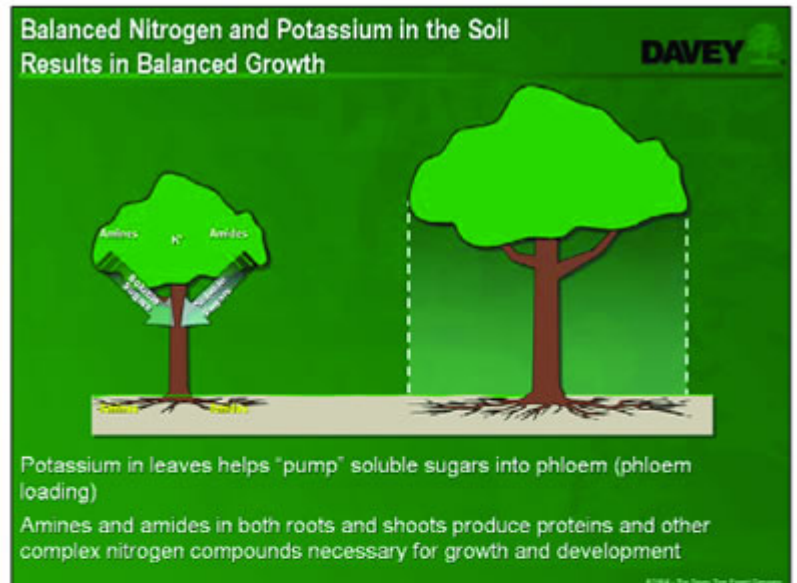
Woody plants have evolved with a continuous, low-level supply of nitrogen throughout the growing season, particularly in relation to available potassium. When grown in the landscape, woody plants are often deficient in nitrogen because the leaf litter is removed and turfgrass, which is more competitive for the same nutrient elements from the soil, planted in its place. Leaf litter is not only a natural source of nitrogen in the soil but also the primary storehouse for nitrogen. Mineral matter - sand, silt and clay - does not retain nitrogen, which can readily leach without the proper amount of organic matter. Unlike forest soils, landscape soils typically have less than 1 percent organic matter. Next to water, nitrogen deficiency is thought to be the most limiting factor in the growth and development of landscape plants, and supplemental nitrogen is the most common form of fertilization.

Although nitrogen applications are often necessary, if done improperly, excess soluble nitrogen in relation to available potassium can upset the physiology of the plant, resulting in additional stress.

Nitrogen is always absorbed by root cells in the charged or ionic state, usually as Nitrate (NO_3^-) or Ammonium (NH_4^+). However, nitrogen normally does not translocate in the vascular system to other parts of the plant in these forms. Rather, an enzyme in the root cells converts nitrate or ammonium to amines or amides, low-molecular weight organic compounds that are precursors to proteins and other complex organic compounds. Some of the amines or amides remain in the root system and some translocate to the shoot system. Thus, all parts of the plants have the base materials to build proteins and other complex chemicals that contain nitrogen. Potassium is essential in the production and activation of this enzyme.

However, when excess nitrate and ammonium are in the root area, as could occur when soluble nitrogen is over-applied in relation to available potassium, the enzyme system in the roots is overwhelmed and nitrogen translocates as nitrate. This initiates a series of physiological changes in the plant that can lead to a root/shoot imbalance and an increase in sucking insects and certain leaf diseases.

When nitrate translocates to the shoot system in the xylem, nitrate reductase enzyme (a large and complex enzyme) forms in the leaf cells, resulting in the conversion to amines and amides in the leaves. Potassium in the leaf cells that is used in conjunction with the enzyme is not available for "phloem loading," a process that moves sugar into the phloem against a concentration gradient. Thus, the first step in the translocation of sugar to other parts of the plant is affected and sugar accumulates in the leaf cells. Also, there is no evidence that the amines or amides formed in the leaf translocate downward in the phloem to the root system to serve as building blocks for cellular growth and activity in root tissue. The accumulation of soluble sugar and organic nitrogen compounds in the leaf cells results in succulent tissue and more favorable food quality for sucking insects and leaf diseases. In addition, the resulting sugar and organic nitrogen deficiency in root cells suppresses the growth and development of the root system.





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In summary, woody plants evolved a mechanism to absorb, translocate and utilize soil nitrogen and the mineral elements based on conditions found in a forest. Landscape soils are often devoid of organic matter and attempts to replace the nitrogen lost through plant absorption and leaching should mimic the natural, slow release of organic matter in order to maintain the proper plant physiology. Research and experience demonstrating root/shoot imbalance or pest problems of woody plants following fertilization can be attributed to excess soluble nitrogen, particularly in relation to the available potassium.

What is the best method to fertilize woody plants?

The roots of woody plants do not go dormant and do not harden-off more than a few degrees to adverse temperatures as does the shoot system. In general, non-woody roots of trees in the temperate zone will withstand temperatures as low as about 28 degrees F and as high as 94 degrees F. For trees growing in the forest, the roots are protected from excessive fluctuations in temperature and moisture by leaf litter and other debris that accumulates on the soil surface.

In the urban environment, however, leaves are typically removed and replaced with turfgrass, which does not buffer adverse environmental conditions and actually competes with trees for the growth factors in the soil. In addition, heavy clay or compacted soil impedes oxygen and water penetration and movement, resulting in surface rooting. The surface of the soil becomes the hottest, coldest and driest during temperature and moisture extremes. Trees growing under these conditions benefit from subsurface applications of nutrients that encourage deeper rooting to avoid competition and injury. Suspending fertilizer in a water carrier, which is injected under pressure at a depth of 4 to 12 inches, creates capillaries that enhance air and water movement while distributing nutrients throughout the desirable root zone.

Roger C. Funk, Ph.D., is vice president and chief technical officer of The Davey Institute at The Davey Tree Expert Company. This article was excerpted from his presentation on the subject at TCI EXPO 2007 in Hartford.



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Prevent Damage to Your Trees' Roots

Trees are hardy plants, and their roots fight back against manmade limits around them. In the urban and suburban landscape, tree roots often are forced to grow between buildings or under driveways and walkways. As roots grow they will break walls, pipes and pavements, causing damage to properties.

Plan before you plant

"Before you plant a new tree in your yard, you need to understand how a tree damages your property and look for methods to preventing it," says Peter Gerstenberger, senior advisor for safety, standards and compliance with the Tree Care Industry Association.

Woody tree roots thicken as they grow, gradually pushing shallow roots toward the surface. Since soil near the surface is best suited for root growth, most tree roots are just below the surface – putting them in conflict with manmade obstacles. Where the soil is covered by a solid driveway or patio, upward growing roots don't experience the normal signals (increased light and air) that they are reaching the surface. As a result, they often grow against the underside of pavement.



"Most damage is found six feet or less from the tree," notes Gerstenberger, "since roots become smaller and less damaging the further they are from the trunk. Keep this in mind before you plant. That small sapling could become a large shade tree with roots spreading 30 or 40 feet outward from the trunk."

Fixing the problem

Some homeowners, masons and landscapers deal with intrusive roots by grinding down or removing them. This can be expensive and is very harmful to the tree. Wounding a tree's roots creates points of entry for pathogens, leaving a tree vulnerable to disease. Cutting major roots also reduces a tree's ability to take up nutrients and water, leaving it more susceptible to drought. Finally, reducing a tree's structural support from the roots increases the danger the tree will topple onto your house in high winds.

Keep these cautions in mind if you plan to deal with a problem tree:

- The farther you cut from the trunk, the less threat to the tree's health, and the less danger of creating a hazard.
- Try not to cut roots over 2 inches in diameter.
- Roots recover better from being severed when you: cut them cleanly with a saw instead of breaking them with a backhoe; mulch and water well after pruning; and fertilize in early fall or spring.

Deciding what to plant

Select trees for your landscape that cause less damage, match species with site conditions, and – most importantly – do not plant large shade trees within 12 feet of hardscapes. Since the health of trees in your yard is put at risk whenever root



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systems are cut back or damaged, anything that can be done to reduce the damage caused by tree roots will also benefit your trees.

In areas within 5 to 7 feet of a paved area or structure, plant trees that grow to a mature height of less than 30 feet. In areas within 7 to 10 feet of a paved area or structure, plant trees that grow to a mature height of less than 50 feet. Reserve trees that mature higher than 50 feet for areas with at least 12 feet of clearance. This allows adequate space for the roots. Also, before you plant check for overhead utility lines and leave adequate space for that tree to mature.

This tip courtesy of: <http://www.treecaretips.org>



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Planting and Plan and Planting Location

No magic chants or mystical charts are required to ensure tree survival. Follow these simple steps and your tree will thank you!

Wider IS better! Dig a hole or even simply rototill or spade an area 2 to 5 times the width of the root ball.

The biggest cause of young tree and shrub failure is planting too deeply. Never dig the hole deeper than the depth of the root ball.

Always remove the twine or nylon and the burlap if a tree is balled and burlapped.

Extensive research has shown there is no need to add fertilizers, living organisms, spores, gels, organic products, etc. into the backfill soil. Simply use the loosened soil that came out of the planting hole.

Put no more than ¼" of soil over the root ball.

Mulch the top of the soil backfill with 2-3 inches of woodchips or pine bark in a three foot radius

Water in everything; never tamp down the soil. Stake only if really necessary.

For maximum energy savings and minimum maintenance costs, plant trees at the following locations:

- For trees which mature greater than 60 feet, plant a minimum 20 feet from a building and 40 feet apart.
- For trees which mature between 30 and 60 feet, plant a minimum 15 feet from a building and 35 feet apart
- For trees which mature less than 30 feet, plant a minimum 10 feet from a building and 15 feet apart.
- Plant trees no less than 15 feet from a driveway, 10 feet from a utility pole, and 30 feet from an intersection.

Scientific research has demonstrated that two deciduous trees on both the east and west sides of a house provided the maximum energy savings.

Courtesy of: www.saforest.org/saf11.htm



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Should I fertilize my trees?

Trees often require fertilization at some point in their life span. Remember, most trees' natural environment is the forest. There nutrients are continually recycled as leaves and other plants, and even animal material, fall and decompose on the forest floor. When you put a tree in a landscape setting it is usually deprived of these nutrients.

One thing you can do is try to recreate the tree's natural environment by providing mulch rings. Most people, however, will not be able to mulch their whole yard! Fertilization is needed by many trees to replace the nutrients they are missing.

Like any other landscape plants, shade trees will respond to fertilization. Most shade trees exist in nature without much care, but transplanting trees into urban areas or man-made conditions can create problems. Often these trees will be growing in restricted root zone areas, be surrounded by pavement or compacted soil or even be physically damaged by construction activities. One should realize that the root system is just as important (and delicate) as the above ground parts. Fertilizer alone will not improve the health of a tree stressed by one of these environmental conditions. Fertilizer is only one factor in the complex formula of plant requirements. Here's how to detect if your tree needs fertilizing. Symptoms of a nutrient deficient tree include:

- a slow rate and low amount of annual growth on twigs and trunk,
- smaller than normal foliage,
- off-color foliage,
- increased numbers of dead branches,
- tip-die back in branches,
- and increased rates of disease and insect problems.

Trees that possess these symptoms generally would respond to a fertilization treatment. One should make sure that nutrients (or lack of) are the problem before fertilizing. Other common tree disorders to be aware of in urban areas would include poor planting techniques, moisture problems, construction damage, girdling roots, or utility leaks from a natural gas line or sewer line.

How does the arborist determine when to fertilize? Why does my tree need a soil test?

Arborists have a number of tools at their disposal. The best is the arborist's knowledge of local soil and environmental conditions. The arborist may be able to make a fertilization recommendation simply by examining your tree and yard. This saves the client time and money. On other occasions the problem may be more complex and the arborist will recommend a soil and/or foliar analysis to determine the problem.

Your arborist does know that most shade trees growing in landscape settings will need nitrogen. Nitrogen is not stable in the soil. It is easily washed away by water and may periodically need to be replaced.