mining degree of renovation to attempt. Turf that is excessively springy or spongy but has fairly good color and density and minimal weed contamination is healthier and can be more severely renovated than turf that has deteriorated to the point it has become thin and weed-infested.

Thatch thickness and root density will determine how extensively turf can be vertically mowed during renovation.

The first step should be an examination of the root system by grabbing a handful of turf and trying to pull it out of the ground. Sparse or shallow-rooted turf is easily pulled out of the soil. Vertical mowing poorly rooted turf in a weakened condition is not advised.

The mechanical slicing action may loosen and strip turf from soil in patches.

Virtually any turf can be renovated regardless of its condition.

Carefully shake or wash soil and/or organic matter from the sample to expose roots and their density. There are no quantitative guidelines for root system evaluation relative to vertical mowing, but successful renovation becomes more difficult as root system depth and density decreases.

A majority of the root system should extend a minimum of six or more inches in the soil. A healthy root system will include a large number of fibrous white roots in the sample.

Thatch thickness should be examined from a cross section of the turf profile which can be removed using a garden spade. Thatch layers greater than one inch are excessive and should be removed. This examination should provide a rough quantitative estimate of how much thatch can be removed during vertical mowing and still leave adequate green vegetation for regrowth afterward.

Steps in Renovation

If undesirable weeds or grass species are a problem, a decision must be made whether to use a selective or non-selective herbicide for weed control.

Presence of a large population of weedy perennial grasses usually dictates spot treatment with a non-selective herbicide. Glyphosate (Roundup) is translocated to the growing points and is more effective than contact materials. Check current Cooperative Extension Service recommendations on weed control if selective treatment is desired.

Advance planning is necessary for this procedure since this may delay other steps. Removing weeds will reduce competition within the turf stand and allow for faster recovery from the renovation procedure.

To Remove thatch and dead vegetation, locate and flag any irrigation heads, electrical outlets, and other obstructions which may be damaged by equipment.

Adjust cutting height as low as compatible for the mower based on the grass being renovated. Because they are strongly stoloniferous and rhizomatous, poorly rooted bermudagrass and zoysiagrass may have much of the above ground vegetation and thatch removed by mowing (or scalping) at a low height of cut. This is not effective for thatch removal, but may precede vertical mowing in the renovation process.

Scalping of centipedegrass and St. Augustinegrass is not advised since it may remove most of the stolons from which regrowth must occur.

Bahiagrass is rhizomatous, but density is lower, and it may be severely injured by scalping. A grass catcher, vacuum or sweeper should be used to remove clippings during or after mowing prior to vertical mowing.

For vertical mowing use a blade spacing recommended from Table 1. Selection of a blade spacing closer than these suggestions may result in removal of too much vegetative material thus damaging grass beyond its recuperative potential.

Set the depth of cut so that as much thatch as possible is removed. If possible, set the blade depth to just penetrate the soil thereby cultivating and topdressing at the same time as dethatching.

If turf rooting and density permit, vertical mow a second time at right angles to the first direction. The decision to vertical mow a second time will depend on how severe the first procedure was for removal of green vegetation.

Thatch and debris brought to the turf surface must be vacuumed or raked and completely removed. A final mowing will smooth the turf surface.

TABLE 1.
Recommended vertical mower blade spacings for warm season grasses.

GRASS TYPE	INCHES
Bahiagrass	2.0 - 3.0
Bermudagrass	1.0 - 2.0
Centipedegrass	2.0 - 3.0
St. Augustinegrass	3.0
Zoysiagrass	1.0 - 2.0

Topdressing

Topdressing can be applied to level renovated areas.

Topdressing materials should be similar to the native soil and light applications are desired. Never bury turf with topsoil since this may smother and kill turf or create undesirable layering in the turf profile.

Verticle mowing poorly rooted turf in a weakened condition is not advised.

Cultivation

If severe compaction at the soil surface or a layering problem is present in the upper two inches in the soil profile, cultivation should be considered. This will improve aeration and water penetration and reduce surface layering problems.

Core cultivation or aeration is preferred although grooving and slicing may also be used. From two to five repeat cultivations may be necessary.

If core cultivation is done, vertical mowing or dragging of the area with a steel dragmat may be necessary to break up cores and scatter soil over the surface. Core cultivation does not remove excessive thatch and should complement, not substitute for, vertical mowing.

In areas which are severely thinned during the renovation procedure or if they were bare areas prior to renovation, seeding or vegetative planting should be done as the next step.

Sprigs removed during vertical mowing are an an excellent source of vegetative material provided they are not contaminated with perennial weeds or other undesirable grass species.

continued on page 24

4. RENOVATION IN PROGRESS DAY 15

1. SPRAY
DAY 1

2. SLICE
DAY 10

3. SEED
DAY 10

5. COMPLETED
RENOVATION
DAY 30

"LAWN RENOVATION WITH ROUNDUP® HERBICIDE IS ABOUT 30 TO 40% MORE PROFITABLE FOR US THAN CONVENTIONAL METHODS."

John Loyet, President
Greenscape Lawn & Tree
St. Louis, Mo.

"We put Roundup® herbicide on our customer's lawn, came back 10 days later to power rake it and then seed it. About 10 days after that, the perennial ryegrass we planted came up. We were just amazed at how good it looked.

We used to have to plow or disk the lawn we were renovating or use a sod cutter to remove it. With Roundup, it only took us 6 man-hours to do a job that used to take 24. And the results were just as good.

Our customers like Roundup almost as much as we do because the lawn holds up really well under light traffic all during the renovation period.

For us, it extends the season by about a month and turns a normally slow fall into a profit opportunity season.

We plan to use Roundup for lawn renovation from here on in."

IF YOU WANT TO LEARN MORE ABOUT LAWN RENOVATION WITH ROUNDUP, CALL TOLL FREE 800-621-5800 FOR YOUR FREE LAWN RENOVATION GUIDE.

ALWAYS READ AND FOLLOW LABEL DIRECTIONS FOR ROUNDUP.
Roundup® is a registered trademark of Monsanto Company
© Monsanto Company 1982. RUP-SP2-103

Circle No. 126 on Reader Inquiry Card

Monsanto

VERSATILE Roundup Herbicide by Monsanto EFFECTIVE

RENOVATION *from page 21*

Post Renovation Care

Renovation is a temporary setback to actively growing turf because it reduces the turf's ability to synthesize plant food due to removal of green grass blades.

Recovery is more rapid if turf is properly fertilized immediately following renovation. The soil should have been tested for pH, phosphorous (P), and potassium (K) levels prior to the renovation procedure.

It is extremely important during the period immediately following the renovation procedure that new rooting occur.

Correction of pH is suggested at this time or the lime spread and worked into the soil profile during cultivation, if performed. In lieu of a soil test a 16-4-8 fertilizer with micronutrients is suggested at a rate which will provide 1.0 lb. of soluble nitrogen per 1000 sq.ft. Dead organic matter exposed in renovated areas dries quickly and becomes hydrophobic.

This further stresses renovated turf which is weakened and less able to withstand water stress. Thus, renovated turf should be treated as a new installation and should be lightly irrigated twice daily until the turf develops a deep root system which is capable of surviving with less frequent, but deeper watering.

Other normal maintenance practices including mowing and control of insects and disease should be resumed immediately following renovation. Weed control can be a serious problem since renovation may expose soil and bring weed seed to the surface.

Use of a preemergence herbicide for weed control is not suggested since many of the preemergence materials inhibit root formation.

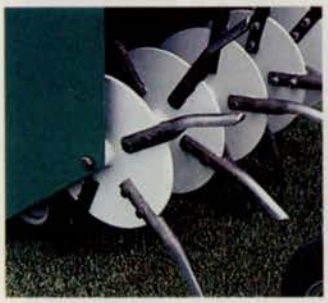
It is extremely important during the period immediately following the renovation procedure that new rooting occur. Weeds are better handled postemergent after the first mowing.

Consult the local Cooperative Extension Service office for details on the best choice of weed control materials for your area. **WT&T**

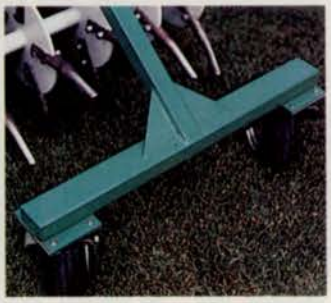
AERATES
9,000 Sq.Ft.
in just 15 minutes!

Engineered and built for continuous use by lawn service companies, this durable, low-maintenance machine is easy to maneuver, economical to operate and efficient to use. Saves time, labor and money.

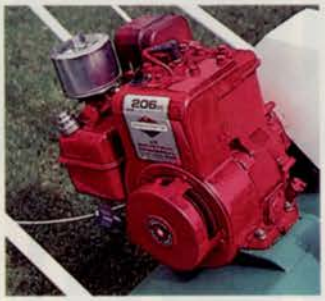
Introducing The LESCO Aerator-30



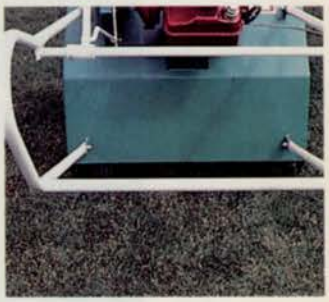
For deeper penetration into the soil, designed so only two spoons are driven into the ground at any one time. Includes 30 half-inch-diameter spoons, five per 10-inch-diameter disc on 5½-inch centers.



For superior balance, easy transport and convenient loading and unloading, includes two steel castor wheels with pneumatic tires.



For long life and reliable operation, equipped with a five-horsepower Briggs & Stratton I/C® recoil-start engine.



For operator protection and safety, features extended shielding on back of machine. Pneumatic tires provide smooth operation.

The new LESCO Aerator-30 is available with open or closed spoons. Your cost is just $795.00

Call LESCO today – toll free. (800) 321-5325 NATIONWIDE (800) 362-7413 IN OHIO

Circle No. 121 on Reader Inquiry Card

LESCO

LESCO, Inc., 20005 Lake Road, Rocky River, Ohio 44116 (216) 333-9250

Turf Nutrient Needs

Determining a soil's nutrient deficiencies is the first step in assuring healthy turfgrass.

by R.P. Freeborg and W.H. Daniel

Good turf maintenance requires the addition of nutrients which will force new growth as well as counteract wear, disease damage, and aging of turf.

This procedure helps to override weed competition and replace nutrients that are lost through leaching, fixation, volatilization, and clipping removal.

Both plant tissue and soil tests have been developed to assay the available nutrients in the soil, to predict plant utilization, and to provide a basis for determining nutrient needs. Before applying nutrients it is important that the soil be tested. This is especially important if lime is to be applied.

Freeborg is an agronomist at Purdue University. Daniel is a retired professor, Purdue University.

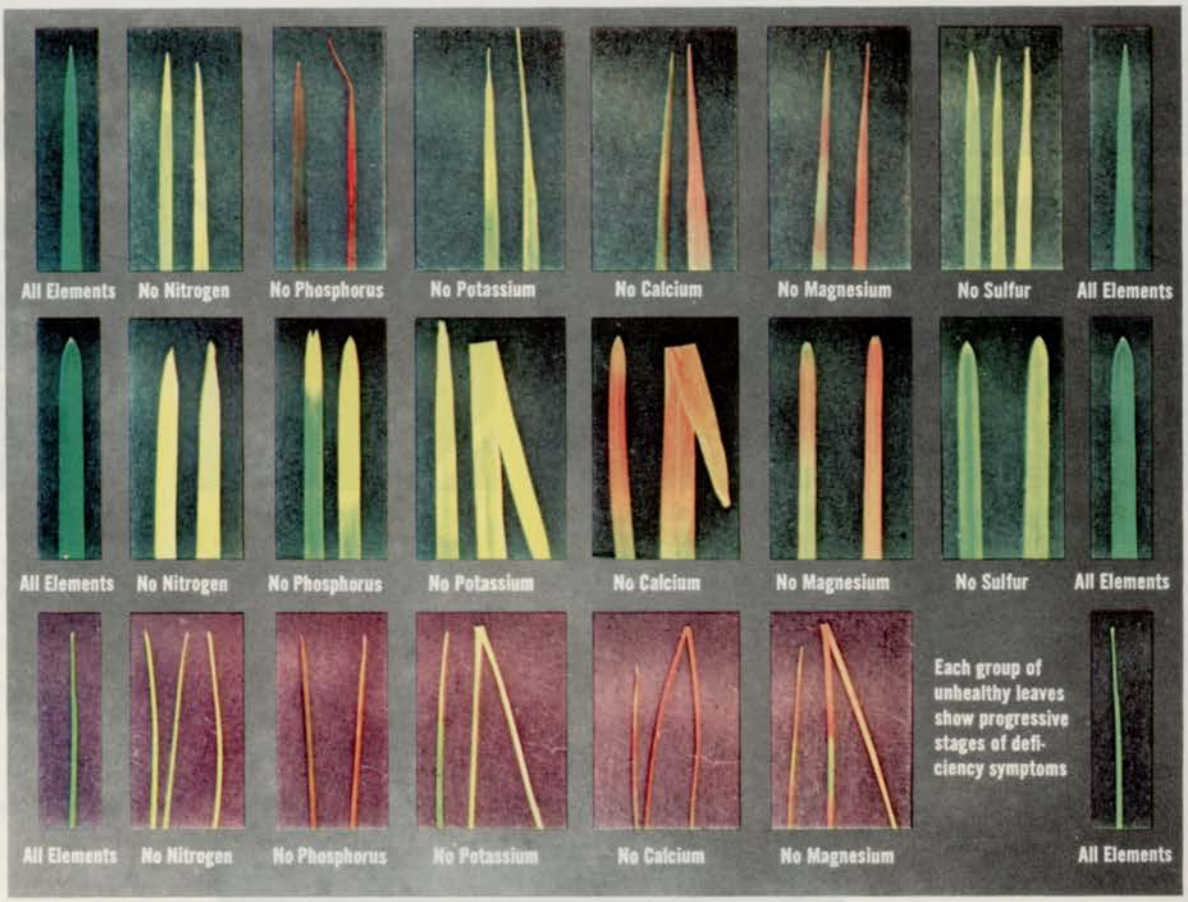
Turfgrass with *phosphorus deficiency symptoms.*

Determining deficiency

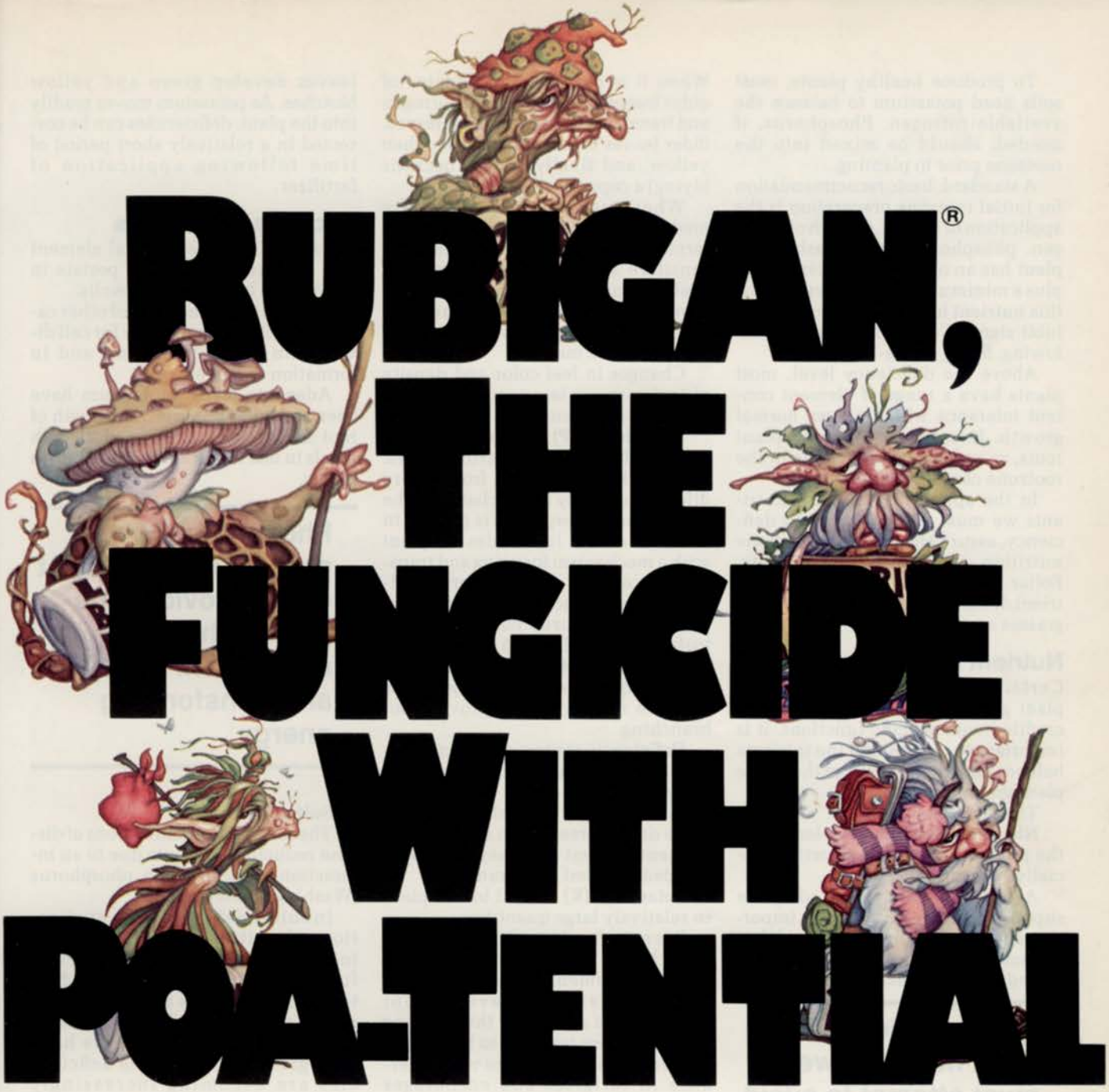
Determination of nutrient deficiency is based on the least fertile soil within the project area. Maximum fertilizer should be used initially in order to produce a good turfgrass or plant growth cover and to correct existing soil deficiencies.

All soils need supplemental nitrogen to maintain fast, vigorous growth of turfgrasses and other ornamental plants. Some soils need additional phosphorus, in the upper soil for turf or in the active rootzone for other plants, to assure an adequate supply.

TABLE 1.



Foliar symptoms of six essential nutrient deficiencies in three cool-season turfgrasses. (Photos courtesy of O. J. Noer Research Foundation, Milwaukee, Wis.)



RUBIGAN®, THE FUNGICIDE WITH POA-TENTIAL

Rubigan puts your fungi on the road again and sends Poa packing. With your blessing. Because while Rubigan controls dollar spot and large brown patch at low rates, at higher rates it also controls snow mold, fusarium blight, stripe smut, and gradually reduces *Poa annua*.

Have Poa your way. Keep it, or slowly phase it out. Depending on application rates, it's your choice. Gradual *Poa annua* reduction can be achieved with Rubigan and proper management techniques, or Rubigan can be used at low rates in a normal dollar spot program without affecting your *Poa annua*.

Rubigan penetrates leaves rapidly. It's not susceptible to washoff once the spray dries. And don't worry about fungi resistance due to Rubigan's multi-sites of inhibition. Rubigan also lasts longer. Longer spray intervals reduce application trips, saving you fuel and labor. Plus Rubigan gives you excellent turfgrass safety. It's as good for your turfgrass as it is devastating to your five major turf diseases.

So whether Poa is friend or foe, build your turf disease prevention program around Rubigan. **Turf products with benefits that make the difference.**

For best results always read and follow label directions. Rubigan®—(fenarimol, Elanco Products Company)
Elanco Products Company • A Division of Eli Lilly and Company • Indianapolis, IN 46285

Circle No. 113 on Reader Inquiry Card

To produce healthy plants, most soils need potassium to balance the available nitrogen. Phosphorus, if needed, should be mixed into the rootzone prior to planting.

A standard, basic recommendation for initial rootzone preparation is the application of 100 lbs./A each of nitrogen, phosphorus, and potash. Each plant has an optimum nutrient range plus a minimum nutrient level. Below this nutrient level, plants begin to exhibit signs of deficiency such as yellowing, firing, or die-back.

Above the deficiency level, most plants have a range of element content tolerance which allows normal growth. Excessive uptake by plant roots, or unbalanced nutrients in the rootzone can cause toxicity.

In the application of plant nutrients we must attempt to avoid deficiency, assure and maintain adequate nutrition, and yet prevent toxicity. Foliar symptoms of six essential nutrient deficiencies in three cool season grasses are illustrated in Table 1.

Nutrient sources

Certain elements are essential to plant growth. Although each one is credited with specific functions, it is important to understand the intricate balance and interrelation of the entire plant growth process.

The major elements are:

Nitrogen (N) is the key element in the production of plant growth, especially turfgrass.

A proper balance and adequate suppply of other nutrients is important and is generally maintained, but the amount of nitrogen should be adjusted for the desired growth response. Variation in the available nitrogen determines the greenness of the leaves, ability to recover from damage or stress, and the quantity of clippings that grass produces.

In the application of plant nutrients we must attempt to avoid deficiency, assure and maintain adequate nutrition and yet prevent toxicity.

Nitrogen affects the grass color, root and shoot growth (density), resistance to disease, cold and heat, and tolerance to drought.

Nitrogen is a mobile element. When it is deficient the proteins of older leaves are converted to nitrogen and transported to the younger leaves. Older leaves become light green, then yellow, and finally, before necrosis (dying) a copper yellow.

When turfgrass tissue tests are made the new leaves are used to determine nutrient content. The most sensitive and accurate measure of available nitrogen in the plant is obtained by tissue test. For turf, the quantity of clippings is the second most accurate measure.

Changes in leaf color and density of turfgrass are less accurate indicators of nitrogen supply.

Phosphorus (P) has been labeled as the workhorse of the nutrition team.

It is taken into plants from a very dilute solution by ion exchange at the root surface. Phosphorus is present in every plant cell. It provides the plant with a mechanism for using and transforming energy. A phosphorus deficiency is reflected in new plant parts.

The phosphorus content in dry turfgrass ranges from .15 to .55 percent P, with 0.3 to 0.4 percent as an average. Adequate levels of phosphorus promote rooting and improved root branching.

Deficiency causes a reduction in tillering and moisture retention. Leaves become more narrow and have a tendency to curl. Leaves become darker green, with some purple pigment evident and they develop a decidedly wilted appearance.

Potassium (K) is used by the plant in relatively large quantities.

It is not a fixed constituent of living cells, but is essential to the growth and development processes. Potassium furthers the development (thickness) of cell walls, thus making the plant more resistant to heat, cold, and frost. It also increases wear tolerance in turfgrass and encourages rooting.

High potassium levels tend to reduce damage caused by dollar spot, fusarium blight, brown patch, and red thread diseases of turfgrass.

Potassium's role is that of a regulator of plant processes. It influences at least 46 enzymes, and controls the uptake of some nutrients. Low oxygen supply in the rootzone reduces the effectiveness of potassium because roots must have oxygen to utilize the elements.

Dry turfgrass tissue may have a range of 0.9 to 4.0 percent potassium, but 2-3 percent is normal. Potassium deficiencies are first indicated by drooping leaves, which feel soft to the touch.

Necrosis of the leaf tip is preceeded by a reduction in foliage density. The leaves develop green and yellow blotches. As potassium moves readily into the plant, deficiencies can be corrected in a relatively short period of time following application of fertilizer.

Secondary elements

Calcium (Ca) is a structural element that accumulates calcium pectate in the middle lamella of cell walls.

It regulates the balance of other cations. Calcium is necessary for cell division in apical meristems and in formation of flowers.

Adequate levels of calcium have been shown to improve the growth of root hairs. Calcium is fixed at high levels in leaf tissue and is immobile in plants.

Phosphorus is present in every plant cell. It provides the plant with a mechanism for using and transforming energy.

Sulfur (S)

There have been indications of disease reduction in plants due to an interaction of sulfur with phosphorus (Washington State study).

In sulfur deficient soils, applications of a nitrogen-sulfur ratio of 7 to 1 is recommended. Earlier, sulfur was obtained through industrial fall-out and as a component of many pesticides and some low grade fertilizers. Since these have been greatly reduced, the deficiencies are becoming increasingly evident.

As a consequence, applications of sulfur may be needed.

Micronutrients include seven elements known for their essential contribution to plant growth. Special tests help estimate the soil supply of micronutrients and determine if additions are needed.

Tissue tests are usually more accurate indicators of the available nutrient supply. If micronutrients are needed, either solid forms as mixed fertilizer or liquid as in dilute foliage sprays may be used at critical states of plant growth.

The soil's nutrient requirements may vary according to soil type, pH, organic matter content, moisture, or stress created by excesses of other nutrients.

A guide to the proper grass for popular sports

The Turformance Team

from Turf-Seed, Inc.

These varieties qualify for Turf Seed's Oregon Blue Tag program. Qualified turf organizations can earn cash for turf research.

If you're involved in the turf industry, you'll want

Turfin' USA

Starring your favorite varieties:

Perennial Ryegrasses
Citation
Citation II
Omega
Omega II
Birdie
Birdie II
Manhattan II
CBS
CBS II
2DF

Tall Fescues
Olympic
Apache
Triathalawn blend

Kentucky Bluegrasses
Columbia
Shasta
Midnight
Challenger
Galaxy blend

Fine Fescues
Shadow
Flyer
Fortress
Waldina
Aurora
Bighorn

Creeping Bentgrasses
Penncross
Penneagle

This twelve page guide is yours for the asking.

Order your copy today!

This booklet tells you what species and varieties of grass seed are used in sports turf mixtures and blends, plus many other facts for the sports enthusiast!

Call or write

Turf-Seed, Inc.®

P.O. Box 250, Hubbard, OR 97032
503/981-9571 TWX 510-590-0957

Circle No. 141 on Reader Inquiry Card