Doug, you say Super Greens Fertilizer works under conditions that can stop others cold. What do you mean?
“Cold weather, of course. But also high pH and deficiencies in iron or manganese. All or any combination of those conditions.”
Let’s start with cold weather. What makes Super Greens better? “Super Greens works quickly in cold, wet soils—spring or fall—because most of its nitrogen doesn’t depend on temperature-related microbial activity.”
How quickly does it work? And what about staying power? “Your greens should respond within five days. And it’s got enough kick left to last well into the second month.”
Will it push greens? Turn them puffy? “No. Super Greens has the balanced ratio of nitrogen and potassium you’re looking for to promote high quality turf.”
Let’s talk about pH. You say Super Greens performs in high pH conditions. Why? “Because of the unique chemistry of the product and the homogeneity of the granules. If you have a high pH condition because of soil or irrigation water, Super Greens is for you.”
What about the iron and manganese. What makes your micronutrients different? “Quantity and chemistry. Super Greens has enough iron and manganese to help overcome deficiencies, including those in sand greens. And both micronutrients are present in forms which make them available to the turf.”
When and where does Super Greens work best? “In the Deep South, I’d recommend Super Greens on bermudagrass greens and tees all year long. In the Southeast, it helps keep bentgrass greens active from October through April, and it’s great for ryegrass overseeded on bermuda greens and tees. It will also help bring bermudagrass out of dormancy quickly in the spring.”
How about the rest of the country? “In cooler climates, superintendents can get earlier green-up in the spring and good strong color on their bentgrass greens through fall and right up to freezing weather.”
How does Super Greens compare with competitive products? “In this business, you get cautious about saying that anything is ‘the best’. But this fertilizer would have to rank among the very best I’ve ever seen.”
For more information on new Super Greens Fertilizer, call your ProTurf Tech Rep. Or call Scotts direct at 800-543-0006.

Doug Horn, Scotts Research project leader (Fertilizer R&D), talks about new Super Greens Fertilizer.

“It’ll give you quick, healthy green-up under conditions that can stop other fertilizers cold.”
Annual Nitrogen Requirement of Turfgrasses*

<table>
<thead>
<tr>
<th>Species</th>
<th>Length of Growing Season</th>
<th>Nitrogen per Season lbs./1,000 sq. ft</th>
<th>Variations in Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cool-Season:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sheeps &amp; hard fescue</td>
<td>4-8</td>
<td>0- 3</td>
<td>low maintenance; roughs</td>
</tr>
<tr>
<td>red fescues</td>
<td>4-8</td>
<td>1- 3</td>
<td>low maintenance to good care</td>
</tr>
<tr>
<td>Kentucky bluegrass</td>
<td>5-12</td>
<td>2- 8</td>
<td>lawns, fairways</td>
</tr>
<tr>
<td>bentgrasses</td>
<td>4-8</td>
<td>1- 4</td>
<td>medium care, lawn, fairways</td>
</tr>
<tr>
<td>bentgrass, greens</td>
<td>5-12</td>
<td>6-15</td>
<td>clippings removed, forced growth</td>
</tr>
<tr>
<td>Warm-Season:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>zoysia</td>
<td>6-10</td>
<td>1- 6</td>
<td>adequate cover</td>
</tr>
<tr>
<td>common bermuda</td>
<td>7-12</td>
<td>2- 8</td>
<td>most variable</td>
</tr>
<tr>
<td>St. Augustine, Bahia</td>
<td>10-12</td>
<td>2- 8</td>
<td>warm areas, lawns</td>
</tr>
<tr>
<td>bermudagrass, fairways</td>
<td>5-12</td>
<td>4- 9</td>
<td>good management</td>
</tr>
<tr>
<td>tees</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bermudagrass, greens</td>
<td>8-12</td>
<td>8-20</td>
<td>may rest over winter</td>
</tr>
</tbody>
</table>


shoot growth activity slows. Care must be taken with the timing of fall fertilization since it may decrease low temperature hardiness if applied late. Maintaining adequate potassium levels in fall increase tolerance to low temperatures. As with cool-season turfgrasses, indiscriminate use of nitrogen fertilization in the summer can increase injury of warm-season grass subjected to disease or environmental stress. As mentioned previously, maintaining adequate soil potassium levels will aid warm-season turfgrass in their tolerance of heat, cold, mowing and wear stresses, and reduce their susceptibility to turfgrass diseases.

Rate of fertilization

The annual nitrogen requirement (pounds per 1,000 square feet) for turfgrass should be determined by considering several factors, including the length of growing season, degree of quality desired, purpose for which the turf is used, and the species and cultivars present.

The length of growing season (time between the last killing frost in the spring to the first in the fall) varies. Along the Gulf of Mexico and in certain areas of Arizona and California, it exceeds eight months. Portions of Maine and Minnesota, however, have as little as three and a half months. The longer the length of growing season, the greater the amount of nitrogen needed to maintain turfgrass quality.

Because of the level of quality desired is subject to human interpretation, the rate of fertilization can be tailored to meet the expectations of the user. A home lawn maintained for aesthetic purposes, for example, can

An objective in timing fertilizer applications is to build carbohydrate reserves and promote root development.

Turfgrass species and cultivars can vary in amount of nitrogen required to maximize quality. Within the cool-season grasses, sheeps, hard and red fescues require a low level, Kentucky bluegrass a medium level, and bentgrass a high level of fertility. Improved cultivars of bermudagrass require more nitrogen than common bermuda.

Cultural practices such as irrigation and clipping removal may require the use of higher annual nitrogen rates to maintain the desired turfgrass quality. Supplemental watering of turfgrasses will increase the rate of which nitrogen is leached from the turfgrass root zone. Losses can be substantial when quick-release sources of nitrogen are applied to sandy soils.

Collection of clippings following mowing has been estimated to remove approximately 20 percent of the nitrogen applied to turfgrass. Additional nitrogen should be factored into the yearly total of these areas.

Phosphorus and potassium have been routinely applied along with nitrogen using fertilizer with ratios such as 3:1:2, 5:1:2 or 4:1:1. These ratios are based on the relative amounts of nitrogen, phosphorus and potassium found in turfgrass clippings but do not take into consideration the inherent levels found in the soil.

Their use should be based on a soil test. Many turfgrass soils contain high levels of phosphorus and little, if any, response is obtained by putting down more.

Two factors to be considered in making individual nitrogen applications are the source of nitrogen and the time of year.

Quick-release sources of nitrogen (for example ammonium nitrate, urea) are commonly limited to no more than one pound of nitrogen per 1,000 square feet. This rule of thumb is observed in spring and fall to avoid overstimulating shoot growth. Summer applications using quick-release sources are frequently limited to no more than one-half pound of nitrogen per 1,000 square feet. Low rates of quick-release sources also minimize the potential to cause fertilizer burn.

Applications of controlled-release nitrogen sources (such as U.F., IBDU, sulfur coated urea) are generally made at rates from one to three pounds of nitrogen per 1,000 square feet. The longer residual of these nitrogen sources reduces the need for more frequent applications, saving...
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or screens, and a nozzle.

Low-pressure spray booms, as the name implies, are operated at low pressures, generally in the range of 15-60 pounds per square inch (psi) and deliver one gallon or less of spray per 1,000 square feet. They are designed to be driven over large areas delivering the spray from a series of nozzles in distinct swaths. They are often used by golf course superintendents on fairways.

High-pressure sprayers can create spray pressure of several hundred pounds or more and use a hose and hand-held nozzle for directed application and are used by lawn care companies.

FERTILIZATION OF TREES AND SHRUBS

Landscape trees and shrubs are often subject to adverse soil and environmental conditions. Compacted soils, poor drainage, restricted root areas as well as highway salts, air pollutants and competition from turfgrass contribute to plant stress and increase the importance of regular fertilization.

Vigorous trees are more resistant to insects and disease, more attractive and a greater asset to properties. When trees are fertilized, only nitrogen, phosphorus and potassium are normally applied. However, supplemental micronutrients such as iron and manganese may be necessary for certain species growing in alkaline or sandy soils.

Plants often respond to applications of nitrogen with dramatic improvements in shoot growth and leaf color. Because of nitrogen's transitory nature in soils and the large amount extracted by plants, soil analysis is not particularly useful. Heavy applications of nitrogen alone may stimulate shoot growth more than root growth, disturbing the natural root/shoot ratio.

The need for supplemental phosphorus and potassium is more difficult to determine since phosphorus and potassium normally do not produce a noticeable, visible response except on young or newly transplanted trees and shrubs. Also, results from field studies have been inconsistent because of differences in soil, age, condition and location of test species, and the timing and method of application. Where reliable soil tests are not available for phosphorus and potassium, most arborists fertilize all trees and shrubs with a complete fertilizer. Since arborists are concerned with the health of individual trees and
Penneagle’s still pushing out Poa at Oakmont C.C.

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Paul Latshaw
Supt. Oakmont Country Club

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shrubs growing in a wide variety of soil conditions, the most practical approach to fertilization is to provide an effective fertilizer formulation for trees and shrubs within a geographic area.

Specific soil/plant deficiencies may be addressed, if necessary, on an individual basis. In most cases a 3:1:1 (or similar) ratio is satisfactory for landscape plants although additional potassium and/or micronutrients may be advisable in sandy soils. Additional micronutrients may also be necessary in alkaline soils particularly for ericaceous or other so called “acid-loving” plants.

Iron deficiency chlorosis is common on oaks, rhododendron and pine grown on alkaline soils and has been reported on sweet gum, ginko and birch as well as many other woody ornamentals. Manganese deficiency chlorosis, also induced by alkaline soils, is a common problem with maples.

**Application rates**

Most fertilizer recommendations are based on the number of square feet in the growing area for shrub beds or the branch spread for individual trees and shrubs.

Fertilizer recommendations based on trunk diameter can result in over fertilization and damage to plants if the root system is restricted by paved areas, foundation walls, or other obstructions.

**Three pounds of actual nitrogen per 1,000 square feet per year or six pounds every other year is satisfactory to maintain the health and vigor of deciduous trees and shrubs. If leaf color, annual growth or general vigor is unacceptable, six pounds of nitrogen per 1,000 square feet may be applied annually.**

Broadleaf evergreens, small shrubs, flowering trees and recently transplanted or declining trees are more sensitive to fertilizer salts and should receive only about one-half the recommended rate, particularly when quick-release fertilizers are applied. The risk of injury to sensitive plants may be reduced by splitting the recommended annual amount into two or more applications.

The amount of fertilizer to be applied per 1,000 square feet of root area can be calculated by dividing the percent nitrogen on the fertilizer bag into the desired nitrogen per 1,000 square feet.

For example, to determine the amount of 30-10-10 fertilizer required to apply six pounds of nitrogen per 1,000 square feet, divide .30 into 6, which equals 20 pounds (6/.30 equals 20).

**Application timing**

Although the roots of woody plants may elongate throughout the growing season, active root growth most often occurs in early spring and late fall when soil temperatures are cool and there is little competition from leaves for water and nutrients.

Fertilization is most effective when supplemental nutrients are available during these periods of optimum root growth. Soluble nitrogen fertilizers, because of their short residual in soils, should be applied at the time of transplanting or declining trees are induced by alkaline soils particularly for ericaceous or other so called "acid-loving" plants.

Iron deficiency chlorosis, also induced by alkaline soils, is a common problem with maples.

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**Application techniques**

Supplemental nutrients can be supplied to landscape plants through foliar sprays, trunk injections or applications on or beneath the soil surface. Though each method has advantages in specific situations, woody plants in most cases respond best to soil applications.

**Surface applications**

Nitrogen fertilizers can be applied to the soil surface since nitrates are highly mobile and will move downward into the root zone. When fertilizing woody plants in sodded areas, surface application should be limited to no more than three pounds of nitrogen per 1,000 square feet from a controlled-release source. However, since turfgrasses within the application zone may be injured or respond with undesirable succulent growth, trees and shrubs in quality lawns are often fertilized with subsurface applications.

Fertilizer containing phosphorus should not be applied to the soil surface. Phosphorus is bound to soil particles and does not move downward to contact the absorbing roots. Surface applications of phosphorus may also stimulate annual bluegrass which is undesirable in home lawns.

**Drill hole technique**

Fertilizer can be placed in the root zone by drilling holes in the ground and dividing the recommended amount of fertilizer equally among the holes. For trees, holes should be 12-18 inches deep and 18-24 inches apart, beginning two to three feet from the trunk and going two to three feet beyond the drip line.

To prevent turfgrass injury, fertilizer should be a least four inches below the soil surface. Calcinated clay, perlite or other soil amendments can be used to fill the top of the hole or, in quality lawns, a plug of grass can be removed before drilling and replaced after adding fertilizer.

**Soil injection**

Liquid soil injection is a fast, economical alternative to the drill hole technique. The injection equipment consists of a hydraulic sprayer operated at 150-200 psi and an injector probe sticking about 12 inches into the soil. The injections are normally in a grid pattern about three feet apart within and slightly beyond the tree canopy.

Soil injection provides more thorough nutrient distribution than the vertical hole technique and generally can be done in about one-fourth the time.

Unfortunately, most soluble fertilizers have a high burn potential and soluble nitrogen may leach from the root zone. It may remain in the root zone for as little as six weeks.

Because of the limitations of liquid soluble fertilizers, suspension fertilizers are gaining acceptance for soil injection. Ureaformaldehyde is particularly effective as a controlled-release nitrogen source in spraying systems since the release rate is not greatly affected by particle size. Suspended in water, powdered ureaformaldehyde can be injected into the soil and dispersed laterally by hydraulic pressure.

Soluble methyol and methylene ureas, recently introduced, have a lower burn potential than urea or other soluble nitrogen sources.

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**The longer the length of growing season the greater the amount of nitrogen needed to maintain turfgrass quality.**

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Continued on page 50

continued on page 50
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Other methods

The aero-fertil technique injects dry fertilizer by blasts of air into drilled holes in the soil. This method is similar to drill hole application and provides additional aeration by fracturing heavy or compacted soils.

Fertilizer stakes or spikes are driven into the ground at intervals beneath the drip line of trees and shrubs. Although they contain satisfactory fertilizer materials, spikes are expensive and not as effective as other fertilization methods. One or two spikes per inch of trunk diameter provide only a small amount of fertilizer, little of which comes in contact with the root system since little lateral distribution occurs within the root zone of most soils.

Foliage sprays and trunk injections and implants can supply a limited amount of nutrients to woody plants and are recommended for micro-nutrients whose availability is reduced by alkaline soils. These methods are most effective when a single micronutrient is deficient.

FERTILIZATION OF TREES AND SHRUBS IN CONTAINERS

The growing of trees and shrubs in landscape containers is common where plants are desirable but suitable planting sites limited. They need careful attention because the reservoir of available growing media—minerals and water—is much smaller. Container soils, often wet and poorly aerated, are subject to excessive leaching and require a regular fertilization program.

In general, recommended fertilizer rates for landscape plants based on square footage have been successful in maintaining container grown plants.

A complete fertilizer applied at an annual rate of 0.5 to one ounce of nitrogen per 10 square feet of container soil surface is commonly used. However, because of the wide selection in plant material, and variations in container design and growing media, fertilizer requirements are best determined through soil and tissue analysis.

Container fertilization includes dry, foliar, and liquid applications. As with landscape plants, foliar applications are usually limited to micronutrients. Foliar fertilization should be considered where soil conditions may inhibit root absorption or where a quick response is desirable. Care should be taken to contain the spray since some micronutrient sources can stain.

Dry fertilizers may be applied either in controlled release or quick-release form. High analysis fertilizers may be difficult to evenly distribute because of the small amount required per container. Liquid applications of soluble or suspension fertilizers provide a uniform dosage and fast and easy distribution, but may require more frequent applications because they may leach from container soil.

FERTILIZING INTERIOR PLANTS

During production, the growth of foliage plants is accelerated by using considerable quantities of nutrients. These same plants grown indoors, however, usually receive less light, and neither require nor will tolerate the amount of fertilizer they received in production.

Precise fertilizer requirements are difficult to predict in interiorscape maintenance without measuring light at strategic locations.

Light varies from one side of a room to another, often within a few feet. Usually, the stronger the light under which foliage plants are growing, the greater the amount of nutrients needed. Recommended annual fertilizer rates can vary from as low as 0.3 grams of nitrogen per square foot for low light intensities to 3.0 grams for high intensities.

A complete fertilizer with a nitrogen/phosphorus/potassium ratio similar to those recommended for landscape plants is suitable for indoor plants. The highest levels of nutrients should be applied at optimum growth periods, for most plants, spring and summer when natural light is strongest.

Micronutrients are seldom recommended but may be necessary when growing sensitive plants in media other than soil. The rubber plant (Ficus elastica) and the Areca palm (Chrysalidocarpus lutescens) are both sensitive to boron deficiency.

In addition, the Areca palm can also become zinc deficient. Beware of overapplications of micronutrients because of toxicity problems.

The proper amount of nutrients is also determined by plant species. Plants normally grown under low levels of fertility include many ferns and fleshy plants such as Peperomia. Plants requiring high nutrient levels include rapid growing species and large leaved plants such as Ficus and Schefflera.

A build up of salts, both from fertilizer and irrigation water, is possible unless the root area is periodically flushed with excess water which is allowed to drain away. This is true when plants are over-fertilized during periods of low light and/or little growth.

Since visual symptoms such as stem rot and leaf necrosis in new growth are similar to those of overwatering, the soil should be tested for soluble salts.

Suggested Fertilizer Rates for Plants in Interior Landscapes

<table>
<thead>
<tr>
<th>Grame N per 6-in. Container per Year</th>
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<tbody>
<tr>
<td>0.2</td>
</tr>
<tr>
<td>0.4</td>
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<tr>
<td>0.6</td>
</tr>
</tbody>
</table>

Circle the number on the enclosed reader information card for more information on fertilizer products mentioned in this article.

- American Pelletizing Corp. (201)
- The Andersons (Tee-Time) (202)
- Canadian Industries Ltd. (SCU) (203)
- Ciba Geigy (Sequestrene) (204)
- W.A. Cleary (Flut) (205)
- CP Chemical (Nito-26) (206)
- Creative Sales Inc. (207)
- Doggett Corp. (208)
- Dow Chemical (N-Serve) (209)
- Eagle Picher (Eagle-Iron) (210)
- Estech Inc. (IBDU, Oxamide) (211)
- Georgia Pacific (GP3431) (212)
- Great Salt Lakes (NVN) (213)
- Hawkeye (Formolene) (214)
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- Lesco Inc. (SCU) (216)
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- Melamine Chemical Inc. (219)
- Miller Chemical (Ferripex) (220)
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- U.A.P. (227)
- USS Agri-Chemicals (228)