or liquid forms. The choice of using either dry or liquid application equipment has been the subject of great controversy particularly in the lawn care industry.

Research has shown, however, that turf response is equal regardless of the method of application when considering a source of nitrogen such as urea. The choice of application method, then, may be decided on the turf manager's perception of productivity and personal preference.

Two types of spreaders are used to apply **granular** (dry) fertilizers; the gravity and the centrifugal. With the **gravity** (or drop) spreader, fertilizer is held in a trough and is agitated by a mixing bar connected to the wheels. The fertilizer is dropped by gravity through a series of slots to the turf below. The gravity spreader applies a defined swath of fertilizer which can avoid waste in confined turf areas.

The **centrifugal** (or broadcast) type of spreader is commonly used by commercial turf managers because the centrifugal applies a wider swath of fertilizer and can treat large areas more quickly than with the gravity spreader. The centrifugal spreader features a hopper from which the fertilizer falls from a hole (or series of holes) onto a spinning disk which propels fertilizer ahead and to the sides of the spreader.

With a liquid application method, fertilizer is either solubilized or suspended in water and sprayed on the turf. The amount of water used normally varies from 1 to 5 gallons per 1,000 square feet.

The equipment used to make **liquid** applications of fertilizer can be broadly classified into either low-pressure spray booms or high-pressure or hydraulic sprayers. Both types of sprayers feature a tank for holding the fertilizer and water, pump to build pressure so as to force the liquid from the tank to the nozzle, pressure regulator to keep the pressure at the level desired, strainers or screens to keep solids from clogging the pump (or nozzle), and nozzle(s) which deliver the spray to the turf in a particular pattern.

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 per 1,000 square feet of spray.

Low-pressure spray booms are designed to be driven over large areas delivering the spray from a series of nozzles in distinct swaths. This type of sprayer has been popularized by golf course superintendents who use it for making liquid applications to golf course fairways.

High-pressure sprayers can create spray pressure of several hundred pounds or more and use a hose and hand-held nozzle for directed applications of the spray. This type of spraying system is used by those companies in the lawn care industry who apply fertilizers using a liquid application technique.

FERTILIZATION OF TREES AND SHRUBS

Landscape trees and shrubs are often grown out of their native habitat and are 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 to maintain healthy growth.

Vigorous, well-maintained trees are more resistant to many insect and disease pests, are more attractive, and are 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 soils.

Plants generally respond to applications of nitrogen often 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 than for nitrogen since phosphorus and potassium normally do not produce a noticeable, visible response except on young or newly transplanted trees and shrubs. In addition, results from field studies have been inconsistent because of differences in soil, the 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 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 market 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 in the soil.

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 amount into two or more applications.

The amount of fertilizer to be applied per 1,000 square feet of root areas 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 30-1-10 fertilizer required to apply six pounds of nitrogen per 1,000 square feet, divide .30

into 6, which equals 20 pounds (.30/6 = 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 relatively 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 between October and December and/or between February and April. Controlled-release nitrogen ensures availability in the root zone for a relatively long period, depending upon the solubility of the nitrogen source. The application timing of these fertilizers may not be a major concern.

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 in soil solution and will move downward into the root zone. However, since turfgrasses within the application zone may be injured or respond with undesirable succulent growth, trees and shrubs in quality lawns normally are fertilized with subsurface applications, either placed in vertical holes or injected below the soil surface.

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.

Fertilizer containing phosphorus should not be applied to the soil surface. Phosphorus is bound tightly 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, the holes should be drilled 12-18 inches deep and 18-24 inches apart, beginning 2 to 3 feet from the trunk and extending two to three feet beyond the drip line.

To prevent turfgrass injury, the fertilizer level should be at least 4 inches below the soil surface. Calcined 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 for applying nutrients within the root zone. The injection equipment consists of a hydraulic sprayer operated at 150-200 psi and an injector probe that inserts

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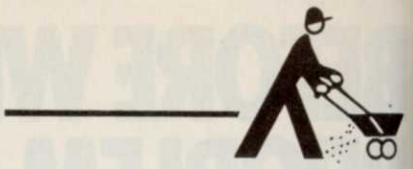

about 12 inches into the soil. The injections are normally in a grid pattern about 3 feet apart within and slightly beyond the tree canopy.

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 relatively high burn potential and soluble nitrogen may be rapidly leached from the root zone. The actual amount of soluble fertilizer applied is often less than one pound nitrogen per 1,000 square feet because of factors such as drought and decline which increase the sensitivity of plants to fertilizer salts.

After application, soluble nitrogen may remain in the root zone for as little as six weeks, further reducing the amount of nitrogen available for absorption.

Because of the limitations of liquid soluble fertilizers, suspension fertilizers are rapidly 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.

At least 60% of the total nitrogen in ureaformaldehyde is water insoluble and becomes available over a one- to two-year period. Since the nitrogen salts are released gradually as the compounds degrade, ureaformaldehyde has a significantly lower burn potential than soluble nitrogen sources and can safely supply the recommended annual rate of three to six pounds of nitrogen per 1,000 square feet in a single application.

Soluble methylol and methylene ureas recently been introduced have a lower burn potential than urea or other soluble nitrogen sources. But their release characteristics and usefulness in tree care have yet to be determined.

Other methods

■ The aero-fertil technique injects dry fertilizer by blasts of air into holes which have been previously drilled 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

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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, very little of which comes in contact with the root system since very 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 micronutrients whose availability is reduced by alkaline soil conditions. 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 becoming more common in locations where plants are desirable but suitable planting sites are limited.

Container-grown plants need more careful attention to maintain proper growth than landscape plants because the reservoir of available growing media, minerals and water is much smaller. In addition, the shallowness of many containers often results in soil conditions that are too wet and poorly aerated for plant growth, particularly when the soil has not been properly prepared.

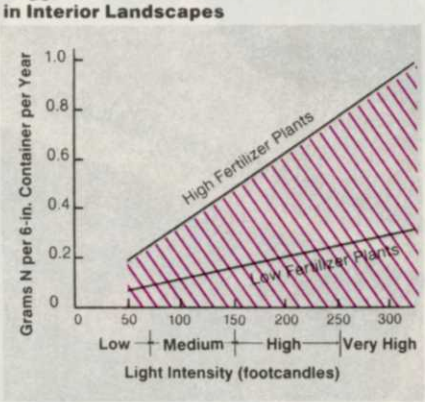
Container soils are subject to excessive leaching and require that a regular fertilization program be followed. In general, recommended **fertilizer rates** for landscape plants based on square footage have been successful in maintaining container-grown plants.

A complete fertilizer applied at an annual rate of 0.5 to 1 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 application. Each may be used successfully with proper management. 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 have staining properties.

Dry fertilizers may be applied effectively 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. Soluble fertilizers, however, will require more frequent applications due to the ease with which these materials may be leached from container media.

Suggested Fertilizer Rates for Plants in Interior Landscapes



FERTILIZING INTERIOR PLANTS

During the production phase, foliage plants are encouraged to grow as quickly as possible, utilizing considerable quantities of nutrients. These same plants grown indoors, however, are normally subjected to much lower light levels, and neither require nor will tolerate the levels of fertilizer typical in production.

Precise fertilizer requirements are difficult to predict in interiorscape maintenance without measuring the **light intensity** at strategic locations. The light level can vary significantly from one side of a room to another side, often within a distance of a few feet. In general, the stronger the light under which foliage plants are growing, the greater the amount of nutrients needed to meet the requirements for growth.

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 of nitrogen per square foot for very 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 coordinated with optimum growth periods. For most plants, this is during the spring and summer months, especially when natural light is the primary light source.

Micronutrients are seldom recommended but may be necessary when growing sensitive plants in soilless media. The rubber plant (*Ficus elastica* 'Decora') and the Areca palm (*Chrysalidocarpus lutescens*) are both sensitive to boron deficiency. In addition, the Areca palm reportedly is sensitive to zinc deficiency.

Care must be taken when applying micronutrients. Overapplications can quickly cause toxicity problems.

In addition to light levels, the proper amount of nutrients is determined by **plant species**. Plants which normally are grown under low levels of fertility include many ferns and fleshy plants such as Peperomia. High nutrient-requiring plants 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 particularly 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 soluble salts of the soil should be tested for confirmation.

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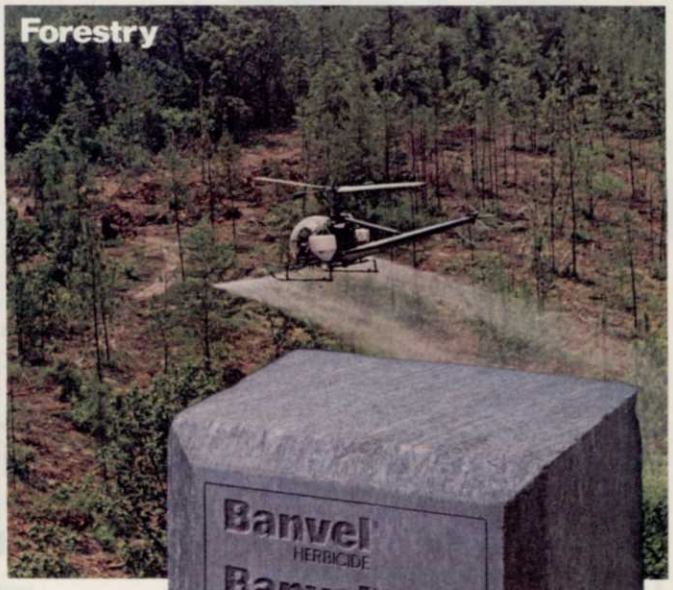

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BIZON *from page 26*

wants Bizon Maintenance to project.

His employees (there are 10 in addition to younger brother Phillip and himself) are fully uniformed with green pants and brown shirts, his company trucks are gloss white Chevy pickups with matching trailers, and his mowing equipment gets a thorough washing at the end of each work day.

Charbonneau Greens *Town Homes association chairman Robert Martin, Phil Bizon and Steve Bizon.*

Even his literature gets that extra touch because when he submits a bid he wants the first impression to count. The bid cover is glossy and displays his company logo in three colors.

"When we do something, we want to do it first class," Bizon stresses. "I don't mind spending an extra dollar, because sometimes it can make something look a thousand times better. That's the way we want to look and the way we operate."

So far the Charbonneau Greens Town Homes association, through its chairman Robert Martin, is responsive to Bizon's suggestions without dealing him carte blanche.

"Steve is doing a marvelous job," Martin says, "otherwise we'd be having a lot of meetings. We seldom have a board meeting now."

But, when it comes to approving all of Bizon's projects. . .?

"He tries to get a little bit extra all the time, but we're a small association and we can't always give him what he wants," Martin adds.

Even so, the condo board (pleased because it doesn't have all those stuffy meetings) and Bizon interact amicably.

Strictly business

Bizon feels the main reason is that he treats condominium maintenance much like he treats his commercial accounts.

"We insist we deal strictly with one person and not with an entire board. In the past a lot of people didn't like dealing with condominiums because there are so many different personalities to deal with. If we have to listen to everybody pretty soon our workers are listening to complaints rather than getting their work done. It's always better to have one person to deal with and that way that person can speak for the whole group."

Bizon realizes he has to bend a little, too, when dealing with a condominium board and he does by providing a written monthly report to Martin who then can make copies for board members. Bizon also makes himself available for meetings with the board.

But, it's been his company's aggressiveness in jazzing up the condo grounds that got the relationship off to a good start.

Shortly after earning the contract, Bizon initiated improvements to the lawn irrigation system. Water from the Willamette River is used in keeping lawns lush and green, but in the summer the water often carries debris which clogs lines and sprinkler heads. Bizon Maintenance installed filters in both the in-coming mains then put in 1,000 new Toro 570 pop-up sprinkler heads with built in filters.

"I felt no job could pay me what I was worth."
—Steve Bizon

Bizon also decided to use only reel mowers on the Charbonneau property, Toro Triplex mowers which he ingeniously converted from riding to walk behinds for more manueverability. He made the conversion by removing the mower seats and installing handlebars. Bizon says reel mowers give the grounds a neater look and also help reduce thatch build up.

With more reliable irrigation and mowing schedules the Charbonneau grounds quickly showed improvement.

The agreement between the board and Bizon stipulates the grounds are to be mowed 38 times, fertilized six times, and sprayed for broadleaf weed control two times annually.

Self-starter

Bizon launched other projects to make noticeable improvements and earn valuable points with the board.

He started an extensive pruning project, then attacked the two traffic islands that had been allowed to grow shabby, tearing out much of the old planting and replacing it with pink and red geraniums, white azaleas, and red rhododendrons.

The colorful flower beds are a calling card for Bizon who goes into almost every job with the idea of doing something special and doing it quickly. Soon after landing the maintenance contract for O'Mark Industries in Portland, Bizon's company planted 3,000 bulbs which, when they flowered the following spring, made a sparkling display.

Bizon isn't afraid to begin tasks that may not show results for several months or even a year because he insists on a two-year contract from all his accounts.

"I'll do more for my customer this year knowing that I'll have that same customer again next year," he says. To provide his company with a winter cash flow and also as a convenience to his customers, billing is divided into 24 equal payments.

After only five years in business it's perhaps a bit early to be burdening Bizon Maintenance with the stamp of "success," but the company is visible and aggressive. And it is growing.

This is due in large part to the moxie of its owner who quit a job building components for nuclear plants to start his own business.

Bashfulness isn't one of his vices. "I felt no job could pay me what I was worth," he says candidly.

With an initial investment of $5,000 he bought a Chevy pickup, three push mowers (two Snappers and one Tru-Cut reel mower), an edger, and a backpack blower.

He was in business.

His first accounts were residential, but it didn't take Bizon long to start pushing for the commerical accounts and the pieces started falling into place. He left the residential market altogether and now brother Phillip, 24, helps share the business load.

"People didn't take good maintenance seriously a few years ago. They thought landscape first and maintenance second. Maybe it's because nobody ever showed them what good service is," Bizon says. **WT&T**

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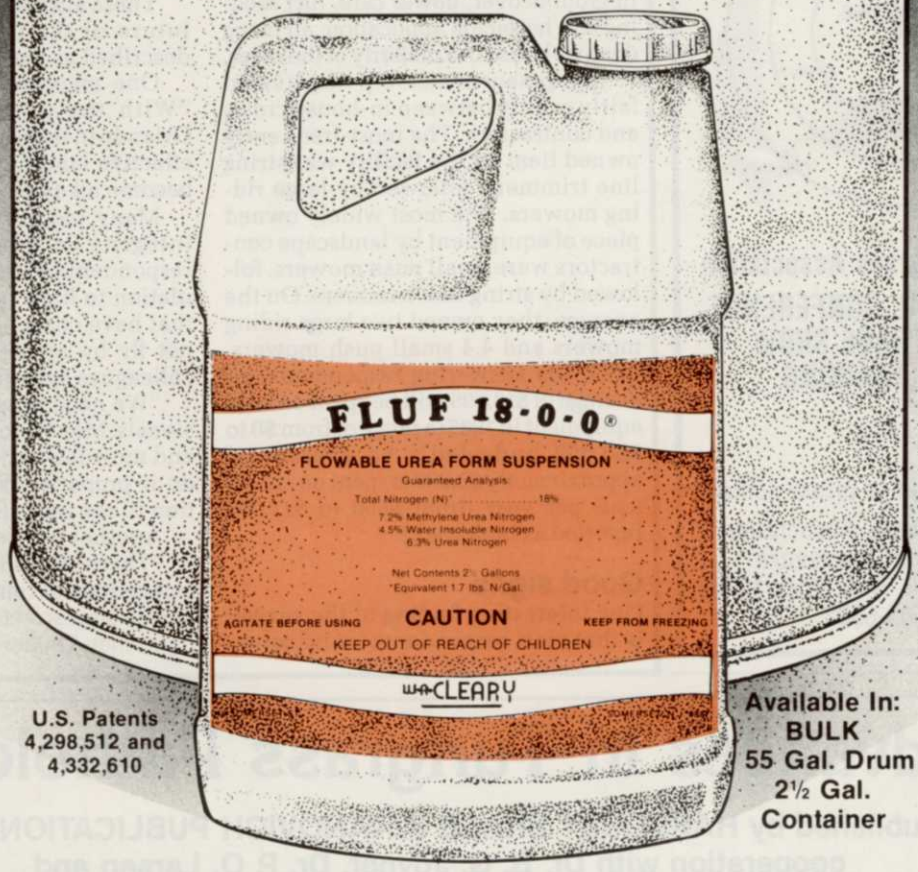

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SURVEY *from page 22*

Balancing the scales

Services such as mowing, trimming, fertilizer application, tree trimming spraying, seeding, were evenly divided between in-house crew and subcontractors.The largest variances were in groundcover, flower care, turf seeding and herbicide application; all being done in-house in a majority of the cases.

Equipment ownership was divided fairly evenly between in-house crews and contractors. The most-frequently owned item by the facility was string line trimmers, followed by large riding mowers. The most widely owned piece of equipment by landscape contractors were small push mowers, followed by string line trimmers. On the average, they owned two large riding mowers and 4.4 small push mowers.

Of the answering respondents, an average of $18,695 will be spent on new equipment in 1985 (a range of from $0 to $50,000 budgeted). An average of approximately $5,000 is spent on chemicals per year (from $500 to $12,000 reported as budgeted.)

Good signs

One interesting finding of the survey is that most respondents found condo owner associations *do* appreciate the difference between professional quality maintenance and less professional, seasonal bidders. There is also little decrease in interest and budget by owners after the units are sold.

These answers all bode well for the future of the industry which most described as excellent.

One manager from Orlando said, "With the tremendous growth in Orlando in the next three to five years, effective landscape maintenance will become a key element."

Many, too, are concerned about the integrity of their profession. One respondent felt there needs to be "regulation to limit participation to those that have chosen this as a profession, not fly by nighters." Another of his colleagues agreed.

"We need properly trained professionals. Many people can prune plants and mow lawns, but not many people do it properly. What about certification in the industry?"

Another was more pragmatic.

"There seems to be more and more competition as time goes on, but I think I'm the biggest factor. If I don't do my job right, then I better worry." **WT&T**