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USGA GREEN SECTION RECORD

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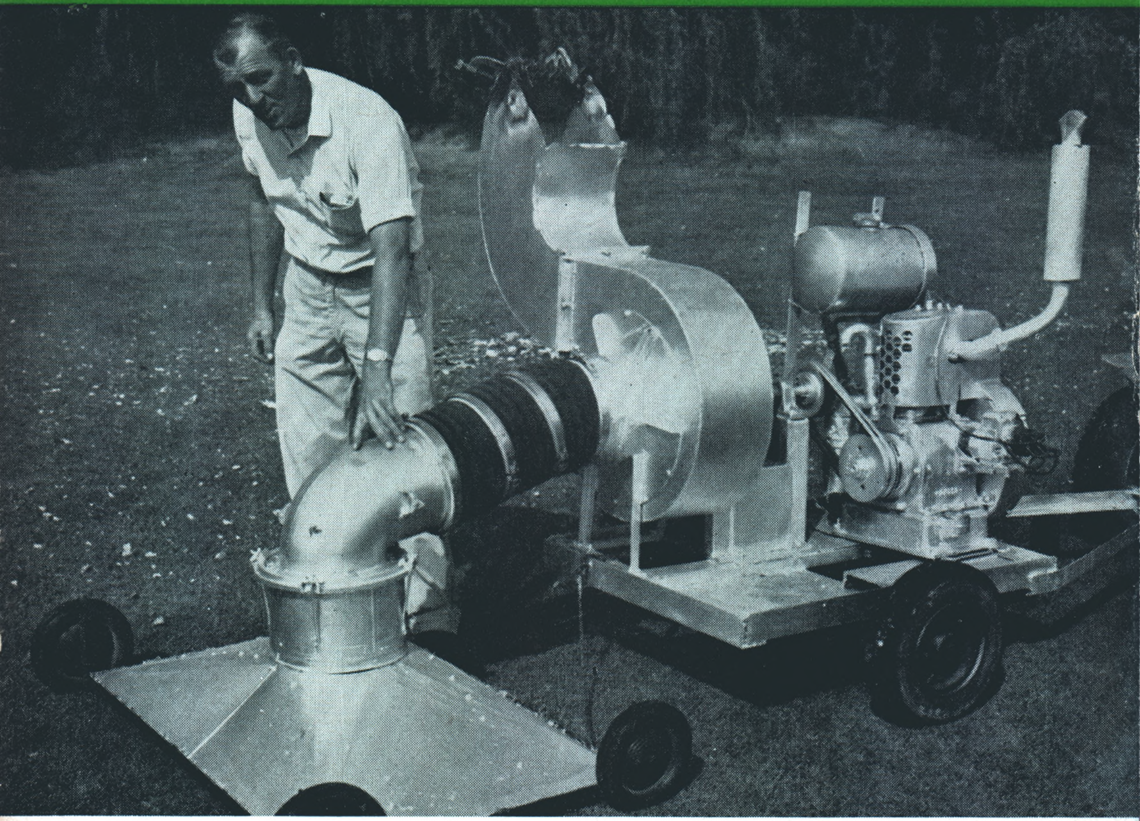
by the United States Golf Association



GOLF COURSE VACUUM CLEANER

Heinz Lessau, ingenious superintendent of Socorro Golf Club, demonstrates one of his numerous improvisations. (See story page 3.)

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Trees for Golf Course Use

By **HOLMAN M. GRIFFIN,** Northeastern Agronomist, Green Section, The United States Golf Association

"I think that I shall never see a poem lovely as a tree": so starts Joyce Kilmer's beautiful poem *Trees*. We have long recognized the economic importance and the beauty of trees, and probably no other plant lends as much individual character to the landscape.

There are 1,100 different species of trees native to the United States and many more imported species which give an almost unlimited choice of size, shape, and adaptability.

In considering trees for golf course use, the following characteristics should be considered:

CHOICE OF SPECIES:

1. Rooting Habit—Trees having large masses of feeder roots, many of which grow near the surface, are seldom desirable for planting in the proximity of greens and other areas where root competition will noticeably injure the grass. Surface roots may also cause mowing problems or in some instances will ruin asphalt or concrete paths and roadways.

Water lines, sewer lines, and the location of similar underground facilities must also be taken into consideration as roots sometimes render them inoperative.

Some of the most notorious trees for massive root systems are cottonwood, willows, maples, elms, poplars, eucalyptus, and hackberry.

2. Foliage Type—Trees are classified according to their foliage characteristics as deciduous— those which shed their leaves; and as evergreen— those which retain their leaves the year around. It is obvious that even though the evergreens retain their leaves, they are not desirable nor adaptable in all situations.

With deciduous trees there is always a leaf problem in fall and winter; however, the problem is much worse with some trees, such as willow, sweetgum, sycamore, Chinese tallow, ash, and elm. If such trees are to be planted on the golf course, they should be well away from areas where fallen foliage will interfere with play or become unsightly if not cleaned up immediately.

3. Fruiting Habits—Fruit as well as foliage from trees can be a detriment to the golf course maintenance operation. The fruit from sweetgum, pecan, catalpa, chinaberry, and osage orange are typical examples of undesirable fruiting qualities. Not only does the fruit of some trees create a litter problem if allowed to remain on the ground but it also clogs or dulls machinery.

4. Susceptibility to Insects and Disease—No tree is completely immune to the ravages of insects and disease, but much can be gained toward more economical and carefree maintenance if adapted hardy trees are selected for planting. Insects and disease occur to some extent on all trees, but the resulting damage is greatly minimized if the tree is an adapted species and in healthy, hardy condition to start with. These factors contribute much toward resistance, but there are specific diseases and insects which infest even the healthiest trees. Dutch elm disease and elm leaf beetle damage to the American elm are good examples of this type of problem. Where these specific insects and diseases exist, they usually are given wide publicity so as to become common knowledge.

5. Susceptibility to Ice and Storm Damage—This is much more a consideration to be dealt with in northern climates than in the deep South and coastal areas where snow and ice storms are less frequent and severe. We must again consider the region of adaptation and growth characteristics before making any final decisions on the species to be planted. In general, trees with weak crotches, brittle wood, shallow roots, and those infested with disease and insects are most likely to be damaged by snow and ice.

Maples and poplars are examples of trees which break easily, and elms need to have their limbs braced to avoid splitting under their own weight as they become older. The sweetgum and live oak are examples of trees which are more resistant to ice and storm damage.

6. Longevity—Theoretically, trees could live forever since the living cells are renewed each year; but, like people, they suffer the infirmities of old age. The rate of food production by the leaves is slower and wounds do not heal as easily in older trees. However, the age at which a tree is considered old varies with the species.

If a tree or group of trees is planned as a permanent feature of the landscape, then the trees of greater longevity would be more desirable. In many instances, a fast-growing but short-lived tree such as mimosa or Chinese elm may fill the immediate needs until trees of greater longevity have had a chance to become established.

In any case, every golf course should plan ahead for the eventual loss of older trees by planting young trees to take their place.

7. Crown Shape—Crown shape is largely dependent upon pruning, but each species of tree has a natural crown shape characteristic of that particular kind. The mature crown shape of a tree should be considered in relation to its surroundings and may serve a special purpose. In vast, open places, a tall, spreading tree such as the live oak can be a thing of beauty. In more restricted locations, the narrow, upright growth of Lombardy poplar may be more in order. With the proper choice of crown shape, the tree may be chosen to enhance greatly the beauty of the surroundings in which it grows.

8. Density of Foliage and Shade—Dense foliage produces heavy shade and, as a rule, poor air circulation in the surrounding area. Neither of these conditions is conducive to the growth of grass.

9. Height—The definition of a tree requires the plant to be at least 10 feet high and classifies similar plants of less height as shrubs. Trees may be selected for their height or lack of it, but ordinarily this is one of the less important characteristics when all else has been evaluated. Common sense, more than anything else, dictates the size of tree required in any given situation. It would be just as ridiculous to plant a large, stately tree, such as live oak or magnolia, under overhead obstructions as it would be to plant an arborvitae for shade.

In choosing the height of a tree, the mature size of the plant should always be considered to avoid difficulty later on.

LOCATION AND SPACING

1. Affected by the Above Factors—All of the growth characteristics of a tree must be considered when selecting the planting location. Shallow-rooted trees are often a menace under concrete walks and near greens; deciduous trees which produce heavy litter are a problem around swimming pools and heavily used areas; a tree which has become an intricate part of the landscape may well become disfigured and ugly if insects or disease are active on it or if it is broken down during a storm; short-lived trees die off within a relatively short period of time and leave a conspicuous vacancy if no replacement has been planned; trees should be planted with the mature crown shape in mind so severe pruning will be unnecessary and so that they do not shade one another; dense foliage and shade may restrict the growth of other plants in the area and reduce the air movement so necessary to proper growth of grasses; if a tree grows too high or too low, it may be out of proportion to its surroundings. From this basic list, it is not hard to see how every aspect of the tree's growth habits should be considered when choosing the proper location.

2. Affected by Maintenance Equipment Operation—All too often trees are planted with little thought of the type of equipment used to maintain the area around them. It is easy to see the folly of planting trees 10 feet apart when the mower maintaining the area around them is 14 feet wide. A considerable amount of time and effort may be saved by simply spacing the trees a little farther apart to allow room for the mowing equipment to move between them easily. By the same token, trees are as often placed too close to other objects as they are to one another, creating the same space limitations on equipment.

Golf Course Vacuum Cleaner

Heinz Lessau, superintendent of the all-grassed golf course at New Mexico Institute of Mining and Technology in Socorro, possesses the rare combination of ingenuity and skill as a metal worker and welder. Out of a smoke vent from an old commercial stove, a metal and rubberized section of a carburetor from a junked B-29 bomber, a section of an air-conditioning vent, the frame of a three-wheel motor scooter, and a motor from a piece of farm equipment, he has fashioned a vacuum cleaner that copes with leaves that tend to clutter his fairways.

Besides picking up leaves, the equipment grinds them to tiny fragments and blows them out on the course. The total cash outlay to construct the vacuum cleaner machine was $75 and this was to purchase the 12-horsepower motor which operates the combination leaf grinder and blower. A miniature rubber-tire tractor is used to pull the machine about the links.

Lessau says the machine enables one person to perform the work of five or six men in the removal of leaves from the fairways.

This is only one of several machines Lessau has built. He has access to a supply of surplus military "junk" which he uses profitably in extending his golf course machinery budget. Lessau has adapted low pressure aircraft tires to farm tractors to lessen the damage to wet turf, he has devised a compost grinder, a dump trailer, and has improved spraying equipment. A fertile imagination, his skill as a metal worker and welder, a supply of odd parts and materials, pride of workmanship and a devotion to his job combine to make Heinz Lessau a valuable man on the staff of the New Mexico Institute of Mining and Technology.

On the Research Front

Turfgrass research has been accelerated greatly in the past decade. While it is impossible for the GREEN SECTION RECORD to carry accounts of all turfgrass research being done in the United States, the following abstracts will indicate the kind and amount of investigative effort being expended.

These abstracts are reproduced from *Agronomy Abstracts—1963*. They summarize the papers presented to the turfgrass division at the Agronomy Society's annual meeting, held in Denver in November, 1963.

Causal Factors in the Winter Injury of Turfgrasses

J. B. BEARD, Michigan State University

The causes and conditions resulting in winter injury associated with ice sheets were studied utilizing three grasses; *Poa pratensis* 'common,' *Agrostis palustris* 'Toronto,' and *Poa annua*. All vegetative materials were allowed to harden naturally in the field. On November 26, 1962, four-inch plugs were taken and the following treatments applied: (1) flooding, then freezing, (2) freezing, then applying thin ice layers, (3) freezing, then applying a snow layer followed by an ice layer, (4) placing in a sealed container and freezing, (5) bulk pressure freezing, (6) no treatment, and (7) submerging in water at 35° F. All treatments were held at 25° F. except for No. 7. At 15-day intervals, replicated samples from each variety and treatment were removed from the low temperature chamber, thawed, and placed in a 70° F. growth chamber. Results of this study showed that during the 90-day period winter injury by oxygen suffocation, toxic accumulations, cellular leaching, or outward water diffusion into ice was of no significant importance. No injury occurred in *A. palustris* while some injury was observed in *P. pratensis* with *P. annua* intermediate between the two.

The Effect of Various Mulches on Microclimate and Turf Establishment

R. E. BLASER AND D. G. BARKLEY, Virginia Polytechnic Institute

Experiments involve the effect of mulching materials and irrigation on microclimate and turf establishment. Straw, sawdust, Turfiber (wood fiber cellulose) and Soil Saver (jute net) moderated soil temperatures in the seed zone and improved grass germination, emergence, and growth. Soilset was not consistently beneficial to seedlings. Straw mulch tended to be more effective in moderating soil temperature and conserving soil moisture than the other mulches, but the results varied among the four experiments. Weeds and small grain were most prevalent with straw mulching. Sawdust improved turf establishment, but it washed off easily. Turfiber eliminated the introduction of undesirable plant species; had a favorable influence on soil temperature and moisture; and increased seedling germination, emergence, and growth. Soil Saver increased seedling height, weights, density, and soil moisture. Soilset conserved more soil moisture than no mulch, but soil temperatures were usually higher than for no mulch. Irrigation was usually beneficial with all grasses and mulches, but of least benefit with no mulch. Tall fescue was less sensitive to high temperatures than bluegrass.

Effects of Silvex on the Physiology and Survival of Colonial Bentgrass (*Agrostis tenuis*)

L. M. Callahan and R. E. Engel, Rutgers University

The purpose of this study is to determine the tolerance and the response of Colonial bentgrass to several rates of silvex under various environmental influences. Ten-week-old Colonial bentgrass seedlings were treated with ½, 1, 1½, or 3 pounds per acre of silvex and maintained in a growth chamber under 75-97° F., or 50-60° F., alternate temperatures. These tests were conducted in solution cultures regulated at a pH 7.0 or a pH 4.8 and short or long day conditions. The significant responses obtained showed that silvex caused much greater injury to Colonial bentgrass seedlings under high temperatures than under low temperatures. In general, a gradual decrease in root length and density and an increase in leaf burn occurred with increasing silvex rate. The most detrimental rates appeared to be 1 and 1½ pounds per acre. With low pH and long day conditions, silvex treatments appeared to give more severe action.

Fusarium Roseum as a Foliar Pathogen of Turfgrass

H. B. Courch and E. R. Bedford, Pennsylvania State University

Fusarium roseum was found capable of inciting severe foliar blighting of certain turfgrasses. Foliar infection by the pathogen is accomplished by both direct penetration of intact epidermal cells and by mycelial growth through cut leaf tips. Virulent strains of the organism have been isolated from commercial turfgrass seed lots. Using dew cabinets for post-inoculation environment, the interactions of three air temperatures (75° F., 85° F., 92° F.), three *F. roseum* isolates, and three turfgrass species (Highland bentgrass, Merion Kentucky bluegrass, and Illahee fescue) were studied. Quartz sand was used as the plant support medium and irrigations were accomplished with balanced Hoagland's solution. The inoculum was prepared by growing the isolates on a corn meal-sand medium. Inoculations were performed eight weeks from the time of seedling emergence. Disease incidence was rated on the basis of percentage plants blighted. Within the temperature range studied, all isolates were pathogenic to all turfgrass species. At certain air temperatures, however, the isolates differed significantly in degrees of virulence.

Response of Bentgrass Putting Green Turf to Various Ratios of N, P, and K

Roy L. Goss, Washington State University

This study is being conducted to yield information on bentgrass response to high and low levels of nitrogen, phosphorus, and potassium fertilization. Poor quality putting green turf is common when fertilizer levels are low and some serious problems arise as a result of intensive fertilization practices. From this study it is intended that a satisfactory level of N, P, and K can be derived for optimum fertility level maintenance. In this study, applications of 6, 12, and 20 pounds of N, O and 1.76#P, and O, 3.32 and 6.64# of K have been applied per 1,000 square feet per season. Treatments are arranged in a factorial design with four replications. Visual ratings have been made for three years on the basis of color, density, texture, and the incidence of diseases. The highest levels of N, P, and K have produced excellent quality turf during cool portions of the year, but degenerate in quality during July and August. The lowest fertility levels appear best during the hotter months. Extremely wide ratios of N:P have resulted in inferior turf. The intermediate level of N, P, and K consistently produce superior quality turf with the least amount of disease.

Seasonal Relationships between Nitrogen Nutrition and Soluble Carbohydrates in Leaves of Four Turfgrasses

D. G. GREEN AND J. B. BEARD, Michigan State University

The objectives of this study were (1) to determine the levels of applied nitrogen necessary to cause carbohydrate reserves to become a growth-limiting factor, and (2) to determine the quantitative effects of various nitrogen treatments on the individual sugar fractions which compose this carbohydrate reserve. *Agrostis palustris* 'Toronto,' *Poa pratensis* 'Merion' and 'common,' *Lolium perenne* 'common' and *Festuca rubra* 'Pennlawn' were the grasses studied. Nitrogen treatments providing 0, 3, 6, 9 and 12 pounds of actual nitrogen per 1,000 square feet per season were administered in one application and in six monthly applications. Nitrogen applications of 6, 9, and 12 pounds uniformly lowered all carbohydrate fractions with the three-pound treatment having an intermediate effect. Oligosaccharide generally disappeared at nitrogen levels above three pounds, while fructosan remained in trace amounts. Sucrose, glucose and fructose appeared to maintain adequate levels under all nitrogen treatments.

Response of Common Kentucky Bluegrass and Red Fescue to Several Levels of Phosphorus

F. V. JUSKA, A. A. HANSON, AND C. J. ERICKSON
USDA Agricultural Research Service

In the greenhouse, common Kentucky bluegrass and red fescue were compared in a complete factorial with six levels of phosphorus (0-1745 pounds per acre), two pH levels (4.5 and 6.5), two levels of N, and two soils (sandy loam and silt loam). Cultures were clipped weekly at a height of two inches and treatments evaluated in terms of dry weight of clippings, crowns, roots, and rhizomes. Yield of plant material was greater for silt loam, red fescue, pH 6.5, and three pounds of N per 1,000 square feet. Red fescue outyielded bluegrass at all levels of P in total weight of plant material. The two grasses showed a large increase in the weight of clippings at both pH levels with the first increment (109 pounds) of P. For bluegrass, an increase in clipping weight was obtained for each increment of P through 1,746 pounds, whereas the yield of red fescue declined after the 873-pound level. Red fescue produced a larger quantity of roots than bluegrass at each level of P and at each pH level. The weight of bluegrass rhizomes increased with each increment of P to 873 pounds per acre, after which a sharp decline was noted at pH of 6.5 and to a lesser degree at pH of 4.5.

Growth and Anatomical Characteristics of Zoysia

W. C. LECROY AND W. H. DANIEL, Purdue University

Zoysia is a slow growing, warm season, sod-forming grass that can be used for many turf purposes. The use of this species as a covering for playing fields has been limited due to the very dense turf formed. This study was initiated to find the relationship of growth rate and internode length to several environmental factors. An anatomical study also was carried out to see if the structure of the plant would help in answering some of the questions concerning Zoysia growth habits in relation to environmental factors. Measurement data from the field, when subjected to statistical analysis, showed the following relations: growth rate was dependent on internode length, growth rate and internode length was correlated with minimum air temperature, and the number of leaves per square inch became less as the growth rate and internode length increased. As a general rule those plants that stop growth first in the fall are the ones which start regrowth first in the spring. The anatomical structure of the Zoysia stem and root is typical of a festucoid grass plant. The differences noted in above and below surface stems are ones which would be expected. The Zoysia leaf is composed of a large number of vascular bundles, varying from a wedge to a round shape arranged in an orderly sequence across the leaf.

Tolerance of Five Turfgrass Species to Soil Alkali

O. R. LUNT, C. KAEMPFFE, AND V. B. YOUNGNER
University of California at Los Angeles

Yolo loam was made alkali by treatment with Na_2CO_3 to produce six levels of ESP ranging up to about 30. For all ESP treatments, a Krilium (VAMA) treated series was compared against soils not so treated. ESP levels were maintained by irrigation with solutions containing a total of 5 me. per liter of $NaNO_3$ and $Ca(NO_3)_2$ adjusted to give SAR values up to about 22. Allowing for a projected two-fold increase in the soil solution due to evapotranspiration, these solutions maintained the ESP's in approximately the desired range. All grasses proved to be tolerant to ESP levels up to about 15. Above this level increasing sensitivity to ESP was observed in the following order: Seaside bentgrass, Kentucky bluegrass, alta fescue, common bermuda, Puccinellia. Treatment of the soil with Krilium improved growth by about 10 to 50% at nearly all ESP levels with bermuda, Kentucky bluegrass, and Seaside bent, but had little effect on the growth of alta fescue or Puccinellia.

Vertical Distribution of Dry Weight and Chlorophyll in Turf

JOHN H. MADISON, Department of Landscape Horticulture
University of California, Davis

Plots of *Poa pratensis, Agrosis tenuis* 'Highland' and *Agrostis palustris* 'Seaside' were established at various mowing heights from 1/4 to 2-1/2 inches. The plots were mowed down in increments and the dry weight and chlorophyll of each increment was obtained. The data showed no effects of shading on chlorophyll development in turf mowed less than 7/8 inch. Below

1/2 inch the chlorophyll contained in new growth after mowing was a major fraction of that present. The full photosynthesizing capacity of turf in terms of chlorophyll was reached when turf was mowed 1-3/8 inches or higher. Dry weight continued to increase with increasing height but the greatest rate of increase occurred between plots mowed 1/2 inch and 7/8 inch. The center of chlorophyll concentration was above the center of gravity of the turf. Highland bent appeared to grow optimally mowed at one inch or above two inches. Between these heights it produced false crowns and failed to make increasing increments of dry weight with increasing height.

Effect of a Tallow Alcohol, a Non-ionic Wetting Agent and a Polyethylene Glycol on Foliar and Root Development of Kentucky Bluegrass

ELIOT C. ROBERTS AND DAVID P. LAGE, Iowa State University

Kentucky bluegrass was grown for four months in solution culture before treatment with standard nutrient solutions modified as follows: Carbowax 1000 was added to produce osmotic pressures varying from 2.6 to 9.6 atm.; Aqua-Gro was applied at rates to produce surface tensions of from 35 to 45 dynes/cm.; Hexadecanol was added at rates of from 25 to 200 pounds/acre. Effects of these solution modifications on growth of foliage and roots were determined. Osmotic pressures of the nutrient solution above 6.0 atm. were extremely detrimental to plant growth. Production of foliage was increased up to 2.5 atm. when greenhouse temperatures were within the range of 70 to 80° F. Decreases in surface tension decreased fresh and dry weight yields of foliage. Hexadecanol increased fresh and dry weight yields of foliage. Root development was increased with increasing osmotic pressure and decreased with decreasing surface tension. Hexadecanol in the nutrient solution stimulated root growth. Variations in osmotic pressure and surface tension of root zone solutions affect turfgrass production. Turf response to Hexadecanol was favorable.

Effect of Soil Mixture and Cover on Residual Activity of Poa Annua Herbicides

R. A. SCHWABAUER AND N. R. GOETZE, Oregon State University

Greenhouse studies, using *Poa annua* L. as a bioassay to determine influence of cover and soil mixture on residual activity of herbicides, demonstrated significant interaction between herbicides and cover and herbicides and soil mixture. Four soil mixtures, including sand, clay, sand-organic matter, and clay-organic matter, were compounded. Equal volumes of seed were sown on all plots and covered with either sand or organic matter stripped from a Highland bentgrass lawn. Nine herbicides were applied at various rates. Counts of healthy plants were made two weeks after planting. Residual activity of herbicides was measured by replanting four and eight weeks after original herbicide treatment. Diphenamide at 4, 6 and 8 pounds per acre, and trifluralin at 1 and 2 pounds per acre had strongest residual activity eight weeks after treatment. Endothal and one of its analogs exhibited better residual activity under sand cover; two experimental herbicides had better activity under organic matter cover. Trifluralin, zytron, and two experimental herbicides had best residual activity in sand-soil mixture; endothal, dacthal, and another experimental herbicide had highest activity in clay-organic soil mixture.

Evaluation of Cool Season Grasses for Winter Overseeding of Southern Golf Greens

C. G. WILSON, O. J. NOER AND J. M. LATHAM, JR.,
Sewerage Commission of the City of Milwaukee

Four years' evaluation of overseeding individual grasses and mixtures at various locations in the South indicate that the latter are superior to individual grasses. They provide the best season-long playing conditions and color, with no spring transition problems. The best quality ratings were from a mixture of *Poa trivialis,* Pennlawn creeping red fescue and Seaside bentgrass. Kentucky bluegrass increased over-all quality in the Florida and Gulf Coast areas. Domestic ryegrass winterkilled in the upper South in early 1963. Seeding rates are dependent upon seedbed preparation. The 1962-1963 results show that rate of seeding can be reduced by thorough seedbed preparation and sandwiching the seed between heavy and light topdressings.

Influence of Several Environmental Factors on Flowering of Bermudagrass

V. B. YOUNGNER AND S. E. SPAULDING, University of California

Flowering of 10 selected bermudagrass clones of common parentage was studied under several controlled environmental conditions. Low temperature pre-treatment induced early flowering of all clones but significantly reduced the total inflorescence production for three clones as compared with the controls. All clones flowered at photoperiods from eight to 20 hours with maximum flowering occurring at day lengths of 14 hours or greater. Moderate day temperatures (70°-75° F) with cool nights (60°-65° F) were most favorable for flowering. Differences between clones for total inflorescence production were highly significant.

COMING EVENTS

January 24

U. S. Golf Association
Green Section Educational Turf Conference
Biltmore Hotel
New York City, N. Y.

February 9-14

GCSAA's International Turfgrass Conference and Show
Philadelphia Sheraton Hotel
Philadelphia, Pennsylvania

February 24-25

Southern Turfgrass Conference
Memphis, Tennessee

February 24-27

Turfgrass Conference
Cornell University
Ithaca, New York

March 5-6

Turfgrass Conference
University of Massachusetts
Amherst, Massachusetts

March 18

Turf and Grass Conference
South Plains College
Levelland, Texas

March 18-19

Turf Short Course
University of Maine
Orono, Maine

Mat and Thatch
Cause, Effect and Remedy

By **MARVIN H. FERGUSON,** Mid-Continent Director and National Research Coordinator, Green Section, The United States Golf Association

Much of the trouble that occurs on turf and especially on greens can be attributed to accumulations of mat and thatch. Mat and thatch are terms which often are used interchangeably to describe a condition where excessive vegetation has accumulated. The two terms do relate to different conditions, however, and the remedial operations must be chosen to combat the particular condition which may exist. It may be useful to define the two conditions.

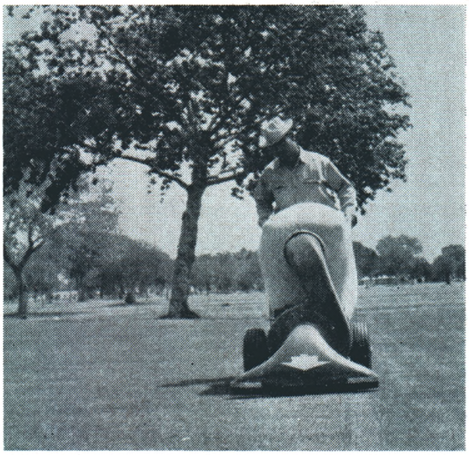
Mat—*thickly overgrown and tangled mass of vegetation. In turf, undecomposed mass of roots and stems hidden underneath green vegetation. Associated with sponginess or fluffiness in turf.*

Thatch—*an accumulation at the soil surface of dead but undecomposed stems and leaves.*

Mat

It is possible, of course, for mat and thatch to occur together but either of the conditions may occur singly. Mat is the more common condition. It occurs as the result of (1) rapid growth, (2) a growth habit that produces a tangle of prostrate stems and leaves, or (3) from faulty mowing practices. Because mat is characterized by sponginess, it contributes to a lack of "trueness" in the putting surface. Uneven mowing, scuffing, and scalping are some of the first signs that the casual observer will note when mat begins to build up.

A matted condition contributes substantially to an environment which encourages disease activity. High humidity may occur in the mat; fungus organisms are harbored and are protected from fungicide sprays. The mat serves as a source of inoculum and when traffic presses healthy turf down against the mat, a favorable situation for fungus attack is created. The grass is bruised and forced against a fungus harboring medium.



Julian Serna, superintendent of the Albuquerque Country Club golf course, demonstrates a vacuum cleaner type of machine for picking up the clippings following the use of a vertical mower.

Fortunately, mat usually can be eliminated without doing more than superficial damage to the turf. Close mowing, coupled with raking or vertical mowing, will remove much of the excess vegetation and will cut or remove the tangle of prostrate stems and leaves. (See accompanying photos.)

Turf may be discolored temporarily from the removal of a substantial amount of vegetation, but because we are dealing with living turf plants, growth will occur to renew the color and density in a short while.

Topdressing is one of the chief tools for combating mat, but ordinarily it should be used with practices such as raking or vertical mowing. Topdressing on top of a mat and failure to get the soil materials in contact with the surface of the soil below will create a buried layer of organic matter. Layers of this kind impede the movement of water and are sometimes associated with very shallow root systems.

Thatch

Whereas mat is considered to be an accumulation of excess growth that is alive, thatch is a layer of dead but undecomposed vegetation. We have said that mat and thatch sometimes occur together and sometimes singly.

Thatch is considered to be a more serious problem because of the difficulty associated with its removal. It is beneath the living turf and consequently removal of the thatch also implies removal of some of the living material overlying it.

Thatch occurs because of an abundance of heavy clippings, the shading and destruction of lower leaves by a heavy overlying mat, or from slow decay of dead plant parts. Slow decay is difficult to understand when we know that efforts to build organic matter in a soil are largely unsuccessful because of rapid decomposition.

One fact which may provide a clue to the reason for slow decay is that a frequently topdressed turf seldom produces a thatch. The mixture of soil with the dead vegetation contributes to a more rapid breakdown. It has been suggested that the relatively thin layer which is involved in thatch may be lacking in some material which is necessary for decay. Could high acidity (low pH) create an environment unfavorable to the activity of the appropriate microorganisms? Could there be a lack of calcium or of nitrogen in this layer? Might the use of fungicides on turf suppress the activity of the decay organisms? Such questions cannot be answered at the moment.

While we may not understand completely the causes of thatch, the effects are well known. Thatch interferes with water movement. It holds excess water near the surface and thus contributes to disease activity, the germination of weeds, and shortened root systems. Paradoxically, when thatch becomes dry it is very difficult to rewet. It then sheds water and is the cause of localized dry spots.

Topdressing, applied over a thatch in too heavy amounts, will create organic matter layers with the attendant difficulties. Topdressing, however, is one of the chief tools to be used in the prevention as well as in the elimination of thatch. Topdressing is best used in conjunction with aerification or cultivation. Holes or slits

A putting surface which has just been vertically mowed. Note the fine, parallel grooves. After mowing with a putting green mower, this green may be temporarily off color but it will be "truer" and more nearly free of grain than before.

made through the turf permit topdressing material to be worked down into contact with the underlying soil. These closely spaced channels offset any tendency of the buried thatch layer to impede the movement of water.

It has been noted that soil or compost brought into intimate contact with organic matter accumulations hastens the decay of that material. This topsoil or compost usually contains the nutrients which would be necessary for the growth of microrganisms. Nitrogen may be especially important in bringing the carbon-nitrogen ratio into a favorable balance.

Cultivation alone may be of considerable value in reducing surface accumulations. It creates channels favorable to water penetration and it deposits soil on the surface which filters back down through the turf. This soil imparts some of the benefits of topdressing.

As is the case with most troubles, the prevention is far easier than is the cure. Regular programs of raking, vertical mowing, cultivation and topdressing will almost guarantee freedom from mat, thatch, and many of the ills to which these conditions contribute.

Care of Sprayers*

The sprayer should be cleaned thoroughly after each spraying operation since many herbicides are corrosive, causing scale to form, in addition to damaging parts of the pump, pressure regulator and nozzles.

When 2,4-D esters or oil soluble materials have been used:

1. Rinse the sprayer system with kerosene.

2. Put in one or two pounds of washing soda to 30 gallons of water or one quart of household ammonia per 30 gallons of water.

3. Allow this to remain in the sprayer for several minutes. Then start the sprayer and circulate it through the system.

4. Drain the sprayer.

5. Rinse the sprayer again with water and drain.

When 2,4-D amines or other water soluble salts have been used:

1. Rinse the sprayer system with either one or two pounds of washing soda or one quart of household ammonia in 30 gallons of water. Allow the solution to stand in the sprayer for several minutes; start the pump and circulate it through the system. Then drain the sprayer.

2. Rinse the sprayer system with six to eight ounces of liquid detergent in 30 gallons of water and drain.

3. Rinse the sprayer system with water and drain.

To prevent rust or corrosion, flush the sprayer system by pumping through it a solution of automobile radiator rust inhibitor in water (½ cup per gallon of water) and drain. Kerosene or fuel oil will not prevent rust or corrosion.

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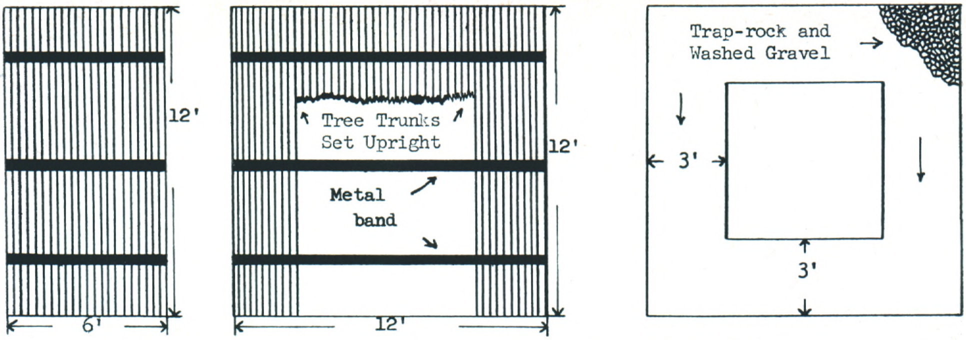

Filter Box Controls Sediment in Water Systems

By ALEXANDER M. RADKO, Eastern Director and LEE RECORD, Northeastern Agronomist, Green Section, The United States Golf Association

Sediment in suspension, leaves, debris, plant growth, and all foreign material in a pond or lake often make their way into the pump and lines of the irrigation system. This problem sometimes occurs in golf course irrigation systems. To prevent this, Supt. Eb Steineger conceived the idea of filtering the water at the Pine Valley Golf Club, Clementon, N. J., with a filter box pictured above.

Two squares of tree trunks of three to four inch diameter are constructed, one 12 foot square frame and one six foot square frame. The trees are set upright into the pond which is 12 feet deep, like pier poles and are banded together by steel strips screwed into the trees. Inside the two sets of frames, he placed traprock, similar to that used on railroad beds, and washed gravel. The suction pipe then draws only clear clean water from the center of the frame and by gravity flows to the pump.

The intake pipe is set in the center of the filter box approximately five feet from the bottom. Every few years when the lake is drained, the leaves and foreign material are cleaned from around the outside of the filter box. This filter box has functioned properly since 1934.

OOPS—WE ERRED!

The article "A Double Victory Over Winter-Spring Injury" which appeared in the September, 1963, issue of the GREEN SECTION RECORD stated that "not one square foot of sod was laid prior to the Championship date." Sorry to say we erred, as a few plugs and sods were used on greens; but to quote Charles L. Peirson, Chairman of the Green Committee of The Country Club, "No large areas were completely sodded and probably 99% of the damage recovered was due to steps taken in your article."

The author, A.M. Radko, in several consultation visits to Brookline prior to the Championship, did not detect any fresh sodding work on greens, so expertly was it done. In discussions with John Kealty, course superintendent, Mr. Radko apparently interpreted Mr. Kealty's remarks to mean that the only sod work was done in prior years when winter injury occurred.

Sorry, the author four-putted this one!

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TURF TWISTERS

CARTS AND PATHWAYS

Question: How close should golfers run their hand pulled carts to the green? (CALIFORNIA)

Answer: We believe that the secret may not be in keeping them at any definite distance from the green, but in varying the pathways that they follow. We have noted that in some places where a line is placed a certain distance from the green, the golfer will go as close as possible and proceed to drive on the turf just beyond the line. It seems to make little difference whether this line is close to the green or some distance from it. However, if you can vary this distance from week to week, they don't always place the carts in the same place; and you will have better luck in maintaining turf.

SAND GREENS AND MIXTURES

Question: What is the most nearly "ideal" sand for use in a putting green—one with fairly uniform sized particles or one with non-uniform size particles? (TEXAS)

Answer: We usually think that uniform sand size is desirable because it will not compact as much as one with variable particle sizes. But then, of course, a sand of uniform size usually must be mixed with materials of smaller particle size to produce a satisfactory mixture. On the other hand some non-uniform sands will almost provide the desirable mixture accidentally. Therefore, the only sure way to determine the desirability of any given sand is to determine the physical characteristics of the final mixture. This is the only valid determinant.

TURF INSECTS AND CONTROL

Question: I am interested in ascertaining the results of any work that has been done on the control of insects in turf grasses by systemic insecticides. Could you furnish me with information or publications on this subject? (COLORADO)

Answer: To our knowledge, there is no record of successful use of systemic insecticides for the control of insect pests on turf. As a matter of fact, we do not know of any research in this field of study.

Perhaps the reason for this lack of investigation is the fact that most of the systemics are of a toxic nature as far as humans are concerned and most turf areas are rather heavily used. It is for this reason that our agronomists do not recommend the more potent types of insecticides.