TECH CENTER

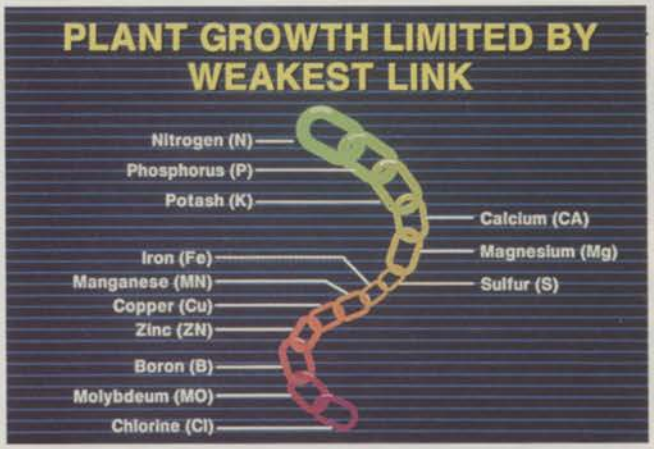
Micronutrients take their place in feeding programs

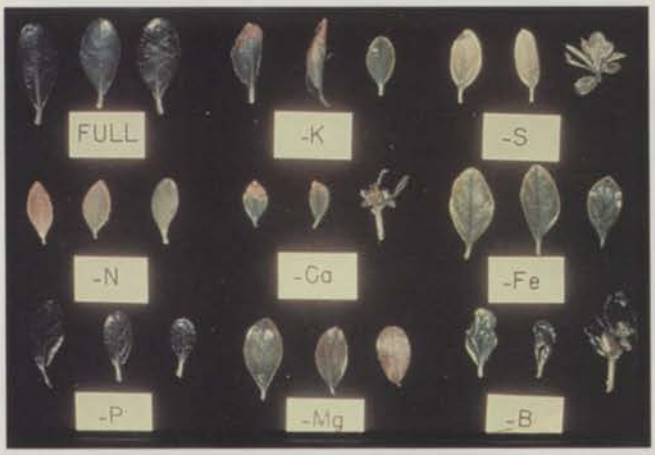
■ Proper feeding of turf and ornamentals is like forging strong links of a chain. To grow and remain healthy, plants need air, water and nutrients.

According to the "Western Fertilizer Handbook," researchers identify 16 elements required for plant growth and reproduction:

- **Carbon, hydrogen, oxygen** and **chlorine** are provided free by air and water.
- **Nitrogen, phosphorus** and **potash** are provided by traditional NPK fertilizer.
- **Calcium** can be provided by liming.
- **Sulfur** and **magnesium** (secondary nutrients); **iron, manganese, zinc, boron, molybdenum** and **copper** (micronutrients) are too often neglected by turf managers. Special micronutrient fertilizer applications are often necessary to provide these elements.

"Even though micronutrients are used by plants in very small amounts, they are just as essential for plant growth as the larger amounts of primary and secondary nutrients," says the Handbook.





The 'nutrition chain' (top) shows the interdependents of elements. Shown below are various deficiency symptoms.

Courtesy United Horticultural Supply

Like a chain, the strength is only as good as its weakest link. If a heavy application of nitrogen or phosphorus is made, it may disturb the balance or, at best, may give the fertility chain one strong link while leaving the other links wire-thin.

While major and secondary nutrients provide basic building blocks for cell reproduction, water transportation and root development, micronutrients allow the synthesis of chlorophyll and activation of enzymes in the growth process. They are essential for the plant to use nitrogen and synthesize proteins.

Iron—The most common micronutrient deficiency is a lack of iron, which often results in the decreased ability of turf to produce the chlorophyll that gives plants their green color. Iron can also enhance a plant's ability to tolerate drought, resist disease and develop a stronger root system.

Even though iron is found in substantial amounts in soils all across the U.S., it is often in a chemical form that makes it unavailable to the plant. Therefore, soil tests alone are inadequate to determine plant deficiency. An assay process which determines the iron in the plant itself is a better (but much more expensive and still not reliable) way to determine iron deficiency. Even this tissue analysis only measures the amount—not type—of iron in the plant.

Iron may be naturally unavailable to plants or the deficiency may be induced by high soil pH or presence of calcium carbonate (around new concrete, for example). Removing the top layer of soil in development can also remove the available iron from the plants' rootzone. Excessive amounts of other nutrients, including

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phosphorus, zinc, manganese and copper, can also limit the plants' ability to take up and use the iron.

Manganese—Likewise, the amount of manganese available to plants is not reflected in the amount of manganese available in the soil. Soil pH, cation exchange capacity, organic matter content, drainage, temperature, soil compaction and microbial activity all limit availability of manganese. Even fertilizer packages of iron with sulfur and nitrogen were found to induce manganese deficiency. They caused growth without necessary additional manganese to fuel such processes as hydrolysis, metabolism of organic acids and oxidation reduction that produced spindly, yellow plants.

Occasionally, too much manganese can be as bad as too little. In acid or poorly-drained soils, manganese becomes extremely available and blocks out the uptake of other vital nutrients.

Zinc—Zinc deficiency can be determined through soil and tissue tests. Muck soils and some western, Florida and Michigan soils are naturally deficient in zinc. High soil pH and removing topsoil can also cause zinc deficiency. Unbalanced applications of phosphorus can intensify zinc deficiencies. Uptake of zinc can be more limited when soils are cold and wet during the early part of the growing season.

Others—Other micronutrient deficiencies are less spectacular in their symptoms and are not as often corrected.

Symptoms of boron deficiency can be confused with other deficiencies and can be more difficult to correct. Researchers have documented boron scarcity in most of the East and Midwest and in some parts of the Northwest. This lack often shows up as reduced plant quality rather than lack of growth.

Organic and very sandy soils are most likely to have copper deficiencies. Problems are fairly localized and can often be diagnosed by soil tests.

Only a small amount of molybdenum is needed for nitrogen fixation and nitrate reduction in plants. Availability may be limited primarily in acid soils; therefore, pH can be a good indicator of a potential problem. Tissue analysis can also diagnose a scarcity. Although turfgrass scientists recognize the element's importance, little else is known about its effects.

Recent research indicates very few cases where overapplication of micronutrients can pose a problem. Balance is most important. Look for a micronutrient package that contains not only iron and manganese, but also magnesium and—depending on soil tests—zinc, copper, boron and molybdenum.

SYMPTOMS OF SOME NUTRIENT DEFICIENCIES

Nutrient	Symptom
IRON	Yellowing of the interveinal area of young leaves. On turf, the chlorosis is not uniform, but often appears in irregular patches.
MANGANESE	First signalled by interveinal chlorosis. As deficiency becomes more severe, leaves get brown spots and developing leaves often drop off.
ZINC	Interveinal chlorotic striping, a thin purple margin around leaf edge. For ornamentals, narrowed or reduced leaf size and internodal spacing, giving the plant a "witch's broom" appearance.
COPPER	Can cause newer leaves to die before unrolling. Older leaves may appear limp or turn gray.

Treating soils for dangerous contamination

Pesticide spills, battery acid, oil and gasoline leaks can be cleaned up with specially-treated rocks.

by James E. Guyette
Contributing Editor

■ A new technology may allow landscape managers, golf course superintendents and institutional groundskeepers to treat lead-contaminated soils more cost-effectively.

The discovery involves covering the affected soil with finely ground phosphate rocks. Research indicates that the phosphate rocks reduce the amount of water-soluble lead in contaminated soil by 57 percent to 100 percent.

For the landscape industry, this could drastically reduce the costs faced by business managers being forced to purify soils tainted by pesticide spills or previous power equipment maintenance activities that resulted in petroleum products soaking into the ground or leaking gasoline storage tanks. The process also will work on battery acid leaks.

In addition to cleaning their own company headquarters' yards, landscape managers may also find economic opportunities in helping other business owners clean polluted grounds.

"A combination of leaded paint and gasoline has caused soils in some urban areas to be very high in lead," explains Dr. Terry Logan, professor of natural resources and director of the Environmental Science Graduate Program at Ohio State University. The U.S. Environmental Protection Agency and the University of Florida are also participating in the project.

"We envision using our treatment and then covering the surface with a couple inches of clean soil and then planting vegetation," Logan predicts.

Combats heavy metals—The technology, which has been patented by OSU

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and the EPA, can also be used to treat soil contaminated by other heavy metals, such as zinc, aluminum, cadmium and possibly uranium. Lead is viewed as the primary health risk because it is especially harmful to young children.

With the process, lead-contaminated soil is covered with ground phosphate rocks on a ratio of two parts phosphate to one part lead. (To be most effective, the lead content has to be measured ahead of time.) In most cases, the phosphate can be applied to the surface just like fertilizer.

One application is likely to do the job, according to Logan, unless the soil has an extremely high concentration of lead.

For alkaline soils, like those found in the West, an application of liquid phosphate, such as the type found at landscape supply centers, may be the best technique, says Logan.

Using phosphate rocks to treat lead-contaminated soil is different from conventional technologies because it focuses on managing the lead where it is. Other treatments seek to remove the lead from the soil, which can rob it of important nutrients, Logan points out.

The technology could drastically reduce the costs faced by business managers who are being forced to purify soils.

"We took a different approach and focused on managing the lead where it is, which is much more cost-effective and eliminates the need to store the contaminated soil in a landfill or to incinerate it," Logan explains.

"Using this technology will cost hundreds of dollars to treat an acre of contaminated soil compared to thousands or tens of thousands of dollars to treat with any other technology," he reports.

The project began five years ago, and now trials are on tap for urban and rural sites, according to Logan. "Since phosphorous is a fertilizer, we were concerned that crops growing in the soil would take out the phosphorous, and the lead would be soluble and able to move into the groundwater and be absorbed by the crops," he recalls. "But as long as there is an excess of phosphorous, that shouldn't be a problem," Logan adds.

"Another important thing we found was that it worked regardless of what the source of the lead was, including soluble forms of lead, mineral forms, or even leaky batteries."

Phosphate is abundant and easy to mine. "The key to this technology is that it doesn't use another synthetic, man-made chemical," Logan says. "It uses a natural product that we know and understand well to treat a very serious problem in a cost-effective manner."

These herbaceous plants are best for shady spots

■ Much of the gardening world hungers for the cooling pleasures of shade trees in their landscape. The rest of the world regrets they cannot plant many of the sun-loving plants which will not thrive in their shady landscapes.

Here are a few favorite plants for various levels of shade.

Ajuga

- A spreading member of the mint family; can be showy when bright blue flowers appear;
- has many uses as a background groundcover.

Astilbe

- Feathery flower spikes rise above the dark green dissected foliage. Astilbes give an airy look to garden borders. If flowers are deadheaded, the blooming period will be lengthened.

Begonia

- These plants range from the widely popular wax begonia bedding plant to an exotic range of fancy hybrid tuberous begonias.

Climbing hydrangea

- A wonderful climbing vine for along garden walls. This vine with glossy green foliage and fine, fragrant blooms takes years to develop, but it's well worth the wait.

Coleus

- This edging and window-box plant has a wild range of foliar colors and patters, which seem almost incongruous with its preference for shade;
- blue flowers are not a key characteristic.

Columbine

- Airy blossoms which come in many colors have attractive spurs as a feature;
- excellent for naturalized areas;
- may bring the columbine leaf miner insect.

Daylilly

- More and more varieties are available each year;
- will bush out if they are cut back somewhat at transplanting. New Guinea impatiens can tolerate less shade than the standard impatiens varieties.

Lily of the Valley

- Very aromatic, white bell-like flowers;
- multiply and spread over large areas quickly.

Lilyturf (Liriope)

- Grasslike leaves make this an excellent border plant or groundcover for small areas.

Primrose

- Easy spring flowers provide the promise of summer warmth with heady aroma ;
- will bloom in chilly spring temperatures.

Vinca minor

- Also known as creeping myrtle;
- a standby groundcover with lavender flowers;
- remains evenly green throughout the year.

Violet

- An attractive range of plants with mostly heart-shaped leaves;
- attractive in clumps, but can be cultivated to serve as a groundcover.

—Source: Jim Chatfield, writing in the Northeast Ohio Forum *of the Professional Grounds Management Society.*

Plants best adapted for specific conditions

Fern leaf yarrow, *Achilea Flipendulina*

Light pink, *Dianthus Plumarus*

Spoonleaf yucca, *Yucca Filamentosa*

■ Though it's now too late to do anything about plants lost to drought this summer, it's not too late to start planning for the 1996 growing season.

According to various growers and marketers, bermudagrass and buffalograss has excellent drought tolerance in warm-season locales. Among the cool-season grasses, perennial ryegrass and tall fescue both offer very good drought tolerance.

Dr. Balakrishna Rao of the Davey Tree Company also suggests some trees and shrubs that can be planted in droughty sites without as much danger of damage than normal plants (see accompanying chart).

"Remember, though, that these plants can survive if the dry conditions are not very severe," Dr. Rao observes. "Proper mulching and fertilizing will also help during drought conditions."

Good drought tolerance:

TURFGRASS

bahiagrass	*(Paspalum notatum)*
bermudagrass	*(Cynodon sp.)*
buffalograss	*(Buchloe dactyloides)*
perennial ryegrass	*(Lolium perenne)*
tall fescue	*(Festuca arundinacea)*
zoysiagrass	*(Zoysia japonica)*

TREES

black locust	*(Robinia pseudoacacia)*
amur maple	*(Acer ginnala)*
black oak	*(Quercus velutina)*
bur oak	*(Quercus macrocarpa)*
hardy rubber tree	*(Eucommia ulmoides)*
Scotch pine	*(Pinus sylvestris)*
Eastern white pine	*(Pinus strobus)*
bristlecone pine	*(Pinus aristata)*
hedge maple	*(Acer campestre)*
tatarian maple	*(Acer tataricum)*
Japanese pagoda tree	*(Sophora japonica)*
Austrian pine	*(Pinus nigra)*
Kentucky coffeetree	*(Cymnocladus dioicus)*
goldenrain tree	*(Koelreuteria paniculata)*
amur corktree	*(Phellodendron amurense)*
callery pear	*(Pyrus calleryana)*

SHRUBS

flowering quince	*(Chaenomeles sp.)*
purple smokebush	*(Cotinus coggygria 'Royal Purple')*
cotoneaster	*(Cotoneaster sp.)*
Northern bayberry	*(Myrica pennsylvanica)*
mugo pine	*(Pinus mugo var. mugo)*
fragrant sumac	*(Rhus aromatic 'Gro-Low')*
spirea	*(Spirea sp.)*
barberry	*(Berberis sp.)*
meserve blue holly	*(Ilex x meserveae 'Blue Prince' & 'Blue Princess')*
meserve holly	*(Ilex x meserveae 'China Boy' & 'China Girl')*
sweet mockorange	*(Philadelphus coronarius)*
prostrate juniper	*(Juniperus horizontalis)*

PERENNIALS

tulip, most species	*(Tulipa sp.)*
crocus	*(Crocus sp.)*
lavender	*(Lavandula officinalis)*
Basket of Gold	*(Aurinia saxatilis)*
lilyturf	*(Liriope muscari & L. spicata)*
Some Pinks	*(Dianthus sp.)*
thyme	*(Thymus vulgaris, T. x citriodorus)*
seathrift pink	*(Armeria sp.)*
gasplant	*(Dictamnus albus)*
hardy sage	*(Salvia officinalis and cultivars)*
wall flower	*(Cheiranthus cheiri)*
yarrow	*(Achillea filipendulina)*
artemisia—wormwood	*(Artemisia sp.)*
coreopsis	*(Coreopsis sp.)*
sedum	*(Sedum spectabile)*
stachys	*(Stachys sp.)*
yucca 'Bright Edge', 'Gold Sword,' 'Adams Needle'	*(Yucca filamentosa sp.)*
gaillardia 'Goblin'	*(Gaillardia aristata)*

Ground covers beat weeds, prevent soil erosion

■ Ground covers tend to be lower-growing, usually evergreen plants used in place of grass, mulching materials or stone, to beautify areas inhospitable to turf. As a living mulch, they prevent mechanical damage to trees and shrubs.

Ground covers can be used under trees where low branches prevent mowing, or to hide exposed tree roots.

Periwinkle, *Vinca Minor*

Ground covers can trail close to the ground or grow as high as three feet tall. The Garden Council reports a wide variety of ground covers which prevent weed growth and soil erosion while decorating large garden areas.

The best ground covers are free of insect and disease problems; semi-evergreen to fully evergreen; widely adaptable; easily propogated, and vigorous.

Of course, the most commonly used ground cover is grass, but there are many others which come complete with flowers, berries, textures and colors.

Some ground covers flourish in shady areas, rocky slopes or hot, arid spots. When they're done blooming, they decompose to provide a permanent mulch which encourages further growth.

How to choose—The choice of ground cover depends on a variety of site-related factors:

- the design characteristics you seek, such as color, texture, form, shape, size, growth habit and rate of growth;
- the site—sun or shade, wet or dry, acid or alkaline, salt exposure and wind flow;
- how will they function in the landscape—as a transition zone or as area of visual interest;
- the hardiness and adaptability of the plant to the area;
- maintenance needs of the plant and the ability to care for it as needed;
- availability.

Sources: Russell Balge, Free State Nursery News; *The Garden Council*

Ground covers for shade

winter creeper *(Euonymus fortunei & cvs.)*
English ivy *(Hedera helix & cvs.)*
creeping lily turf *(Liriope spicata)*
periwinkle *(Vinca minor)*

Ground covers for sun

winter creeper *(Euonymus fortunei & cvs.)*
edging candytuft *(Iberis sempervirens)*
three-toothed cinquefoil *(Potentilla tridentata)*

Ground covers for acid soils

European wild ginger *(Asarum europaeum)*
heather *(Calluna spp.)*
lily-of-the-valley *(Convallaria majalis)*
barrenwort *(Epimedium spp.)*
wintercreeper *(Euonyumus fortunei cvs.)*
sweet woodruff *(Galium odoratum)*
wintergreen *(Gaultheria procumbuens)*
English livy *(Hedera helix)*
hosta *(Hosta spp. & cvs.)*
edging candytuft *(Iberis sempervirens)*
partridgeberry *(Mitchella repens)*
Japanese spurge *(Pachysandra terminalis)*
canby pachistima *(Paxistima canbyi)*

Ground covers for moist soils

bugleweed *(Ajuga spp. & cvs.)*
European wild ginger *(Asarum canadense)*
heather *(Calluna vulgaris)*

Advantages of ground covers

- can be used on steep slopes or rocky areas where mowing is not possible
- usually do not require much maintenance
- will function as living mulch
- assist and enhance soil structure by virtue of their greater root penetration that turf grasses; this improves soil aeration and water percolation;
- they may enrich the soil by adding organic matter to the soil;
- generally more resistant to insects and diseases.

Disadvantages

- must usually be transplanted from vegetative starts;
- can not usually be weeded with selective herbicides; the exception is the elimination of grassy weeds in broadleaved ground covers with Fusilade (*fluazifop-P-butyl*) or Poast (*sethoxydim*);
- usually more susceptible to damage by pedestrians;
- the tender varieties are sometimes killed by harsh winters;
- they can sometimes be smothered by leaves;
- they may have to be treated for a wider range of insects and diseases than lawns;
- until well established, they may be difficult to keep free of weeds for 2-4 years.