January 1989

LAWN INSTITUTE

Harvests

Volume 35 Number 4

THE HARVEST MIX

Take this pop quiz:

Q - What are the most prevalent turf insect and disease pests ?

Q - What are the seeded cultivars recommended by the Variety Review Board for 1989 ?

Q - What new books are out about lawns ?

Q - What is the newest state turf survey?

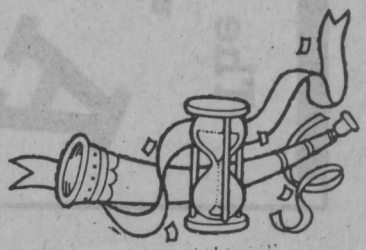
Q - When is National Garden Week ?

Q - Why shouldn't you bag your grass clippings ?

Q - What is the latest in turf research ?

These and other questions are answered in this issue of Harvests.

HAPPY NEW YEAR



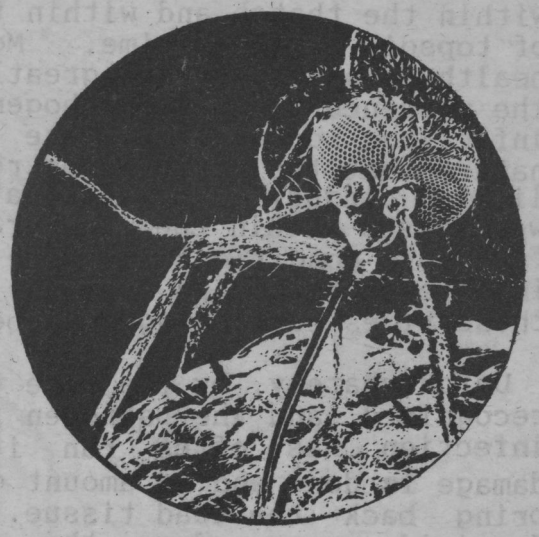
THE LAWNSCAPE — AN ECOLOGICAL WONDER

Part III — Disease and Insect Pests

by

Eliot C Roberts
Director

The Lawn Institute
Pleasant Hill, Tennessee



The sounds of frogs and insect life in wetlands calls our attention to the ecology of these places. Biologically lawns are rather quiet, but even so, they are composed of plant and animal life that is teeming with activity.

A lawn cut at a two inch height is a very small "forest", but within this vegetative canopy are fascinating organisms that influence one another's life style and respond dramatically to changes in the environment.

Wetlands may be located some distance from us, but chances are good that you walk on a lawn most every day. Isn't it time to become more familiar with those organisms that contribute so much to the enjoyment of lawns and sports turf ?

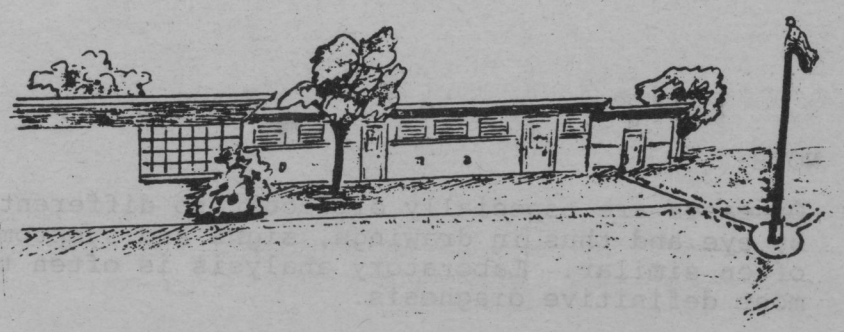
Six groups of plants and animals live on or within the soil to a six inch depth and within the two inch lawn foliar canopy. These are:

- turfgrasses;
- weedy plants;
- organisms that cause turfgrass diseases;
- insects that feed on turfgrasses;
- soil microorganisms - generally beneficial to turfgrass;
- and soil macroorganisms - generally not harmful to turfgrasses.

Then there is "bigfoot" - those of us that walk and play on the lawn. At times we do more harm to the turf by compacting the soil and scuffing the grasses than is caused by all the diseases and insects combined.

Have you noticed that sometimes lawn quality will vary from very good to very poor within a short distance ? Poorly maintained lawns may look awful. On the other hand, some of the best lawns I've seen were just left alone most of the time. Other lawns respond well to tender loving care, and yet, still others are over-maintained to the extent that they are less hardy and persistent and may even die. Why is this ?

It's all related to the ecology of the lawn, that branch of science that is concerned with relations between plants and animals and their environment. Lawns and sports turf provide good examples of ecological principles and the understanding of these can help make you a lawn expert. This is not only good for improving environmental quality of your neighborhood, it is also likely that you can make your school grounds more attractive and your sports fields safer for play.



Disease and Insect Pests continued

Organisms That Cause Turf Diseases

Most diseases of turfgrass are caused by fungi. There are some bacteria and viruses that also incite disease. By in large, they live within the turfgrass foliar canopy, within the thatch and within the upper levels of topsoil all the time. Most of the time healthy grasses are not greatly affected by the presence of these pathogens. Often when infections occur they are of such minor nature that the lawngrasses recover with only limited injury. However, at other times, weaknesses within the lawngrasses and highly favorable conditions for the pathogen result in disease outbreaks of major proportion. At these times turf damage may be severe.

Unfortunately, by the time the disease is recognized and the pathogen identified, the infection has often run its course, the damage is done and no amount of fungicide can bring back the dead tissue. At best, the fungicide may reduce the spread of the disease.

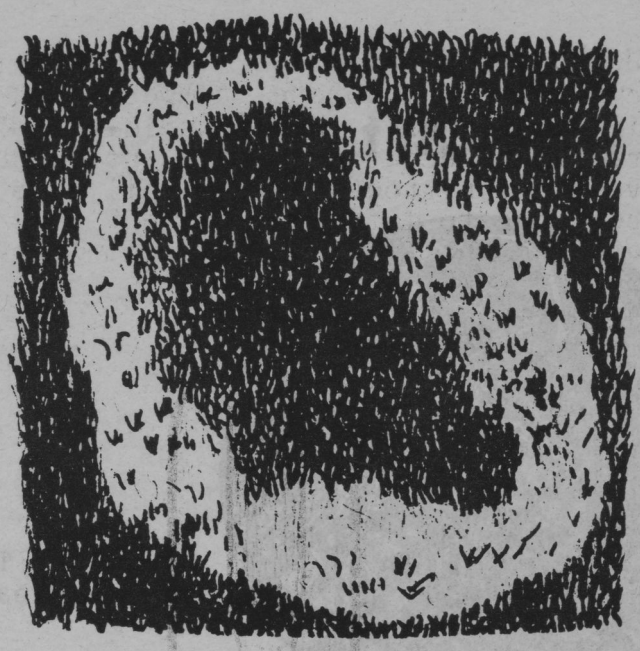
Any condition that weakens the vigor of lawngrasses predisposes them to disease. It may be:

- too much water;
- too little water;
- too much fertilizer;
- too little fertilizer;
- too acid a soil;
- too low a clipping height;
- too much thatch;
- hard compacted soil- poor aeration;
- use of too much pesticide;
- a combination of two or more of these.

The most common lawn pathogens are described briefly as follows to provide an indication of how they function within the ecological structure of the lawn.

NOTE:

Diseases are especially difficult to differentiate by eye and thus in drawings, signs and symptoms are often similar. Laboratory analysis is often the most definitive diagnosis.



Brown Patch - [Rhizoctonia solani Kuhn]

Brown patch disease develops on turf during warm wet weather. High nitrogen fertilizer predisposes the grass to disease as does excessive irrigation. Lawn areas with poor air circulation have prolonged periods of high humidity. These are especially prone to brown patch. Grass leaves turn light brown in circular patches up to 3 feet in diameter. A black ring of spores is often seen around the outter edge of the circular patches.

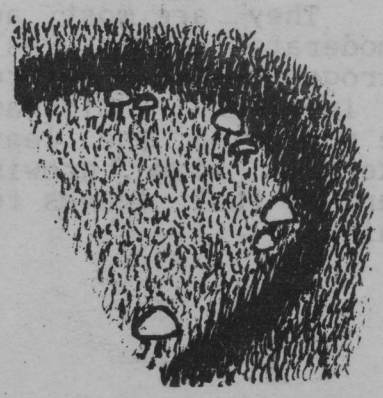
Disease and Insect Pests continued

Dollar Spot - [Sclerotinia homoeocarpa F T Bennett]

Dollar spot infection is more likely to occur during moderate temperatures and dry soil conditions. High humidity within the turf is needed to activate the fungus. Low levels of nitrogen in the soil make grasses more prone to infection. Light tan lesions that band the leaf create small patches of bleached turf - less than 3 inches in diameter.

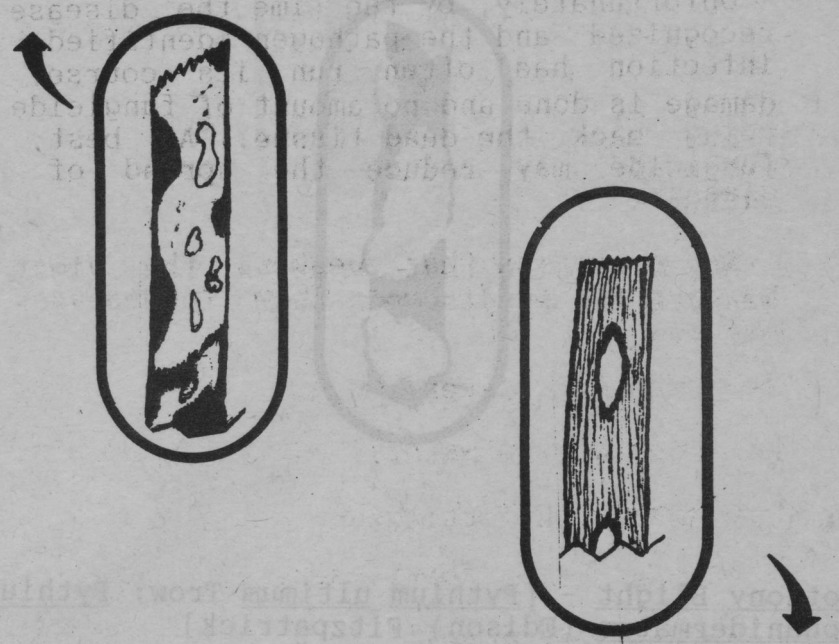
Fairy Ring - [Agaricus; Collybia; Hygrophrous; Lepiota; Lycoperdon; Marasmius; Psalliota; Scleroderma; Tricholoma]

A number of fungus organisms that develop toad stools create the characteristic fairy ring. These fungi live on dead and decaying roots in the soil. Often these are old tree roots left at the time of lawn construction. These fungi do not infect lawngrasses but they build up such quantities of mycelium in the soil that they crowd and choke out the grass. The mycelium is hard to wet [hydrophobic] and a zone of dead grass often is noted just inside the advancing ring of fungus. As the ring spreads outward, the inner portion of mycelium will die and rot away releasing nitrogen. This will stimulate regrowth of lawngrasses on the inner side of the ring with characteristic dark green leaves.



Fusarium Blight - [Fusarium roseum (LK) Snyd and Hans; Fusarium tricinctum (Cda) Snyd and Hans]

Fusarium blight occurs during moderate temperatures of summer whenever the grass is placed under stress. This might be too much water or too little water; too much nitrogen or too little nitrogen. It is often most damaging where the lawn has formed thatch above the soil surface. This fungus infects grasses already weakened and causes the development of tan blotches starting at the leaf tip. These develop into circular patches with some living grass left in the center. The patches are often up to 2 feet in diameter and have a "frog-eye" appearance [dark center and lighter edges.]



Helminthosporium:

Netblotch -[Helminthosporium dictyoides drechsl];
Leafblotch - [Helminthosporium cynodontis Margi];
Leafspot - [Helminthosporium sorokinianum Sacc];
Melting Out - [Helminthosporium vagans Drechsl]

There are several blotch and spot diseases caused by one or more Helminthosporium fungi. Infection usually starts in cool, moist weather on lawns that are fertilized with too much nitrogen, irrigated too frequently, and cut at lower than recommended heights. As the weather gets warmer, root rots may develop and the turf thins out drastically. Usually some resistant plants survive but lawn weeds become easily established during periods of Helminthosporium infection.

Disease and Insect Pests continued

Powdery Mildew - [Eyrsiphe graminis D C]

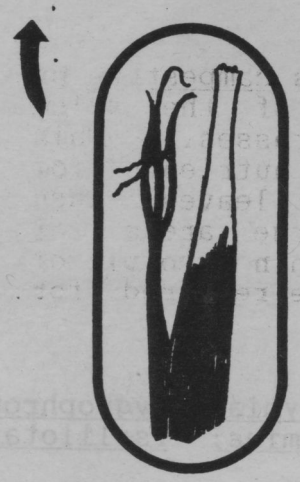
Powdery mildew is caused by a fungus that often is most active in cool humid shady locations. High nitrogen fertilization predisposes the grasses to this disease. It is a weak pathogen and causes most damage on grasses that are already weakened because of a lack of tolerance to shade. Fine white to grayish cobweb-like mycelial growth coats the grass leaves and this is recognized as mildew.

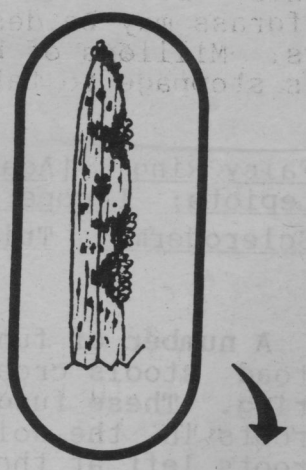
Cottony Blight - [Pythium ultimum Trow; Pythium aphanidermatum (Edison) Fitzpatrick].

The Pythium fungus is active during hot humid weather and often attacks turf that is thatched and already weakened from this condition. Leaves appear water-soaked and small irregular spots or streaks of light-brown grass develop.

Red Thread - [Corticium fuciforme (Berk) Wakef]

The fungus that causes red thread develops pink to red mycelium that can be seen early in the morning on grass leaves wet with dew. It is most active during periods of moderate temperature and high humidity. Turf that is nitrogen deficient is often predisposed to infection. Water-soaked lesions on the leaves develop into irregular patches up to 2 feet in diameter.





Rusts - [Puccinia spp]:

Leaf Rust - [Puccinia brachypodii Otth];
Stem Rust - [Puccinia graminis Pers];
Stripe Rust - [Puccinia striiformis West (39)];
Crown Rust - [Puccinia coronata Cdo].

Several rust causing fungi infect lawngrasses. They are most active during periods of moderate temperatures and moisture levels. Nitrogen deficiency predisposes the grass to infection. Elongated reddish pustules are noted on the leaves or stems. These weaken a slow growing nitrogen deficient turf so that leaves turn brown and the cover thins.

Disease and Insect Pests continued

Slime Mold -[Physaricum cinereum (Batsch) Pers]

Slime mold is likely to develop under conditions of moderate temperatures and plentiful moisture. Ugly white to grayish slimy irregularly shaped masses develop on leaves. These do little harm to the leaves other than coat them and reduce photsynthetic activity. Actually, the slime masses can be washed off with water from a garden hose.

Bacterial Wilt

Certain bacteria [Xanthomonas campestris pv graminis] cause a plugging of the xylem conducting tissue of turfgrasses. This prevents the transportation of nutrients from the roots to the crown and leaves. When plants become infected, large areas of turfgrass may be destroyed within a couple of days. Millions of bacteria are required for this stoppage to take place.

Smut:

Flag - [Urocystis agropyri (Preuss) Schrot];
Stripe - [Ustilago striiformis (West) Niessl]

Smuts usually develop when soils are dry, turf is thatched and weather conditions are moderate. Long narrow gray to black steaks develop lengthwise on leaves. This causes a curling of the leaf and often a splitting or shreading of the tissue. Turf turns brown and thins out as the infection spreads.

Gray Snow Mold -
[Typhula itoana Imai;
Typhula idahoenis Remsberg;
Typhula ishikariensis Imai]

Gray snow mold occurs during cold humid conditions, especially under snow cover. Where snow is packed close to the ground under foot traffic, skiis or other winter sports apparatus, the fungus is activated and infects dormant or nearly dormant lawngrasses. Light gray mycelium can be noted on leaves and whitish-gray circular patches develop up to 2 feet in diameter. Snow mold injury to the grass can be severe.

Saint Augustine Decline Virus
- SAD Virus

This virus infects St Augustinegrass grown under low levels of soil fertility. Moisture stress and other culturally induced stress, such as improper clipping, make the turf more prone to infection. A chlorotic mottling is noted at first on leaf blades. Then stolons develop with shortened internodes. Finally, the turf thins and is completely killed out over a 3 to 4 year period.

Other Diseases

Several other diseases of lawns and sports turf are common across the country. Among those most troublesome are the following:

- Anthracnose - [Colletotrichum graminicola Ces Wils];
- Copper Spot - [Gloecoercospora sorghi Bain and Edgerton];
- Ophiobolus patch - [Ophiobolus graminis Sacc].

Disease and Insect Pests continued

Insects That Feed On Turfgrasses

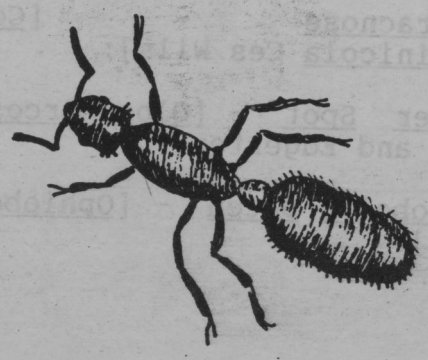
Lawn insects live out their often complex life cycles within the vicinity of the lawn. At some stage in their development they feed on grass plants and during these periods may cause damage. This depends on how many insects are present. There are always some within the turf canopy, within the thatch and within the root zone. It is not possible to completely irradicate turf damaging insects from the lawn. Thus, it's a matter of keeping populations in balance with other organisms that are not harmful or at least less harmful.

Normally natural systems work well and what little insect damage that does occur is quickly repaired by healthy, vigorous grass plants. Grasses that produce new leaves, stems and roots with ease can afford to lose some to feeding insects. But, when populations of insects build to proportions that result in such extensive injury that plants cannot continue growth, then control measures must be implemented.

The most common lawn insects are described briefly as follows to provide an indication of relationships between them and lawn ecology.

Ants - [Formicidae family]

Ants are social nest-building insects. They do not directly feed on lawngrasses, but they do form mounds that may smother the turf or form tunnels that dry out root zones and otherwise disrupt the uniformity of the turf.

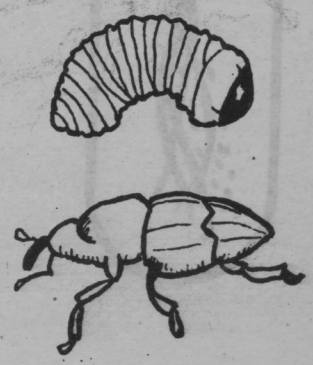


Armyworm - [Noctuidae family]

Armyworm larvae feed on the shoots of lawngrasses. They are nocturnal feeders that produce somewhat circular patches of defoliated turf. Moths fly at night and are attracted to light. Females begin depositing eggs on grass in May. Upon hatching, larvae start to feed. They migrate from place to place as a group. Unless it is cloudy, larvae hide in thatch during the day. Most armyworms migrate north from the south and may have two or three generations of young a year.

Bill Bugs - [Calendrinae subfamily]

Bill bug larvae burrow into stems where there is moisture. They feed on roots, rhizomes and shoots by puncturing the tissue. As stems and crowns die, irregular brown patches form. They belong to the weevil family. As adults, they may feed on stems and leaf blades but cause only minor damage. In late May, females deposit their eggs in the stem area just above the crown. Newly hatched larvae appear in late May and June feeding inside the stem where they hatch.



Chafer - [Chrysomeloidea super family]

Larvae feed on roots and rhizomes in midsummer. As roots are destroyed and lawngrasses are unable to generate new roots, the turf dies out in irregular brown patches.

Chinch Bugs - [Blissus spp]

Chinch bugs suck juices from lawngrasses, thus weakening them so a to form large irregular yellowish to brown patches. Nymphs are similar in shape to adults but much smaller in size. They emerge in May and June and go through 5 stages in some 30 days. A second generation develops in September. As chinch bugs feed, they inject a salivary fluid into the grass plant that disrupts water conduction causing wilt and eventual death.

June Beetle - [Phyllophaga spp]

Larvae of these beetles feed on roots and rhizomes during the summer time. Without roots, lawngrasses soon die out in irregular shaped brown patches. The June beetle grub is larger than other root feeding grubs and has the characteristic "C" shape of all white grubs. There may be as many as two generations of grubs a year or as few as one every three years.

Japanese Beetle - [Popillia japonica Newm]

Larvae of these beetles feed on roots and rhizomes during the summer time. Grasses that cannot regrow roots soon die in irregular brown patches.

Mole Cricket - [Gryllotalpidae spp]

Mole crickets are active nocturnally during warm humid weather. They feed on roots and rhizomes and their burrowing uproots seedling grasses. As roots are consumed, grasses die out. These warm season insects are migrating from southern sections of the Gulf Coast states into more northern regions of these states.

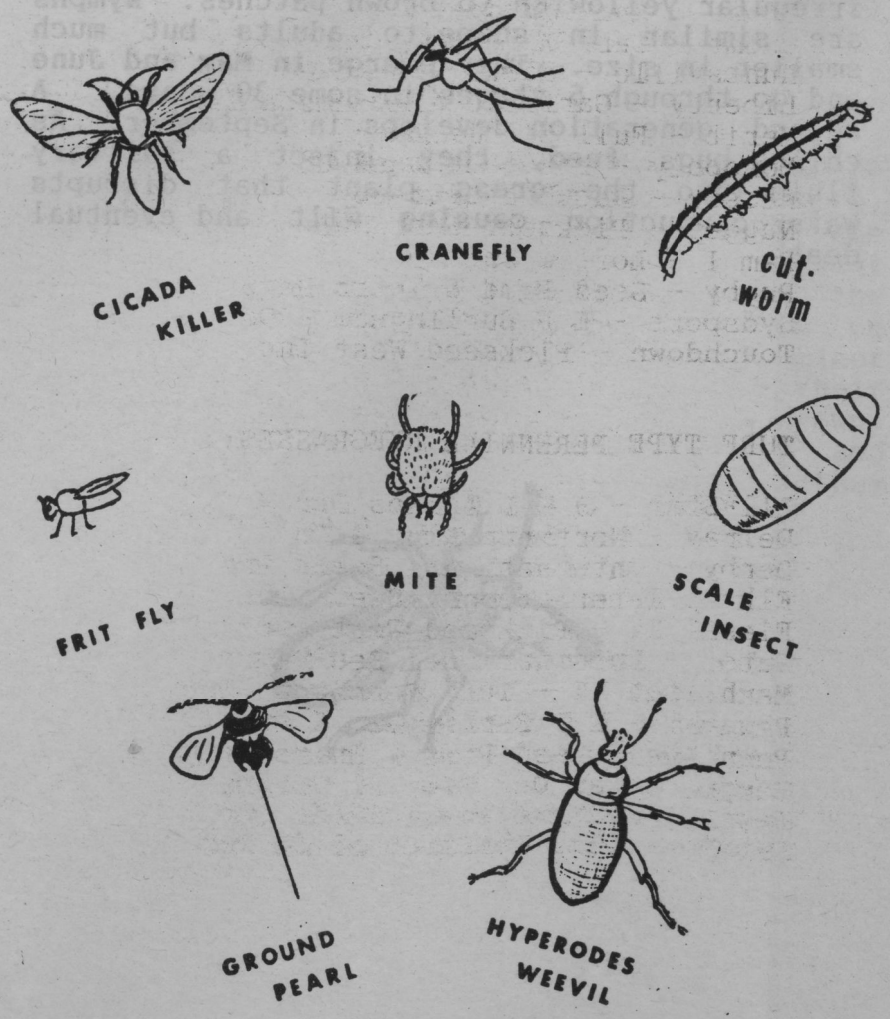
Sod Web Worms - [Crambinae subfamily]

Larvae of these insects feed nocturnally on shoots. These are consumed down to the soil and large irregularly shaped brown patches develop. Sod webworms are the larvae of a buff colored lawn moth. They construct silk-lined burrows through the thatch layer and on down into the soil. The moths hide in the grass during the day and usually fly at dusk in zigzag patterns close to the lawn surface. The females randomly drop eggs during these flights.

Other Insects

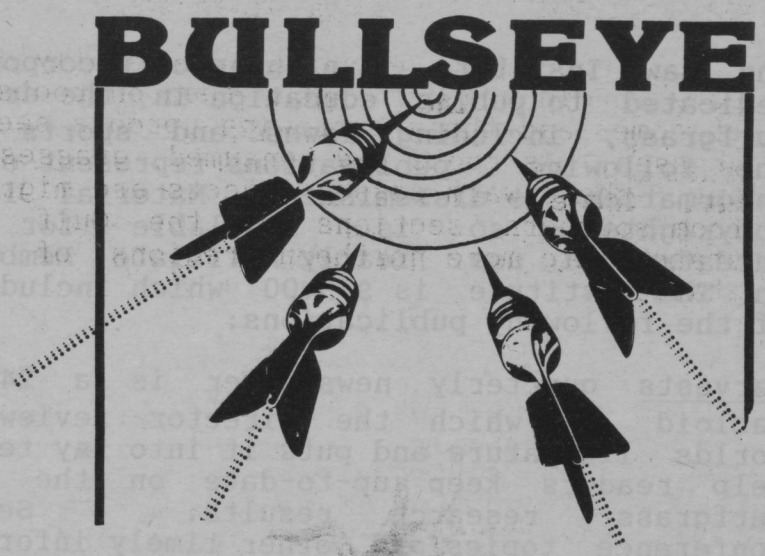
Several other insect pests are common across the country. Among the most interesting are:

- Cicada Killer - [Sphecius speciosus Drury];
- Crane Fly - [Tipulidae family];
- Cutworms - [Noctuidae family];
- Frit Fly - [Oscinella frit L];
- Leafhopper - [Cicadellidae family];
- Mites - [Acarina order];
- Scale Insects - [Coccidea super family];
- Ground Pearls - [Margarodes spp];
- Weevils - [Hyperodes spp];
- Wireworms - [Elateridae family];



Turfgrass Cultivars That Are

Right On Target



The following cultivars have been recognized by the Lawn Institute's Variety Review Board as top cultivars for cool, humid lawns and turf and for overseeding in southern, humid regions. Marketing areas differ so some of the following names may be found in your areas, and some will be found in other regions.

KENTUCKY BLUEGRASSES:

A-34 Bensun - Warren's Turf Professional
Adelphi - J & L Adikes Inc
America - Pickseed West Inc
Arboretum - Mangelsdorf Seed Co
Baron - Loft's Inc
Classic - Peterson Seed Co
Eclipse - Turf Cultivars Asso
Estate - Agway/Roberts Seeds
Freedom - Jacklin Seed Co
Fylking - Jacklin Seed Co
Glade - Jacklin Seed Co
Gnome - Turf Merchants Inc
Huntsville - Jacklin Seed Co
Liberty - Garfield Williamson Inc
Merit - Full Circle Inc
Monopoly - Peterson Seed Co
Nassau - Jacklin Seed Co
Nugget - Pickseed West Inc
Ram I - Loft's Inc
Rugby - Seed Prod & Intro Corp
Sydsport - E F Burlingham & Co
Touchdown - Pickseed West Inc

TURF TYPE PERENNIAL RYEGRASSES:

All*Star - J & L Adikes Inc
Delray - Northrup King & Co
Derby - International Seeds Inc
Elka - International Seeds Inc
Fiesta II - Pickseed West Inc
Gator - International Seeds Inc
Manhattan II - Turf Merchants Inc
Pennant - E F Burlingham & Sons
Pennfine - Seed Prod & Intro Corp
Ranger - Van Der Have of Oregon
Regal - International Seeds Inc
SR4000 - Seed Research of OR Inc

COLONIAL BENTGRASS

Exeter - Pickseed West, Inc

FINE FESCUES:

Banner - Chewings type - E F Burlingham & Sons
Jamestown - Chewings type - Loft's Inc
Koket - Chewings type - E F Burlingham & Sons
Reliant - hard fescue - Loft's Inc
SR3000 - hard fescue - Seed Research of OR Inc

TURF TYPE TALL FESCUES:

Arid - Jacklin Seed Co
Falcon - E F Burlingham & Sons
Galway - Northrup King & Co
Houndog - International Seeds Inc
Mustang - Pickseed West Inc
Rebel II - Loft's Inc
Titan - Seed Research of OR

SPECIALTY GRASSES:

Fults - alkaligrass - Northrup King & Co
Sabre - Poa trivialis - International Seeds Inc
Reubens - Canada bluegrass - Jacklin Seed Co
Prominent - creeping bentgrass - Seed Research of OR

Lawn Institute Publications

The Lawn Institute is a nonprofit corporation dedicated to public education in the area of turfgrass, including lawns and sports turf. The following publications represent one way information is disseminated. Material is not copyrighted so is available for your unrestricted use. Yearly Affiliate Membership in The Institute is $75.00 which includes all of the following publications:

Harvests quarterly newsletter is a 24 page tabloid in which the Director reviews the worlds literature and puts it into lay terms to help readers keep up-to-date on the latest turfgrass research results. Selected conference topics and other timely information are included. Released to members, communicators and subscribers. [Member benefit. Subscription rate for non-members: $10.00 US Funds for USA & Canada; $25.00 US Funds for overseas.]

LAWN INSTITUTE
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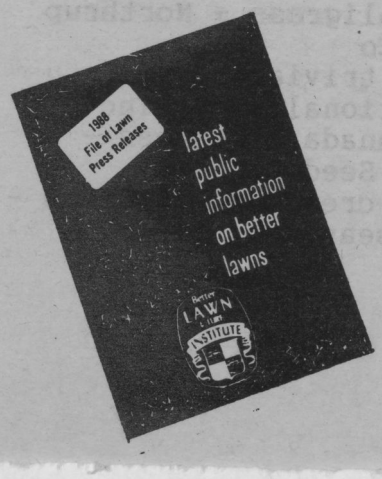
Volume 35 Number 3
THE HARVEST MIX

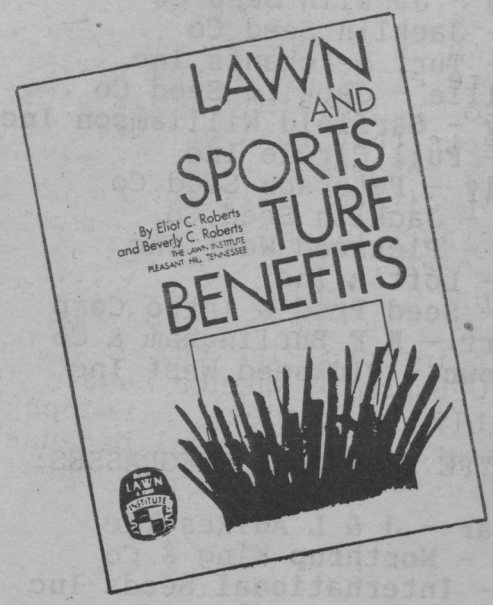
Press Kits are issued quarterly to members and garden communicators in the northern, humid region with timely concise articles that can be used for articles or customer information sheets. Special topics are covered in-depth. [Member benefit]



Sports Turf Management Kit is a resource which helps set the stage for those who are interested in upgrading sports turf, especially for public playgrounds and sports fields. [Member benefit. Non-member price: $10.00 US Funds]

LISTS Notebook is a compilation of 150 pages of Lawn Institute Special Topic Sheets encompassing information on cultivars, lawn maintenance, contacts and pages of graphics. [Member benefit. Non-member price: $15.00]

Lawn and Sports Turf Benefits is a 31 page in-depth look at the many benefits we receive from turfgrasses. This is an important document for policy makers, communicators and industry members. [Member benefit. Extra copies: $2.00 US Funds]



For more information or ordering, send your name, address and name of publication with a check to: The Lawn Institute, P O Box 108, Pleasant Hill TN 38578 or call [615]277-3722.

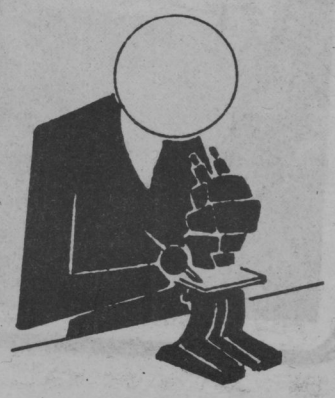
ENDOPHYTE ENHANCED TURF PERFORMANCE

Mike Robinson

Seed Research of Oregon
644 SW 13th Street
Corvallis OR 97333

It was around 1980 when reports first began to surface in the turfgrass industry of grass species that were naturally resistant to certain common turf insects. Further studies indicated the possibility of a direct correlation between insect resistance in turfgrass and the presence of an endophytic fungus infecting the tissues of resistant cultivars.

An endophyte is a symbiotic fungus that lives in the tissues of a host plant. Since 1980, research and testing have proven conclusively that grass cultivars infected with an endophyte possess greater improved insect resistance. The endophyte either produces toxins or induces the plant to produce chemicals that kill or repell insects that feed on turf. In addition, the studies showed that insect resistance increased in direct relation to an increase in the percentage of viable endophyte living within the plant. Cultivars which contain high levels of viable endophyte exhibit significantly increased resistance to many common turf insects including: bluegrass bill bugs, sod webworms, chinch bugs, army worms, and possibly nematodes. Endophyte-enhanced insect resistance is useful because it offers an effective alternative to chemical insect control.



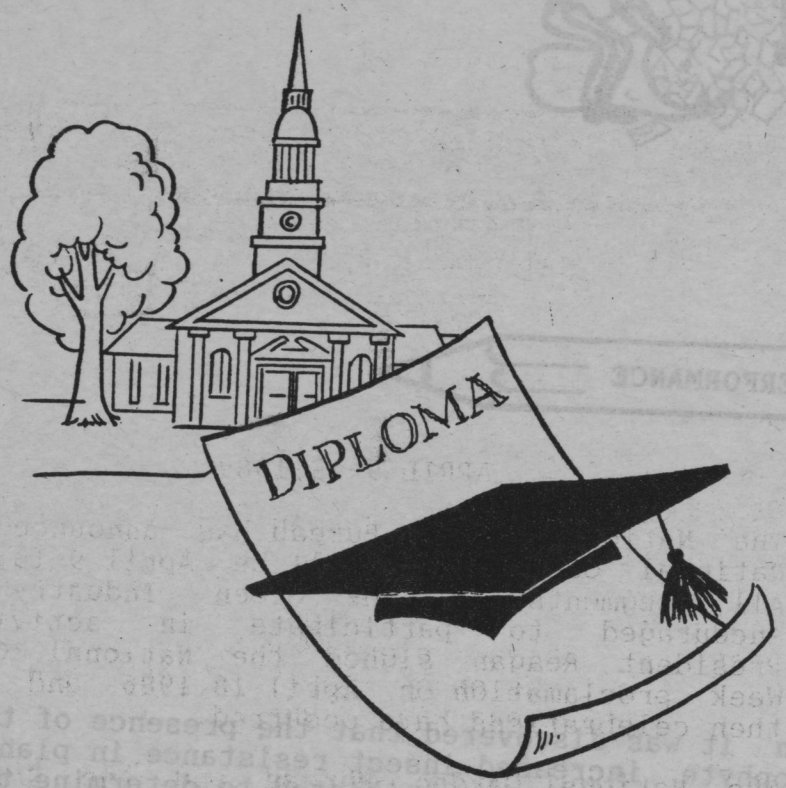
When it was discovered that the presence of the endophyte increased insect resistance in plants a parallel study was initiated to determine the effect of the endophyte on turf quality over a period of time. At Rutgers University, data was reviewed on perennial ryegrass plots that were seeded in 1976. The results of this study showed that from 1976 to 1983 ryegrass cultivars that were infected with the endophyte maintained their turf quality and some even improved each year. Conversely, cultivars with no endophyte deteriorated in turf quality each year.

Under conditions of high stress, cultivars containing the endophyte exhibited significantly higher ratings on turf performance. These results indicated that endophyte-enhanced turf performance was a result of the infected cultivars' increased tolerance of stressful conditions in addition to increased insect resistance.

The qualities characteristic of endophyte-enhanced cultivars during high stress periods include: increased vigor, reduced weed invasion, rapid recovery from injury, improved persistence, greater density, and increased heat and drought tolerance.

The following cultivars from Seed Research of Oregon contain high levels of endophyte:

- SR4000 perennial ryegrass;
- SR4100 perennial ryegrass;
- SR3000 hard fescue;
- Titon turf type tall fescue.



MICHIGAN STATE UNIVERSITY'S NEW PROGRAM

TURFGRASS MANAGEMENT
LAWN CARE AND LANDSCAPE MAINTENANCE

2-YEAR PROGRAM

A new 2-year program in Turfgrass Management has been announced by Michigan State University. Preparation for careers in the lawn care and maintenance area is the emphasis. Course offerings will include technical, communication, math and business. Placement opportunities will be offered students.

This 18-month technical training program consists of four terms on campus and two terms of placement training for a total of 80 credits. A certificate is granted at the completion of the program requirements.

Students with a high school diploma and work experience in lawn care will be given priority consideration. A C or greater GPA in high school and a diploma are required. ACT or SAT are not required.

Write: Mr Eric Miltner, Coordinator
A154-B Plant & Soils Science Building
Crop & Soil Science Department
Michigan State University
East Lansing MI 48824-1325
[517]355-0207

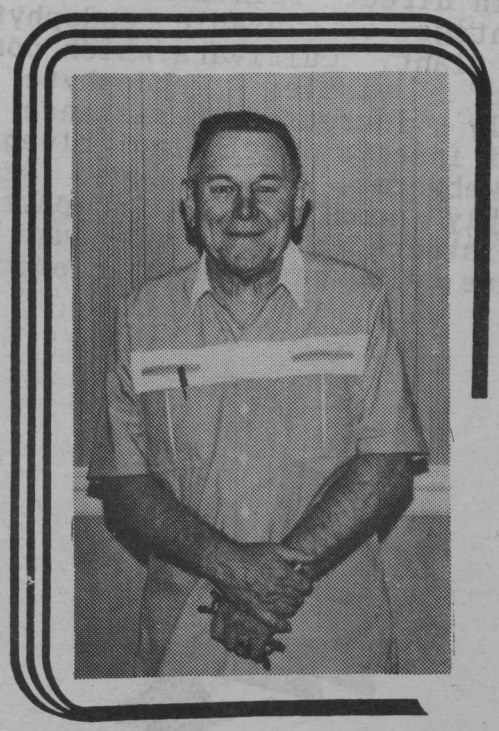
ATLANTIC SEEDSMEN'S ASSOCIATION HONORS BOB RUSSELL

Robert A Russell, owner and president, J & L Adikes, Inc, Jamaica, New York was named Seedsmen of the Year by the Atlantic Seedsmen's Association at its recent convention in Arlington, VA.

Mr Russell began his career in the seed business in 1946 with J & L Adikes and has been associated with that firm for his entire career. A pioneer in marketing turfgrasses, he started experimenting with fine leaved ryegrass in 1957 and was among the first to market an improved turf type ryegrass in the East. He was also responsible for the market introduction of Adelphi Kentucky bluegrass in 1970.

Over the years, Mr Russell has been very active in seed association affairs. He is a past director of the NY State Turfgrass Association; served as Secretary-Treasurer of The Lawn Institute for 15 years and is still on the Executive Committee; and is a past president of both the Atlantic Seedsmen's Association and the American Seed Trade Association. He is a Lifetime Member of ASTA.

Congratulations, Bob Russell.



MARYLAND TURFGRASS SURVEY - 1987

Dr Thomas Turner
University of Maryland
Agronomy Department
1112 Patterson Hall
College Park MD 20742

An economic value study sponsored by the Maryland Turfgrass Council shows the progress and growth of the turfgrass industry and its influence on the state's economy. Data is compared to information from a 1979 study. The total acreage in turfgrass for Maryland is reported at 614,024.

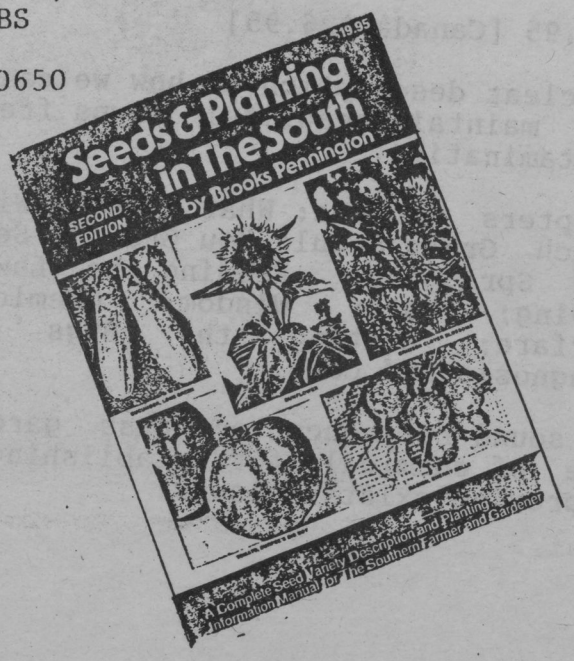
SEEDS AND PLANTING IN THE SOUTH [2ND ED]

Brooks Pennington

McFarland Press
Harrisburg PA
1985

A complete seed variety description and planting information manual for the southern farmer and gardener. More than 200 pages of seed and planting facts including 24 pages on forage and lawn grasses. Photographs of the South's leading vegetable, field crop and lawn plants, including weeds.

Pennington Seed, Inc of Madison
Department DBS
P O Box 290
Madison GA 30650
$19.95



NATIONAL GARDEN WEEK

APRIL 9-15,1989

The National Garden Bureau has announced that National Garden Week will be April 9-15,1989. All segments of the Green Industry are encouraged to participate in activities. President Reagan signed the National Garden Week proclamation on April 18,1986 and since then celebrations have occurred.

The National Garden Bureau and the National Junior Horticultural Association are cosponsoring the "Children's Poster Contest". Organic Gardening magazine sponsors a telephone hotline for gardeners.

A promotional kit is available from the National Garden Bureau, 1311 Butterfield Rd, Suite 310, Downers Grove, IL 60515 at a cost of $15.00 plus postage.

All of April will be designated as Garden Month and companies are encouraged to plan activities to celebrate gardening, including lawn care which is the number one gardening activity.

BUILDING A HEALTHY LAWN

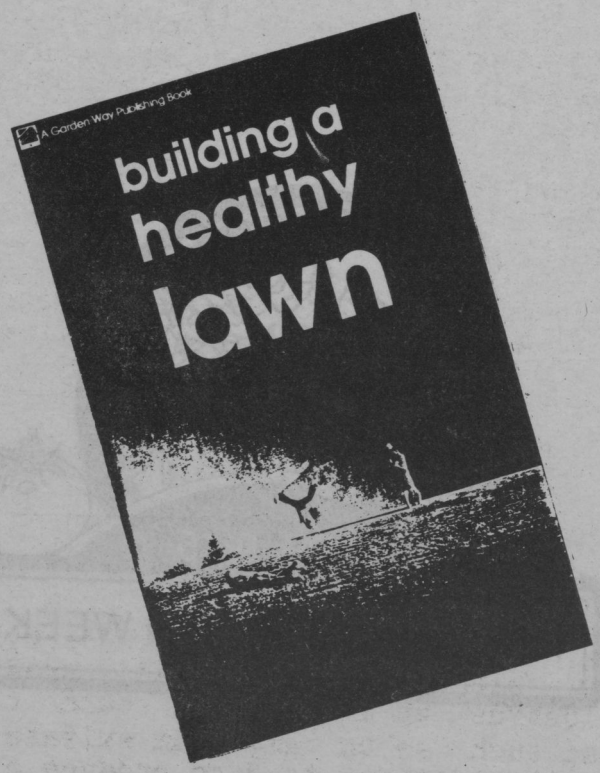
Stuart Franklin

A Garden Way Publishing Book
Storey Communications, Inc
Schoolhouse Road
Pownal VT 05261
168 pages
1988

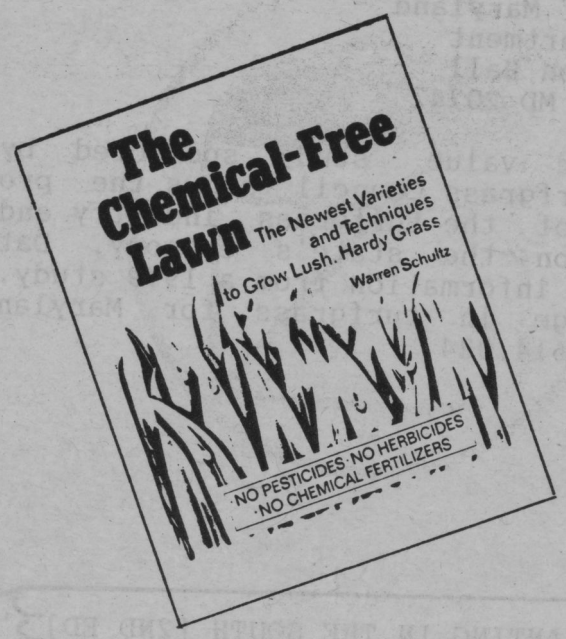
$9.95

A book for homeowners who want to move away from reliance on chemicals and still have a beautiful lawn. The secret is to build healthy soil and roots. The caretaker must work with the lawn, not against it by using maintenance practices that encourage the plants and the soil organisms.

Chapters include: What is a Lawn ?; Mowing; Choosing Equipment; Watering the Lawn; The Soil; Fertilizing; Thatch; Types of Grasses; Seeding a Lawn; Sod Lawns; Lawn Chemicals - An Overview; Insects in the Lawn; Weed Control; Mowing, Spraying, and Fertilizing Services; Ground Covers and Mulches; Lawn Calendar.



THE CHEMICAL-FREE LAWN



The Newest Varieties and Techniques to Grow Lush, Hardy Grass

Warren Schultz

Rodale Press
33 E Minor St
Emmaus PA 18049
194 pages
1989

$21.95 [Canada $26.95]

A clear description of how we can all establish and maintain beautiful lawns free of chemical contamination.

Chapters include: What's Wrong With Your Lawn?; Which Grass Should You Grow ?; Seeding, Sodding and Sprigging; Feeding the Lawn; The Art of Mowing; Water Wisdom; Chemical-Free Weed Warfare; Getting the Bugs Out; Disease Diagnosis and Cure.

A sound reference on grass gardening without use of chemicals for establishing new lawns and improving existing lawns.

DON'T BAG IT

Harvests 15

Lawn Care Plan, City Ft Worth, Texas

Introduction

The following notations from a 1982 article by Dr William Knoop in Grounds Maintenance about a waste-saver lawn care program in Plano, Texas [population 80,000] are of interest.

- A one week sampling of trash pickup in mid-June 1980 revealed that 29.1 % of all garbage bags picked up were filled with grass clippings. By weight, this was 40 % of the garbage truck's loads.

- One bag weighed approximately 40 pounds, so the 33,000 bags meant 700 tons of grass being dumped into the landfill each week.

- The analysis of the week's collection of grass clippings on the basis of dry weight was approximately 2 1/2 tons of nitrogen, 1/2 ton phosphorus, 1 ton potassium and all the remaining essential nutrients. There is no value in having these in a landfill and, in fact, they could become a future source of ground-water pollution.

- An educational program helped reduce the number of bags containing grass clippings saving Plano over $100,000 and reducing the burden on the landfill.

- It is estimated that in some cities that 95 % of homeowners bag grass clippings which can compose 50 % of the solid waste collected in the summer.

****

This "Don't Bag It Lawn Care Plan"
Will Save You Time,
Energy and Money, Too !

Most people like a beautiful, green lawn, and we often use more fertilizer and water than necessary. More mowing, extra back-breaking work in bagging grass clippings and higher water bills often result.

Between March and September, the volume of residential solid waste increases 20-25 percent because of grass clippings. During the spring and summer months, grass clippings strain the garbage collection system and use valuable landfill space.

Now, consider not bagging your grass. With the "Don't Bag It Lawn Care Plan" you won't have to stoop every ten minutes to empty your mower bag. By leaving your clippings on the lawn and allowing them to work their way back into soil, you will produce a beautiful, green lawn. Your lawn will recycle its clippings and you will save time, energy and money !

Fertilizer Plan

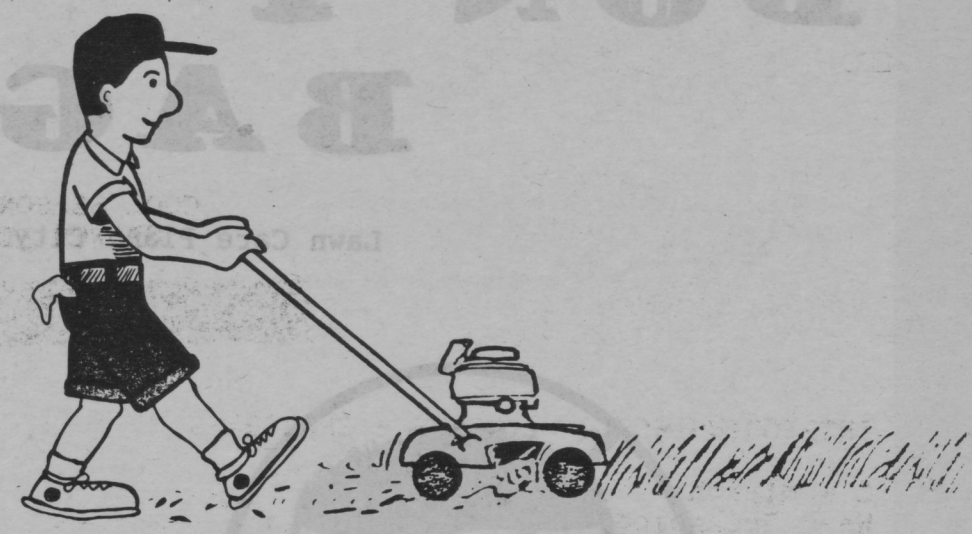
The rate of fertilizer application, the frequency of application, the ratio of nutrients in the fertilizer and the source of the nitrogen all have a great deal to do with how fast the lawn grows.

The following fertilizing plan is designed to allow the lawn to grow at a reasonable rate and still have a good color.

Fertilizer Ratio [NPK]	Fertilizer Analysis	Application Rate Lbs/1000 sq ft
3-1-2	12-4-8	8
	15-5-10	7
	21-7-14	5
or		
4-1-2	16-4-8	6
	20-5-10	5

For slow, even growth, use a fertilizer containing either sulfur-coated urea or ureaformaldehyde as a nitrogen source rather than those such as an ammonium sulfate, or ammonium nitrate that tend to produce a very fast growth for short periods.

DON'T BAG IT cont



Fertilizer Application Dates

Common bermuda: April 15, June 1, July 15 and September 1

"Tif" bermuda: April 1, May 1, June 1, July 1, August 1 and September 1

Buffalo: May 1 and September 1

St Augustine: May 1, June 1, and September 1

Tall fescue: March 1, September 15 and November 15

Zoysia: May 1, June 1, and September 1

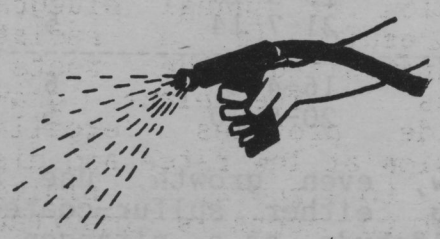
Water Plan

Turfgrasses vary in their need for water:

1. tall fescue [requires the most water];
2. St Augustine
3. "Tif" bermuda
4. zoysia
5. common bermuda
6. buffalo [requires the least water].

During the driest period of summer, our lawns usually require about one inch of water every five to six days. Most hose sprinklers put out one-fourth to one-third inch of water per hour, so they would need to run approximately four hours in one spot. If water runs off the lawn before one inch is applied, turn the sprinkler off, let the water soak in for about one hour, then continue watering.

The best time to water is early morning, so less water is lost by evaporation. The worst time to water is in the evening because the lawn stays wet longer through the night which encourages disease development. Lawns watered too frequently tend to develop shallow root systems which may make them more susceptible to grub damage.



Follow This Plan and Never Bag Grass Clippings Again !

Mowing Plan

The "rule of thumb" for mowing home lawns is not to remove more than one-third of the leaf surface at any one time. If you use the following mowing schedule, you will no longer need to bag your grass clippings.

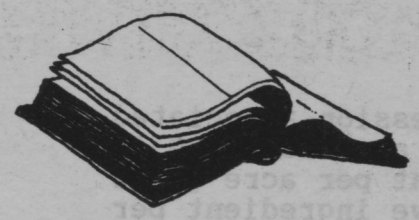
Type of Grass	Mower Setting	Mow When or Before Below Height
common bermuda	1 1/2 "	2 1/4"
"Tif" bermuda	1"	1 1/2"
buffalo	2"	3"
St Augustine	2"	3"
tall fescue	2 1/2"	3 3/4"
zoysia	2"	3"

Grass clippings left on your lawn will not contribute to thatch, but will return valuable nutrients to the soil. They usually contain about 4 percent nitrogen, .5 percent phosphorus and about 2 percent potassium as well as all the necessary minor elements plants need.

Grass clippings make an excellent compost for gardens. Compost use is the best way to improve garden soil because it returns nutrients to the soil and improves the soil's physical characteristics.

The "Don't Bag It Lawn Care Plan" was developed by Dr Bill Knoop
Extension Turfgrass Specialist
Texas Agricultural Extension Service
17360 Coit Rd
Dallas TX 75252-6599
[214/231-5362]

THRESHING THE JOURNALS



COOL SEASON WEED CONTROL AND GROWTH REGULATOR RESEARCH

INTRIGUING WORLD OF WEEDS - CRABGRASS

L W Mitich
Weed Technology
Volume 2 Number 1
Pages 114-115
1988

Turf managers know Digitaria species as crabgrass [Digitaria sanguinalis - large crabgrass and Digitaria ischaemum - smooth crabgrass]. In fact, Digiteria species were first cultivated as grains for food thousands of years ago. Digiteria is a genus of about 60 species that grow in the world's temperate and tropical regions. Many species are good forage grasses.

Seeds of Digiteria species are very nutritious. Stone age lake dwellers in Switzerland cultivated foxtail millet. A form of crabgrass was an important food crop in China in 2700 BC. It has been a food source in India and Africa since prehistoric times.

The United States Patent Office introduced large crabgrass into this country as a forage crop in 1849 when livestock numbers were increasing rapidly and good forage was scarce.

Characteristics which once made crabgrass a valued crop, now make it a pernicious weed. A large crabgrass plant can produce 700 tillers and 150,000 seeds in temperate areas of the United States and even greater numbers of seeds in tropical climates, where it grows as a perennial and flowers all year. The plant escaped to fields, roadsides and wastelands and ultimately spread to every state. It is now one of the nation's major lawn weeds because the stems are usually prostrate and below the mower blade. The rapidly growing seedlings soon crowd out preferred finer-leaved grass species. Mats of broadleaved gray-green grass spot the lawn and turn brown after the first frost.

Ada George wrote in 1914 "The seeds of this grass must be very long lived, for, though it is never sown, let the ground be cultivated, and as a general thing, crab-grass will be there."

AN ANALYSIS OF THE CARBOHYDRATE STATUS OF MEFLUIDIDE-TREATED ANNUAL BLUEGRASS

R J Cooper, J R Street, P R Henderlong and A J Koski
Agronomy Journal
Volume 80 Number 3
Pages 410-414
1988

Extensive spring seedhead production is a major factor limiting the quality of annual bluegrass turf. Annual bluegrass is a prolific seed producer with virtually every mature tiller producing an inflorescence. Using labeled carbon dioxide, developing annual bluegrass seed were found to monopolize assimilate at the expense of root assimilate content. When seeds are removed 1 hour prior to treatment with labeled carbon dioxide, more assimilate is utilized by annual bluegrass roots.

Monopolization of assimilate by developing seed may be responsible for the decline in annual bluegrass spring root activity. Reduced root growth following flowering and seed formation is common in other grasses.

An experiment at Ohio State University was initiated to determine if chemical suppression of annual bluegrass seedheads would result in a redistribution of carbohydrates to the roots of annual bluegrass. The plant growth regulator mefluidide provides excellent seedhead suppression at low rates and displays limited movement to roots. Limited mefluidide transport to roots is important since roots of treated plants must be capable of growth in order to benefit from any potential redistribution of carbohydrates. The following observations were made:

- Complete seedhead suppression associated with mefluidide applied at 0.13 and 0.18 pounds active ingredient per acre [0.14 and 0.21 kilograms active ingredient per hectare] resulted in greater concentrations of fructose and glucose in annual bluegrass roots compared to roots of untreated plants during peak seedhead emergence.

- Redistribution of carbohydrates was short in duration, with no differences in carbohydrate content occurring among treatments after peak seedhead emergence.

- Mefluidide had little effect on leaf and stem carbohydrates. Regardless of mefluidide rate, concentrations of fructose, sucrose and fructans were considerably greater in leaf and stem tissue than in roots.

- Annual bluegrass stems were the major storage organ for fructans with only minor fructan storage occurring in roots.

- The carbohydrate content of mefluidide-treated annual bluegrass decreased substantially in leaf, stem and root tissue following growth inhibition due to a post-inhibition growth surge.

ANNUAL BLUEGRASS CONTROL AND TOLERANCE OF KENTUCKY BLUEGRASS AND PERENNIAL RYEGRASS TO ETHOFUMESATE

P H Dernoeden and T R Turner
HortScience
Volume 23 Number 3
Pages 565-567
1988

Annual bluegrass is one of the most common and difficult to control weeds in intensively managed golf course turfs. Ethofumesate has been reported to control annual bluegrass effectively in bermudagrass turf overseeded with perennial ryegrass in the southeastern United States. Only a temporary reduction in the quality of overseeded perennial ryegrass treated with ethofumesate has been observed. Ethofumesate has caused unacceptable injury to mature stands of Sydsport, Vantage, Pennstar and Adelphi Kentucky bluegrasses and to Kentucky 31 tall fescue.

A study conducted at the University of Maryland was designed to determine safe use rates for ethofumesate on Merion, Mystic and a blend of Kentucky bluegrasses and perennial ryegrass fairway turf. The following results are of interest.

- Ethofumesate applied at 3/4, 1 and 3/4 plus 3/4 pound per acre [0.84, 1.1, and 0.84 plus 0.84 kilograms per hectare] provided poor annual bluegrass control.

- Ethofumesate applied at 2 and 1 plus 1 pounds per acre [2.2 and 1.1 plus 1.1 kilograms per hectare] provided good control of annual bluegrass.

- Ethofumesate applied at 2 + 1 and 2 plus 2 pounds per acre [2.2 + 1.1 and 2.2 plus 2.2 kilograms per hectare] provided excellent control of annual bluegrass.

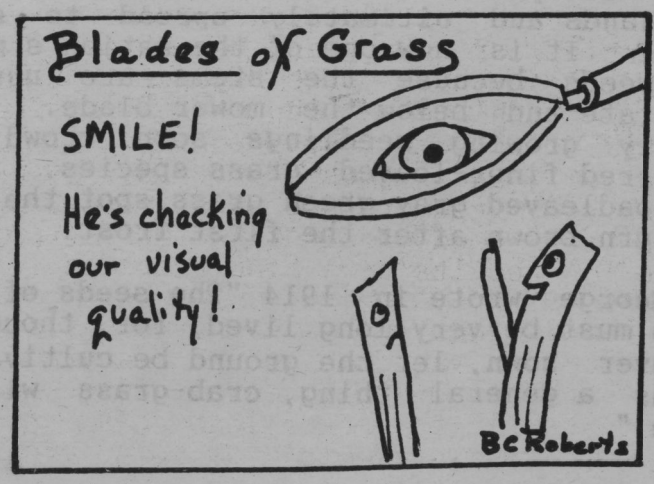
- Overall quality of Kentucky bluegrass was only slightly reduced by ethofumesate at 1 or 2 pounds per acre [1.1 or 2.2 kilograms per hectare]; however, split applications at 2 plus 1 and 2 plus 2 pounds per acre [2.2 plus 1.1 and 2.2 plus 2.2 kilograms per hectare] severely reduced bluegrass cover and overall quality for 7 months.

- Foliar growth of sequentially treated Kentucky bluegrass appeared suppressed throughout fall and winter.

- Between January and April, Kentucky bluegrass treated with split applications of 2 + 1 or 2 plus 2 pounds per acre of ethofumesate [2.2 plus 1.1 or 2.2 plus 2.2 kilograms per hectare] had a dark-green color.

- No visual injury was observed from treatments on perennial ryegrass.

- Ethofumesate applied at 2 or 1 plus 1 pounds per acre [2.2 or 1.1 plus 1.1 kilograms per hectare] provided the best combination of safety to Kentucky bluegrass and control of annual bluegrass.



THRESHING THE JOURNALS continued

FENOXAPROP COMBINED WITH PREEMERGENCE HERBICIDES FOR CRABGRASS AND GOOSEGRASS CONTROL IN TURF

P H Dernoeden
HortScience
Volume 23 Number 1
Pages 154-157
1988

Fenoxaprop has been shown to be an extremely effective postemergence herbicide for control of crabgrass. Fenoxaprop applied in combination with a preemergence herbicide may provide a useful control strategy where unexpected crabgrass problems arise, especially in regions where crabgrass seed germinates over an extended period of time.

The objective of research conducted at The University of Maryland was to determine whether several preemergence herbicides combined with fenoxaprop would provide both effective postemergence control of smooth crabgrass and goosegrass as well as subsequent preemergence control of annual grass weed seed germinating thereafter. The following results have been recorded.

- When fenoxaprop was applied alone in June or July to smooth crabgrass, the level of control ranged from poor [40 percent] to excellent [99 percent] depending on herbicide rate and timing of application.

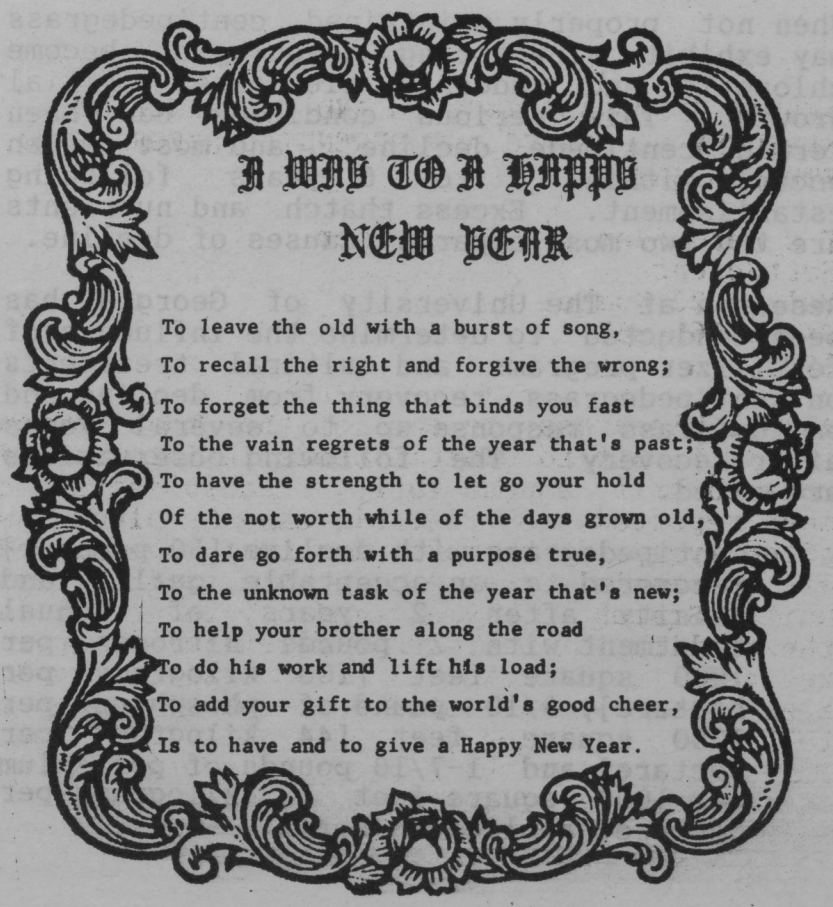
- Smooth crabgrass control was erratic where plants had more than four tillers, particularly on a droughty site.

- When fenoxaprop at rates of 0.15, 0.18 or 0.35 pounds per acre [0.17, 0.20 or 0.39 kilograms per hectare] was applied in combination with bensulide, benefin, DCPA, oxadiazon, pendimethalin or prodiamine, excellent [90 to 100 percent] season-long smooth crabgrass control was achieved.

- Fenoxaprop plus preemergence herbicide combinations exhibited complementary action, particularly in tank mixes applied to tillered smooth crabgrass.

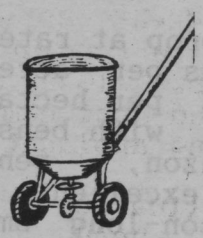
- Fenoxaprop applied alone controlled goosegrass [two-leaf to three tiller stage] but goosegrass reinfested treated plots from seed germinating after the herbicide application.

- When fenoxaprop at 0.18 pounds per acre [0.20 kilogram per hectare] was applied with oxadiazon at 2 pounds per acre [2.2 kilograms per hectare] to nontillered goosegrass, exceptional [99 percent] season-long goosegrass control was achieved.



Robert Brewster Beattie

Turf Fertilization



CENTIPEDEGRASS DECLINE AND RECOVERY AS AFFECTED BY FERTILIZER AND CULTURAL TREATMENTS

B J Johnson, R N Carrow and R E Burns
Agronomy Journal
Volume 80 Number 3
Pages 479-486
1988

Centipedegrass persists under limited maintenance and is adapted to the southeastern United States. Because of its low fertility requirements, this grass is used effectively for home lawns and industrial parks. Under these conditions it has light green foliage and maintains a good dense turfgrass stand. Excess nitrogen is required to achieve dark green foliage.

When not properly maintained, centipedegrass may exhibit slow spring green-up or become chlorotic and suddenly die after initial growth. This serious condition has been termed "centipede decline" and most often occurs within 3 to 6 years following establishment. Excess thatch and nutrients are the two most apparent causes of decline.

Research at The University of Georgia has been conducted to determine the influence of fertilizer programs and cultural treatments on centipedegrass recovery from decline and on turfgrass response up to several years after recovery. The following observations are noted.

- Centipedegrass with decline [50 percent] recovered to an acceptable quality and density after 2 years of annual treatment with 2 pounds nitrogen per 1000 square feet [100 kilograms per hectare], 9/10 pound of phosphorus per 1000 square feet [44 kilograms per hectare] and 1-7/10 pounds of potassium per 1000 square feet [83 kilograms per hectare] applied in April.

- Quality of the turf was improved by doubling these applications for the first three years, but thereafter, the grass lost density and was chlorotic.

- There was no benefit from additional potassium applied in late August to turf that had previously received 1-7/10 pounds of potassium per 1000 square feet in April.

- Thatch increased by 18 percent when annual fertilizer treatments were made at both rates.

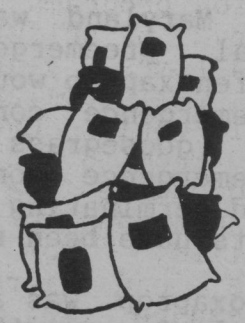
- Scalping, topdressing and vertical mowing did not improve turfgrass recovery the first 2 years.

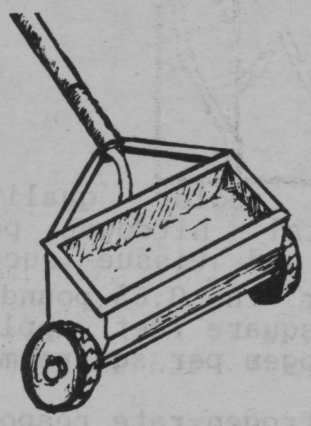
- Topdressing with soil improved spring growth, quality and shoot density more than did vertical mowing or scalping.

- Topdressing with soil decreased thatch accumulation 48 percent compared to untreated turf.

- Vertical mowing twice each year provided 15 to 17 percent thatch control and scalping provided no control.

- Fertilization at the low rate plus annual topdressing provided best turfgrass quality, shoot density and lowest thatch accumulation.





LATE FALL FERTILIZATION OF KENTUCKY BLUEGRASS

D J Wehner, J E Haley and D L Martin
Agronomy Journal
Volume 80 Number 3
Pages 466-471
1988

The practice of applying a portion of the total yearly nitrogen to cool-season turfgrass in late fall [November] has gained acceptance by turfgrass managers in Illinois and surrounding states. The major benefits of a late-fall nitrogen fertilization are improved darker green foliage in early spring and more extensive root growth. Improved root growth may be related to the fact that the better spring color reduces the need for an early spring application of nitrogen. As shoot growth is promoted by early spring nitrogen applications, root growth of cool-season grasses is often reduced. Late fall nitrogen applications in maritime locations and in transition climates provide green turf foliage almost year-round. However, in the Midwest where reduced winter hardiness is a possibility, late fall nitrogen applications have been viewed with caution.

Research at The University of Illinois has been conducted to compare fertilization programs with and without nitrogen application in November using both slow release and soluble nitrogen sources. Baron and Newport Kentucky bluegrass were subjected to 10 fertilization programs utilizing urea, isobutylidene diurea or sulfur coated urea. Urea was applied 4 times a year with either a spring or a late fall application combined with treatments in early June, mid-July and early September. From 3 1/2 to 4 pounds of nitrogen per 1000 square feet per year [171 to 196 kilograms nitrogen per hectare per year] were applied. For IBDU and SCU application dates and nitrogen rates in pounds per 1000 square feet [kilograms per hectare] were June 2 [98] plus September 2 [98], June 2 [98] plus November 2 [98], and June 1 [49] plus September 1 [49] plus November 1-1/2 [74]. The following results were reported.

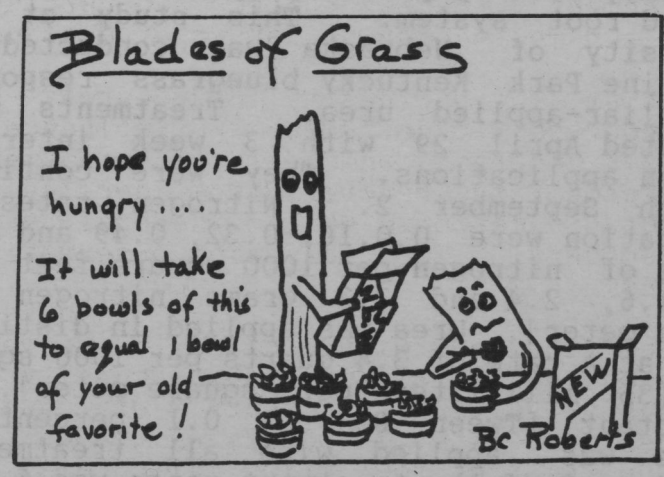
- An application of urea in November without a subsequent spring treatment produced higher turf color ratings in early spring but lower turf color ratings in May and June compared to turf receiving a spring application.

- A late fall application of urea may not eliminate the need for spring fertilization but may allow a reduction in the amount of nitrogen required in a spring treatment.

- Turf fertilized with SCU in November received higher color ratings in the spring than did turf fertilized with SCU in September.

- With IBDU, the June plus September program resulted in the highest ratings with acceptable turf color.

- November IBDU applications did not result in higher color ratings in the spring. Inefficient use of nitrogen applied was indicated.



PARK KENTUCKY BLUEGRASS RESPONSE TO FOLIARLY APPLIED UREA

R W Wesely, R C Shearman and E J Kinbacher
HortScience
Volume 23 Number 3
Pages 556-559
1988

Foliar urea applications have been used on many horticultural and agronomic crops. Urea has been applied to turf in water as a drench, but its use as a foliar application has not been evaluated. The value of urea as a constituent of foliar feeding is demonstrated by its high water solubility and rapid absorption. Rapid absorption is important to minimize potential nitrogen loss and to reduce the possibility of foliar burn. Repeated foliar urea applications may be needed to obtain adequate nitrogen nutrition without foliar burn. These repeated applications may be costly and difficult to manage, particularly in the lawn care service industry.

Foliar urea applications may be advantageous when rapid nitrogen responses are needed. Urea applied foliarly could be used to correct nitrogen deficiencies when soil uptake is restricted by soil chemical problems, soil physical properties or by a damaged root system. This study at The University of Nebraska was conducted to determine Park Kentucky bluegrass responses to foliar-applied urea. Treatments were initiated April 29 with 3 week intervals between applications. They were continued through September 2. Nitrogen rates of application were 0,0.16, 0.32, 0.49 and 0.65 pounds of nitrogen per 1000 square feet [0, 0.8, 1.6, 2.4 and 3.2 grams nitrogen per square meter]. Urea was applied in distilled water at a rate of 3.4 quarts per 1000 square feet [35 milliliters per square meter]., A surfactant [Tween 80] at 0.1 percent by volume was applied with all treatments. Solution pH of the treatment range was 6.5 to 7.8. Soluble salts for these solutions rated low. The following results were recorded.

- Turfgrass color, quality, clipping yield, total nitrogen percentage in clippings and tissue succulence were highest for the 0.65 pounds of nitrogen per 1000 square feet applications [3.2 grams nitrogen per square meter].

- Maximum nitrogen-rate responses occurred during spring and fall and were highest 1 week after treatment.

- Acceptable turfgrass quality was maintained at 0.32 pounds of nitrogen per 1000 square feet per application [1.6 grams nitrogen per square meter].

- Nitrogen recoveries based on clipping removal were 49 %, 60 %, 59 % and 59 % for 0.16, 0.32, 0.49 and 0.65 pounds of nitrogen per 1000 square feet [0.8, 1.6, 2.4 and 3.2 grams of nitrogen per square meter] respectively.

The ABC's of lawn & turf benefits

WHY DO YOU ENJOY YOUR LAWN?

There are many and various reasons why we derive pleasure and pride from our home lawns. How many come to mind? The Lawn Institute suggests that there are at least 26 good benefits of a healthy lawn. They are as simple as A, B, C ...

A. AESTHETIC values of turfed areas have been recognized since emporers in China (157-87 BC) maintained extensive mowed grass for beauty and enjoyment. Today Most segments of the population of the United States enjoy lawns around their homes and in parks open to the public.

B. BUSINESS and manufacturing complexes that have well maintained grass areas extend a favorable impression to the general public, as well as to employees and customers and the lawn increases the value of the property by up to 6%.

C. CLIMATE is controlled at ground level by turfgrasses as they COOL temperatures appreciably, thus working as exterior "air conditioners".

D. DUST and smoke particles from the atmosphere are trapped by turf which helps keep the air cleaner.

E. EROSION of soil by water is highly controlled by grasses as they intercept raindrops before they disturb the soil and slow flowing water so that it drops larger soil particles collected.

F. FIRE retardation by buffer areas of well maintained lawngrasses around buildings is good insurance.

G. GROUNDWATER is enhanced in two ways by a dense turf. Turfgrasses increase infiltration of water and also clean the water as it passes so that underground water supplies are recharged for use by us all.

H. HEALTH of humans is enhanced by turfgrasses as they function in cushioning, cleaning air, generating oxygen and creating a serene landscape.

I. INJURIES in sports and games can be buffered by a soft, resilient turfgrass surface.

J. JUNK is less likely to be thrown on an area where there is a well maintained lawn.

K. KNOWLEDGE of the care of turfgrasses and other plants is therapeutic to humans and is used in rehabilitation programs for the ill, the elderly, the handicapped and the incarcerated.

L. LAWNS are estimated to occupy an area of between 25,000,000 to 30,000,000 acres in the United States (the size of the 5 New England states) and as the population increases so too will the amount of turfgrass acreage.

M. MONETARY value is associated with a well MANICURED lawn and this may amount to a 15% increase in the home selling price.

N. NOISE is absorbed by grass areas which cut down on the excessive sound, a growing problem in urban areas. Grassed slopes beside lowered expressways reduce noise 8-10 decibles.

O. OXYGEN generation by turfgrasses has a major impact in making our environment habitable. A 50' x 50' lawn produces enough oxygen for a family of four.

P. POLLUTANTS, such as carbon dioxide and sulfur dioxide, are absorbed by turfgrasses thereby rendering the air fit to breathe. Turfgrass thatch acts as a barrier detering chemicals from entering the soil profile.

Q. QUIET grassed areas affect people's moods, thus creating feelings of serenity, privacy, thoughtfulness, happiness or sadness depending on our association with their use – home lawn, roadside rest area, city park, golf course or memorial park.

R. RUNOFF of water and pollutants is greatly reduced by a highly maintained lawn. Dense turfgrass cleans the water helping to maintain a high quality environment.

S. SPORTS playing SURFACES are made SAFER when grassed with sure footing and cushioning sod that adds to the quality of play.

T. TRAFFIC, both vehicular and pedestrian, is directed by lawn barriers in areas of heavy movement of people and on roadsides and medians.

U. In URBAN areas, lawns contribute a measure of the countryside and its heritage, providing a much needed linkage with nature. This benefits us by lessening stress.

V. VOLLEYBALL, badminton, croquet, bocce and other games are enjoyed by young and old on grassed areas. No other surface material feels as good on bare feet or is as good for playing games and even turning somersaults.

W. WORLDWIDE golf is a popular game played by millions of people as a means of exercise, relaxation and as an avenue for business transactions. In the United States there are more than 14 million golfers that enjoy highly groomed grass on golf courses.

X. Even the XERISCAPE, a very dry environment where water is conserved by creative landscaping, provides a place for some ornamental grasses.

Y. YEARLY cycles of nature produce changes in the color of lawns, which are among the first areas to green up in the spring, bringing a lift to human spirits and linking urban inhabitants with a symbol of the countryside and its heritage.

Z. ZONES that are stabilized by turfgrasses enhance safety on roads and airfields by reducing runoff which can cause flooding, diminishing soil erosion which muddies the surfaces, and absorbing dust which cuts back visibility.

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