May 1969

USGA GREEN SECTION RECORD

A Publication on Turf Management
by the United States Golf Association

USGA GREEN SECTION RECORD

A Publication on Turf Management by the United States Golf Association

VOL. 7, NO. 3 **MAY 1969**

COVER PHOTO:
Injecting systemic insecticide into the soil to be taken up by roots.

Published six times a year in January, March, May, July, September and November by the UNITED STATES GOLF ASSOCIATION, 40 EAST 38th ST., NEW YORK, N. Y. 10016. Subscription: $2 a year. Single copies: 35¢. Subscriptions and address changes should be sent to the above address. Articles, photographs, and correspondence relevant to published material should be addressed to: United States Golf Association Green Section, P. O. Box 567, Garden Grove, Calif. 92642. Second class postage paid at New York, N. Y. and additional mailing offices. Office of Publication: 40 East 38th Street, New York, N. Y. 10016

Editor: William H. Bengeyfield **Managing Editor: Robert Sommers**

Art Editor: Miss Janet Seagle

Green Section Committee Chairman: Henry H. Russell, P.O. Box 697, Miami, Fla. 33157

Green Section Agronomists and Offices

EASTERN REGION
P.O. Box 1237
Highland Park, N. J. 08904
Alexander M. Radko, Director, Eastern Region and National Research Director
A. Robert Mazur, Eastern Agronomist
James W. Timmerman, Eastern Agronomist
(201) CH 9-0225

SOUTHERN REGION
P.O. Box 4213
Campus Station, Athens, Ga. 30601
James B. Moncrief, Director, Southern Region
Holman M. Griffin, Southern Agronomist
(404) LI 8-2741

MID-CONTINENT REGION
Room 905
211 East Chicago Avenue, Chicago, Ill. 60611
F. Lee Record, Mid-Continent Agronomist
(312) 943-5022

WESTERN REGION
P.O. Box 567
Garden Grove, Calif. 92642
William H. Bengeyfield, Director, Western Region and Publications Editor
G. Duane Orullian, Western Agronomist
(714) 638-0962

Distribution of systemic through the leaf veins.

Systemics, A New Help in Pest Control

by **G. DUANE ORULLIAN,** Agronomist, USGA Green Section

Since Leonardo da Vinci suggested that arsenic be introduced into fruit trees to control pests systemically, man has become increasingly fascinated with the idea. The possibility of allowing the sapstream to move toxicants throughout the plant for the control of pests is an intriguing one. This group of chemicals is referred to commonly as "systemics," and includes certain insecticides, fungicides, nematocides, and a few herbicides.

WHAT ARE SYSTEMICS?

A systemic pesticide is a chemical that is absorbed by the roots, foliage, or other areas of the plant and translocated in the sap to all parts of the living host plant. In turn, pests feeding on the treated host take up the chemical and are killed.

Systemic chemicals are available in a variety of formulations such as liquids, granules, and wettable powders.

Even the modern concept of systemics is really not new. In 1936 A. M. Hurd-Karrer and F. W. Poos in an article in **Science Magazine** revealed that aphids and red spider mites died within a few days when allowed to feed on a nutrient solution containing selenium. This chemical is very toxic to man and animals and should not be used on soils growing food and forage plants.

Plants are also subject to toxicity from selenium. For these reasons its present use is very limited. In addition, selenium has exhibited extended life when incorporated in the soil structure.

Bordeaux mixture and derris (rotenone) are very old chemicals which have also exhibited systemic activity.

HOW DO THEY WORK?

"Uptake," according to D. M. Norris, University of Wisconsin, "involves those phenomena that account for the movement of systemics from the points of application to the soil or

plant into the sites where vascular transport in the phloem or xylem tissues is initiated." Uptake may occur through all portions of the plant. The unique properties of systemics can be more effectively utilized by the plant when the uptake proceeds through the roots. In the case of trees and shrubs, the basal trunk is also included.

Systemics enter the root structure of plants by two methods: passive or active entry. A. S. Crafts from a text **Translocation in Plants** reports:

"Passive entry means that chemicals in the soil solution continue into the root structure via the so-called 'outer' or free spaces within or between the cells."

In 1965 D. M. Norris stated that: "Active entry involves absorption of chemicals through cell walls, adsorption on or absorption through membranes associated with protoplasm, and then subsequent transfer along and through such membranes into vascular tissues (i.e., phloem and xylem)."

The xylem and phloem are composed of elongated cells adapted to the movement of materials through the plant. The xylem provides mechanical support and conducts water, minerals, and undissolved salts upward from the roots through the plant. Xylem tissues are of primary importance to the transfer of systemics within the plant system.

The phloem is the channel through which soluble foods are conducted downward from the leaves through the plant. Ray tissues are bands of cells extending horizontally through both xylem and phloem. These same ray cells are significant in food storage and in the lateral conduction of food and water. They appear to be of major importance in the ingress of systemics. The accompanying diagram may help to clarify the relative positions of these vital plant tissues.

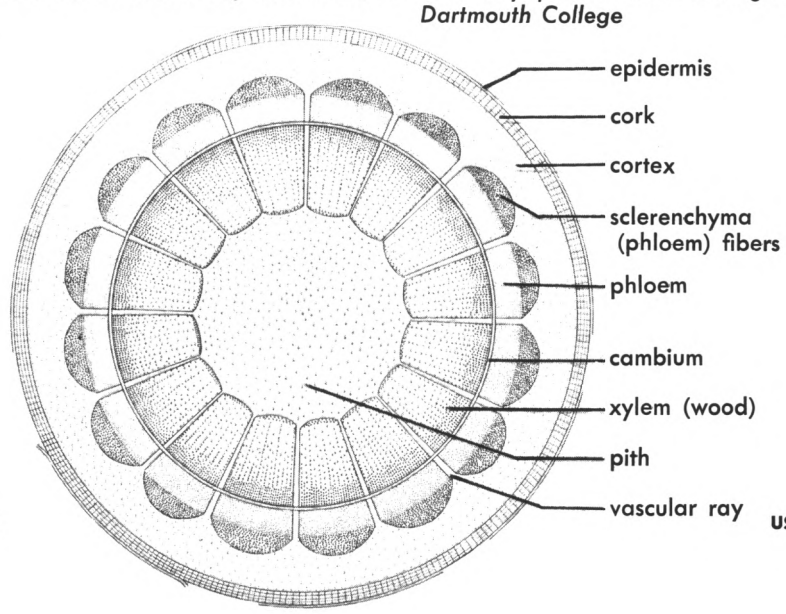
By making use of the soil-root direction of uptake for systemic treatments, we take advantage of the plant's most obvious and important organs of nutrient and water uptake, its root structure. The utilization of the soil as a passageway for systemics into the plant has, however, resulted in problems. Certain systemics such as Phosdrin (melvinphos) have been rapidly broken down. H. T. Reynolds in "Advances in Pest Control Research" (1958), states that heavy clay soils exhibit the tendency to absorb systemic chemicals. In addition, A. D. Hanna and J. Nicol in "Nature" (1955) discuss the problem of leaching, evaporation, and decomposition of chemicals by soil organisms. Generally, soils of high organic content serve to speed up the "breakdown" of chemicals.

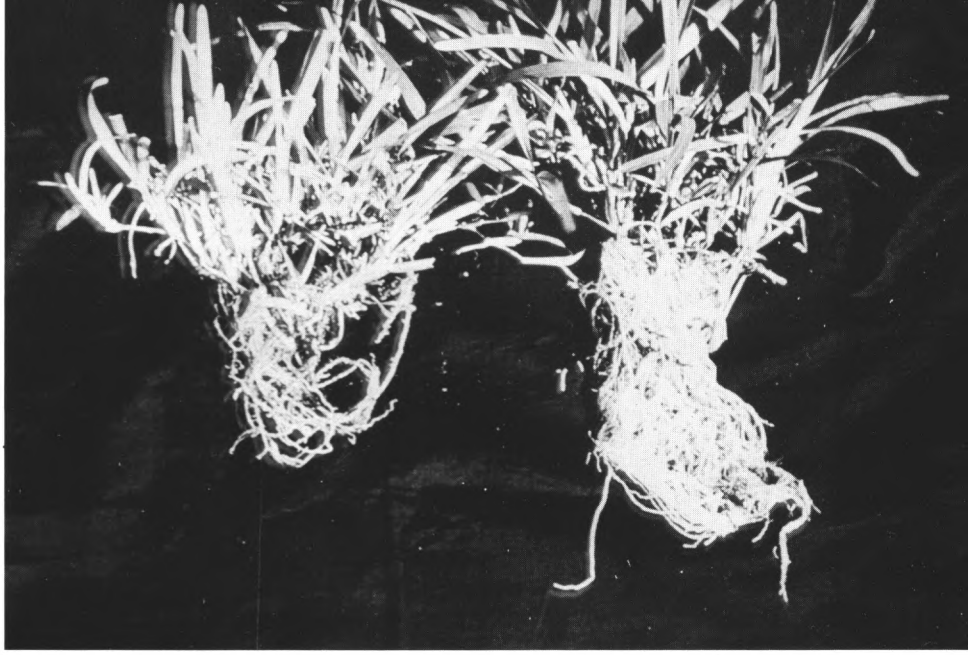
Translocation occurs once the systemic has entered the plant. It is the process by which nutrients, chemicals, and water are moved through the vascular system (phloem and xylem) to all parts of the plant. Present knowledge concerning the transport of foreign chemicals within plants is disturbingly limited—especially in grasses. However, radioactive tracers are being used to some degree for translocation studies. We will know more in the future.

Transpiration greatly influences the direction and rates of movement of systemics in the xylem of trees. Adequate, uniform distribution of systemics within trees and shrubs is still the most limiting factor in the effective use of these types of chemicals. Very little movement downward occurs to the roots from the trunk in trees.

Seasonal growth cycles in plants, especially trees and shrubs, greatly affect the rate of movement of systemics. Application of systemics in January and February in northern climates prove ineffective due to a lack of vascular activity. Growth processes of most plants are

Cross-section illustrating vital tissues of a woody plant. Line drawing by Hannah T. Croasdale, Dartmouth College





Roots of St. Augustine grass, the specimen to the left showing nematode damage, the right showing the response from systemic, Dansanit.

very sluggish at temperatures of about 40°F or below, but increase as temperatures from 70° to 90°F are reached.

HOW ARE THEY USED?

There are three ways in which systemics may be introduced to the plant: soil applications with either granules or a liquid drench, trunk injections, or foliar sprays. Granules are easier to handle and are reasonably safe. They may be used as a broadcast treatment, side dressing, or mixed into the soil. Soil treatments are recommended where underground pests feed on roots. The liquid drench is also a relatively easy way to apply these materials.

Trunk injections or basal trunk banding have been the most effective for trees and shrubs. Foliar sprays on trees are good for rapid response, but they do not have the lasting qualities of the other methods. This is true mainly because the foliage area of the plant does not absorb systemics as readily as the root system. Uniform application of systemic material to the plant is important for faster, more effective distribution throughout the tissues.

Systemics must be used only on plants indicated on the label accompanying the package. Experimental plots established by the uninitiated may be interesting, but may also cause severe injury to plants that are not included on label recommendations. This is due to varied physiologic responses between and among assorted plant species.

WHAT WILL THEY CONTROL?

The golf course superintendent is confronted with a host of pests which harm turf and ornamentals. Generally speaking, present labels of various systemic chemicals include the following types:

Insects: aphids, leaf miners, thrips, leafhoppers, scales, sod webworms, cutworms, lace bugs, whiteflies and mealybugs.

Mites: various species.

Nematodes: stylet, meadow, pin and root lesion.

Diseases: snow mold, Pythium blight, dollarspot, stripe smut of bluegrass, Pucinia rust of bluegrass and powdery mildew.

Sucking insects such as aphis and leafhoppers are quite easily controlled. Scale insects such as San Jose scale, which inhabit the upper portions of trees, are more difficult. This occurs when large populations build up on plant surfaces. Chewing insects, if they are feeding on roots, can be easily controlled with soil applications.

WHERE CAN I USE THEM?

Systemic pesticides are now being developed for control of an ever increasing number of pests. However, present recommendations for turf are disturbingly scanty. Systemic insecticides thus far have practically ignored turf in label recommendations. In most cases the species of turf to treat is not specified. It is quite evident that research has not kept pace in systemic chemical resignations for turfgrass.

In reading the following, trade names are used for illustration purposes only and are not intended as recommendations or endorsement.

Zectran, a relatively new carbamate systemic, has been shown to be beneficial for control of sod webworms, cutworms, snails and slugs. Two granular systemics called Thimet (phorate) and Dasanit (fensulfothion), are listed for certain nematodes. A prominent pest in bermudagrass known as the Rhodes grass scale is listed as being controlled by Meta-Systox-R (oxydemetonmethyl).

Systemic fungicides are just beginning to come into view, and great developments may lie ahead. A new product called Benlate (DuPont 1991) produced good control of **Selerotinia** dollarspot and stripe smut of bluegrass. This new product was also listed as a benefit in controlling powdery mildew in ornamental trees and shrubs in addition to soil-borne diseases such as **Rhizoctonia, Fusarium, Verticillum** and **Botrytis**.

Tipula sp. snow mold and **Pythium sp.** in winter overseeded turf are listed for control with Demosan (chlorneb). Finally, a chemical compound known as Plantvax has shown control of **Pucinia** bluegrass rust. Of the grasses, bermudagrass, bents and bluegrasses have been specifically mentioned for fungicide systemics.

Some of the ornamental plants presently covered for use with various insecticide and fungicide systemics include roses, birch, boxwood and oak in the broadleaf category. Evergreens include cedar, pine, fir, and arborvitae. Certain flowering plants may also be protected by systemics, including perennials such as gladiolus, iris, and carnations. Some annuals represented are azaleas, camellias, dahlias, chrysanthemums, and daffodils.

HOW LONG DO THEY LAST?

The longevity of any chemical is an important factor in its effectiveness. The constant variables such as soil types, leaching, heat, moisture, light intensity, and wind have a definite bearing on the residual life of all chemicals.

The systemic persistence of chemical action within a plant is influenced by extended uptake. White pines 20 to 30 feet tall when injected with a systemic known as Chipman R-6199, and using 16 grams per tree, controlled sawflies for two years after treatment. Reports also indicate that this same chemical was good for control of elm bark beetle in elms for two growing seasons. H. Eidman in 1963 obtained control of insects on pines and birch for one year using 5 per cent Meta-Systox-R.

The dosage of a systemic when injected into a tree also influences the persistence of chemical action in that plant. D. M. Norris and H. C. Coppel in the **Journal of Economic Entomology,** (1961), found that eight grams of Bidrin injected into white pines gave 75 per cent mortality of sawflies up to one year after treatment. Four grams of the same chemical failed to give such control. Successful demonstrations as these indicate that longer periods of control are possible. This does not hold true for all systemics, however, since they vary greatly in chemical composition.

Some tree systemics exhibit such great persistence that at the time of leaf fall the surrounding environment is contaminated by leaves from previous chemical treatments. Systemics of this type cannot be used commercially.

WILL THEY HURT THE GOOD BUGS?

It has been said by some that "the only good bug is a dead bug." This rather bold statement is far from being true. Ninety-eight per cent of all known insects are either predators or parasites of one another. Most conventional insecticides such as DDT have delivered a terrible blow to beneficial insect populations. These "friends" play a vital role in the balance of nature.

It is important not to contaminate the environment with undesirable chemical residues. This is where systemics shine! Because a systemic is confined inside the plant, people, domestic animals, and beneficial insects do not come into direct contact with it.

Also, systemics are not lost through external weathering action. They are incorporated within the plant sapstream and are well barricaded by the exterior areas of the plant.

WHAT SYSTEMICS ARE AVAILABLE?

Thus far, most systemic chemicals have been quite poisonous and have required extra care in handling. New label registrations and a variety of new systemic materials are coming on the market this year. They cover a wide range of ornamentals and turf with broad spectrum control for a great variety of insects and diseases.

Following is a list of systemics presently in use:

INSECTICIDES

Baygon (propoxur)
Bidrin
Cygon (dimethoate)
Dasanit (fensulfothion)
Di-Syston (disulfoton)
Meta-Systox-R (oxydemetonmethyl)
Phosphamidon (dimecron)
Systox (demeton)
Thimet (phorate)
Zectran

FUNGICIDES

Benlate (DuPont 1991)
Demosan (chloroneb)
Plantvax (F-461)
Vitavax (D-735)

SUMMARY

All chemicals have advantages and disadvantages, depending on a particular situation. None of them are sure fire. Although the initial cost of systemics seems high, their use can be justified when they give control over an extended period of time. This will result in dollar savings for labor and material.

Price ranges of systemics generally vary from $20 to $25 a gallon for liquids and 25 to 30 cents a pound for granules. This is somewhat misleading, however, because the rates recommended for each product vary.

Systemics are quite easy to apply with many formulations to choose from. Extra care should be taken during application to insure proper rates and coverage. This in turn enables more effective absorption and distribution within the plant tissues.

Phytoxicity can result from excessive dosages. When leaves transpire, these high concentrations of chemical salts accumulate and marginal leaf burns appear. The idea that "if one ounce is good, three is better," is to be avoided when using systemics.

Soil application of systemics exhibit reduced effectiveness occasionally. Hydrolysis from alkaline waters and absorption onto muck-type soil particles contribute to this. Once the systemic has been absorbed by the plant, however, it is protected from "weathering off." This provides long-lasting residual control.

Systemics control a fairly broad range of insects and diseases. In the case of trees, pests which attack the leaves and young twigs are readily killed because most of the systemics concentrate in these areas. Pests which attack the trunk and vascular tissues in trees and shrubs are less vulnerable. The problem here is one of keeping the chemical in the tissue long enough to do the job. Frequently it moves to the leaves too rapidly.

Some systemic materials take longer to actuate with the plant system because of insolubility. This can be a benefit, however, because chemicals of this nature are not readily lost by rapid translocation throughout the plant system.

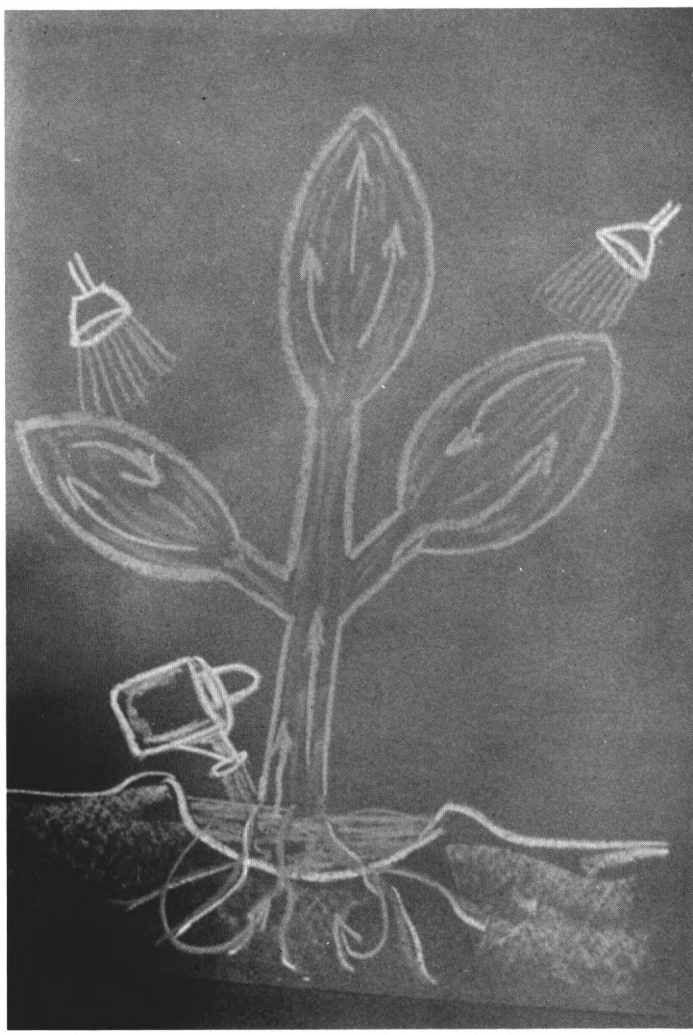
Systemics will occupy an important area of pest control in the future. Such new developments as impregnation of systemics onto particles of fertilizer and soil amendments is already a reality.

We may be able to establish control programs that will include a variety of situations on the golf course. Think of what it would mean if with a single application of a systemic we might obtain control over such pests as frit fly, **Pythium** blight and Dutch elm disease.

Such built in protection would save many dollars in pest control and labor. The superintendent would then have additional time to devote to other turf management requirements. His program would move that much farther ahead.

"The future always holds something for the man who keeps his faith in it."

H. L. Hollis



Uptake from both soil and foliar applications of systemics.

60 Days of Trouble with Pythium Blight

by PAUL M. ALEXANDER, Clemson University

The severity of **Pythium** blight on both bentgrass and bermudagrass golf greens in the Piedmont area of the South from June 26 through August 26, 1968, will be remembered for many years. Many courses, especially those with bentgrass greens, will not be fully recovered until late spring or early summer of this year in spite of the best efforts of fully capable superintendents.

Pythium blight, sometimes called cottony blight or greasy spot, can be caused by any one of three species of **Pythium** (2, 9, 10, 11, 12):

Pythium aphanidermatum (Edson) Fitzpatrick

Pythium ultimum Trow

Pythium myriotylum Dreschler

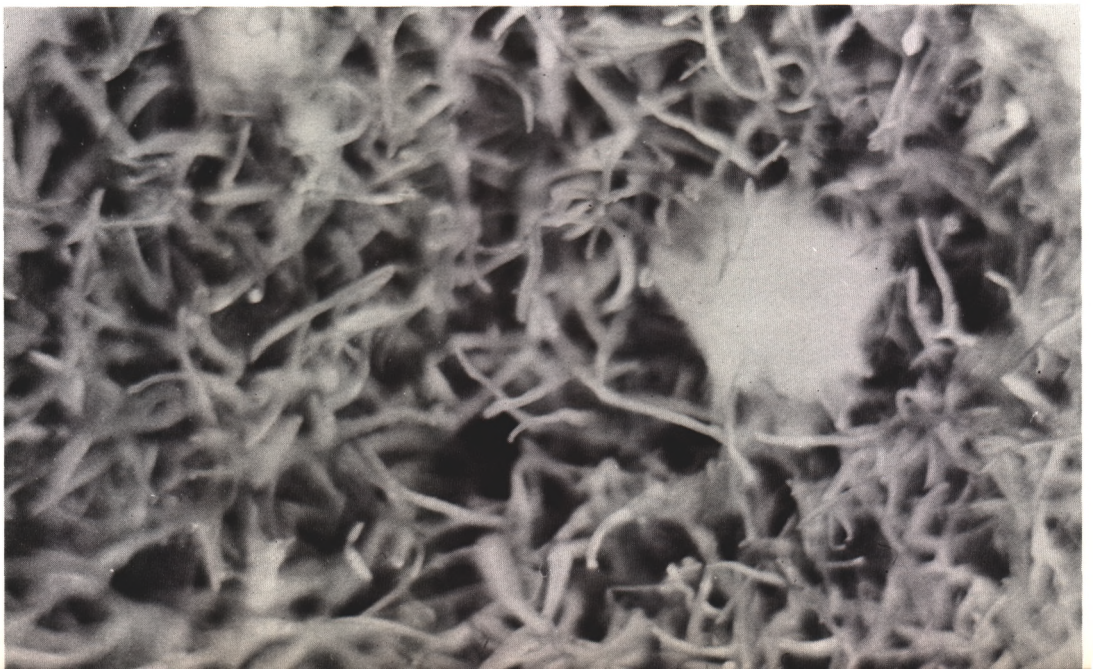
All three species are most active during warm, humid weather, but much needs to be learned regarding specific factors which result in the situation so prevalent during the summer of 1968 (3, 4, 8, 13). It is also obvious that contemporary fungicides are not fully adequate once the disease becomes established; a change in weather conditions is often the only way the disease is stopped. A preventive fungicide program (spraying at weekly or bi-weekly intervals) is generally very good, but even this was not completely effective last year (5, 6).

The bentgrass research green at Clemson University, Clemson, S. C., was divided into two parts during construction. Following the necessary soil analysis, half of this was built according to the USGA Green Section Specifications with tile, sand, and gravel for adequate drainage. The other half of the green was constructed without any provisions for drainage except surface runoff. Each half was then divided into two parts with Penncross planted on one section and Cohansey on the other, thereby dividing the green into four distinct sections.

This green was observed closely during June 26 to August 26 period while **Pythium aphanidermatum** was extremely active and destructive.

The first outbreak of **Pythium** blight was noted early in the morning of June 26, and the fungus remained active for the next 60 days (through August 26). Initially, the disease occurred on the undrained Cohansey bentgrass fringe (½ inch height). Within three days the putting surface (¼ inch height) on the undrained Cohansey and Penncross sections and

The cottony mycelium stands out on the turf blades in early morning.



Pythium spreading in a new seedbed.

the drained Cohansey section was infested. During these same three days the entire green, including six feet of the fringe, was sprayed daily with fungicides. Subsequent fungicide applications did not prevent the fungus from spreading over the entire putting surface, and before the first week elapsed approximately 20 per cent of the 5,000-square-foot green was dead. On August 26 an accurate rating disclosed that 60 per cent of the grass on the entire green was dead and that another 10 to 15 per cent was considerably weakened.

During the 60 days it was noted that the disease was most pronounced (as measured by mycelial activity and rate of enlargement of individual diseased spots) when the minimum night temperature stayed above 66 degrees F. This was enhanced if relative humidity (at 7 a.m.) was over 90 per cent and/or if dewfall was heavy. These findings tend to substantiate the findings of other researchers (2, 4, 8, 10, 13). It was also interesting to note that dewfall (measured at a point ¼ inch **above** the turf surface) exceeded five inches during the period June 24-August 31; this could be an important factor in the spread of the fungus from leaf blade to leaf blade (2).

Thirty fungicidal applications were made during the 60 days of the outbreak, yet the fungus continued to kill the turf. From the economic viewpoint (chemicals only) the cost to spray this one green of 5,000 square feet plus the six feet of fringe for control of **Pythium** blight was approximately $154. Add to this the cost of labor, water, equipment, usage and depreciation, plus player inconvenience and it can be seen why a disease of this nature is to be feared.

Turf management procedures found to be helpful in fighting this disease problem included:

1. Soil aspect
   - A. Keep the green as dry as possible.
   - B. Avoid the use of excessive nitrogen.
   - C. Do not permit water to stand on green after rainfall or irrigation; if necessary aerify or spike to "open up" soil surface.
   - D. Check on calcium nutrition; plants are more susceptible to **Pythium** blight if soil is low in calcium.
2. Above-ground factors
   - A. Remove dew and/or guttation by poling, mowing, or blowing **early** in morning. The fungus strands (mycelia) of **Pythium** will spread from plant to plant very quickly in these liquids.
   - B. Vertical mow (lightly) or use a brush or comb on the greensmower to help break up the mycelia and to thin the grass so it will dry out faster. This technique appeared to be effective

during periods of increased fungus activity on the research green.

C. Apply hydrated lime at two to three pounds per 1,000 square feet during periods of high humidity; but do not water in. This tends to keep the surface of the green drier. **(Do not apply too often).**

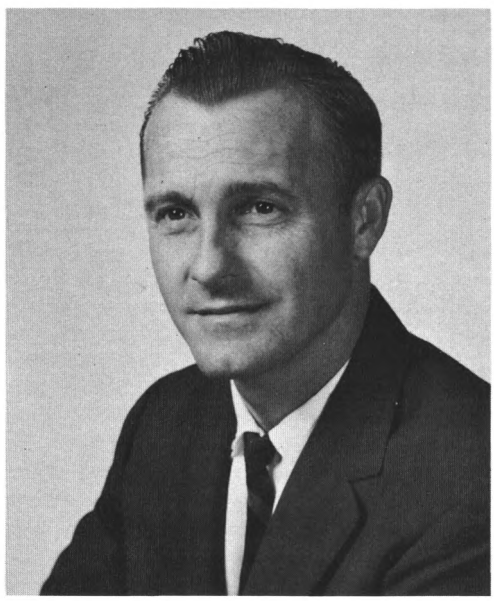
D. Drop the height of cut as much as possible without risking serious injury to the grass. This will also help provide faster drying conditions.

E. Be sure to mow daily—tall grass holds water on the blades longer.

Finally, keep your eyes and ears open with respect to new developments in the fungicide field. Several chemical companies have been working on fungicides which provide excellent prevention and/or control of **Pythium** blight.

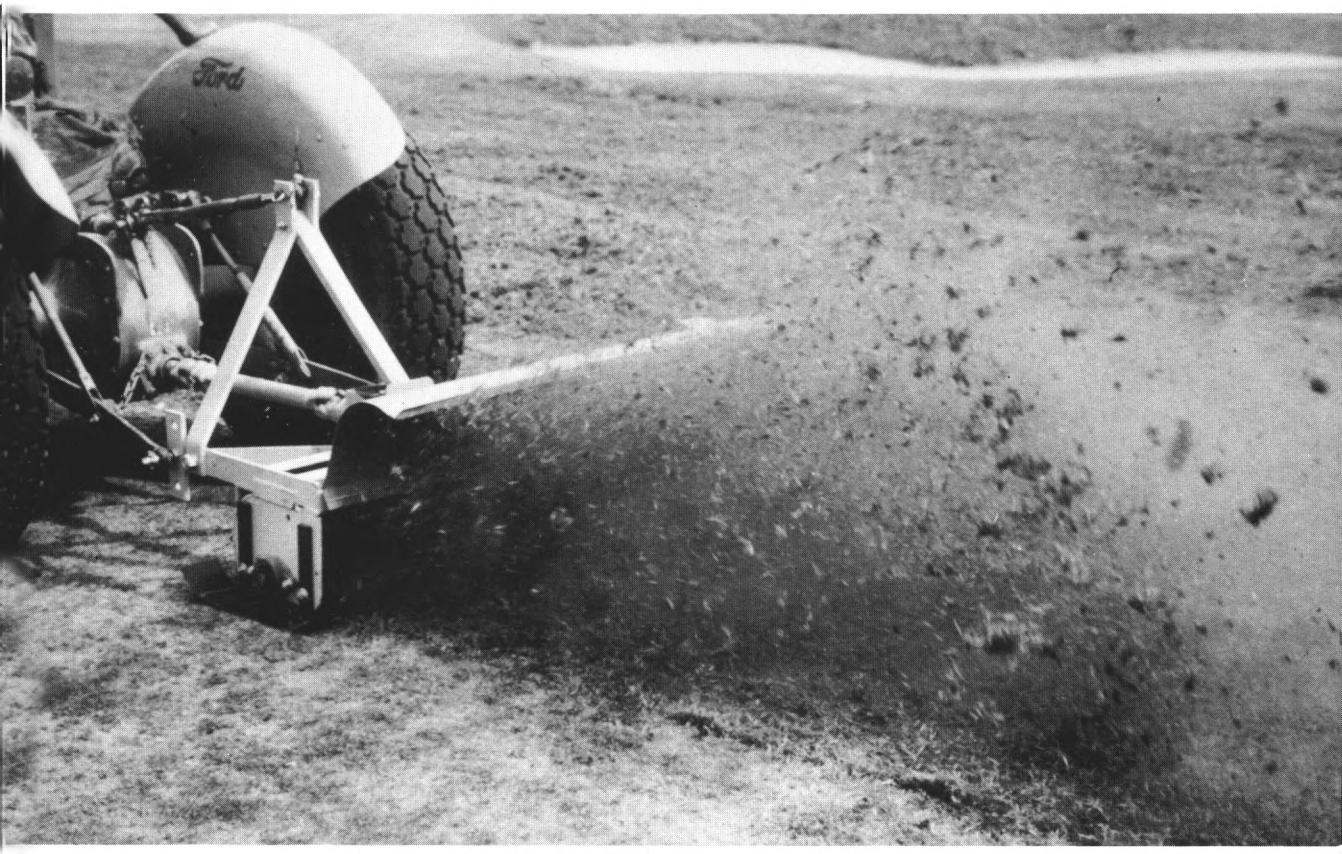
LITERATURE CITED

1. Anonymous. 1968. American golf courses stricken with blight. Weeds, Trees and Turf 7(10):26.
2. Couch, H. B. 1962. Diseases of turfgrasses. Reinhold Pub. Corp., New York, N. Y. 289 pp.
3. Freeman, T. E. 1968. Developments in disease control. Proc. Florida Turf-Grass Management Conf., Vol. XVI:85-86.
4. Freeman, T. E. 1960. Effects of temperature on cottony blight of ryegrass. (Abstr.) Phytopathology 50:575.
5. Freeman, T. E., and G. C. Horn. 1967. **Pythium** fungicides. The Golf Superintendent 35(2):58, 60-61.
6. Gould, C. J. 1967. Use of fungicides in controlling turfgrass diseases. The Golf Superintendent 35(1):18, 20, 22, 74.
7. Kish, A. J. 1969. Clemson University and South Carolina Agricultural Experiment Stations 1968 Climatological Data. S. C. Agri. Expt. Sta. Agri. Weather Research Series No. 19.
8. Kraft, J. M., R. M. Endo, and D. C. Erwin. 1967. Infection of primary roots of bentgrass by zoospores of **Pythium aphanidermatum.** Phytopathology 57:86-90.
9. McCarter, S. M., and R. H. Littrell. 1968. Pathogenicity of **Pythium myriotylum** to several grass and vegetable crops. Plant Disease Reptr. 52:179-183.
10. McCarter, S. M., and R. H. Littrell. 1967. Influence of temperature on the liberation, motility, and germination of zoospores of **Pythium aphanidermatum** and **Pythium myriotylum.** (Abstr.) Phytopathology 57: 281.
11. Monteith, J., Jr. 1933. A Pythium disease of turf. (Abstr.) Phytopathology 23:23-24.
12. Moore, L. D., and H. B. Couch. 1961. **Pythium ultimum** and **Helminthosporium vagans** as foliar pathogens of Gramineae. Plant Disease Reptr. 45:616-619.
13. Moore, L. D., H. B. Couch, and J. R. Bloom. 1963. Influence of environment on diseases of turfgrasses. III. Effect of nutrition, pH, soil temperature, air temperature, and soil moisture on Pythium blight of Highland bentgrass. Phytopathology 53: 53-57.



ABOUT THE AUTHOR: Dr. Paul Alexander is a native of Akron, Ohio. He received his Bachelor of Science degree from California Polytechnic College and an M.S. and Ph.D. from Ohio State University. Dr. Alexander is a member of numerous professional organizations and is presently on the staff in the Department of Horticulture, Clemson University, Clemson, South Carolina. He was actively involved in producing the USGA Green Section film, "The ABC's of Putting Green Construction," at Clemson.

Fairway Renovation— It's Paying Off



You have to make it worse before you can make it better.

by WILLIAM H. BENGEYFIELD, Western Director, USGA Green Section, and LEE RECORD, Agronomist, USGA Green Section

It's a tribute to today's golf course superintendent and a mark of his progress; Fairway Renovation is Paying Off! It is not a simple project; not a run-of-the-mill operation. But with thorough planning and total dedication, it works —beautifully!

Only in recent years have numbers of clubs become interested in improving fairway turf. Their reasons may be varied (heavy weed population, new irrigation system coverage, closer cut for fairway turf, a change of fairway grasses, etc.), but basically today's golfer wants opti-

mum playing conditions at all times. He wants a permanent turf and a good fairway lie. He also wants a smooth ride in his electric car. One club undertook fairway renovation for this purpose only—a smoother ride!

With today's technology, a permanent turf population can be established along with smooth-flowing contours. Several methods have been used and each has met with varying degrees of success. Regardless of the renovation method, the timing of each cultural practice is critical in encouraging and maintaining a permanent turf. The cultural program begins with the initial renovation and must continue on through the life of the plant. Permanent turf establishment is easy. Keeping it without invasion from undesirable weeds (mainly, **Poa annua)** is another problem.

There are four common methods of fairway renovation;

1) Heavy aeration.
2) Aeration and thatching.
3) Thatching.
4) The "scorched earth" technique.

They are listed in ascending order of difficulty and effectiveness.

Aeration

Aeration is undoubtedly the easiest and therefore the most prominent method of renovation today. It is not the most effective and results are slow to show themselves. A very suitable seedbed is produced by aerating a fairway eight to 10 times. The seed must come in contact with the soil for good germination and plant development.

This program must be repeated at least three to four consecutive years, or until such time that the permanent turf will hold its own against weed invasion. Each season as the permanent turf increases the total number of aerations are reduced.

Joe Camberato, Superintendent of Sleepy Hollow Country Club, Scarborough, N.Y., has had excellent results with aeration and overseeding of bentgrasses on his course. Joe comments as follows:

"Aerifier holes show definite advantage over mere slicing or spiking of fairway turf. I find faster germination, better plant movement (360°), quicker plant development and especially in the root zone. Introducing Astoria and Seaside bentgrasses, thinning out the matted bents, etc., are interesting problems. The Astoria sticks up well from the aerifier hole —sort of like an oasis in a desert! In general, I am well pleased with the results I have obtained."

In the West, Superintendent Harvey Hardin, of Indian Wells Country Club, Palm Desert, Calif., relies on aeration of his bermudagrass fairways each fall for ryegrass establishment. He has had a considerable amount of success.

If one seriously considers the aerification technique for fairway renovation, he should not lose sight of the fact that it is a long-range program (at least several years) and rapid progress should not be expected.

Aeration and Thatching

The aeration-thatching method has had mixed results and received mixed ratings from super-

"The Scorched Earth" policy is by far the best method of establishing a new turf cover.

The smaller unit can be used to supplement the larger one to assure a minimum mowing of three times per week.

intendents. With this method aeration is accomplished but three to five times over a fairway followed by one thatching operation. The new seedlings develop rather well in the aerification hole, but they have diminishing success in the thatching groove because of competition from the old turf. The results of this method have been fair to poor.

Thatching Method

The thatching method has shown only fair results. This operation requires two thatchings in opposite directions, or at right angles to each other. The thatching machine should be set for reasonable penetration (½ inch or more) to insure a good seedbed development. The seed germinates in the thatching grooves, and rows of new plants are soon visible. However, before the plants can mature and develop they are frequently choked and crowded out by undesirable turf and weeds on either side of the thatching groove. **Poa annua** is the main weedy pest.

The two methods mentioned above (aerating-thatching and thatching) help reduce existing thatch, but they do not expose sufficient soil for new turfgrass establishment. Both of these programs must be carried out yearly if a permanent turfgrass percentage is to be developed. Bluegrass-fescue mixtures seem to survive this type of renovation better than bentgrass turf.

The Scorched Earth Method

The "scorched earth method" requires considerable understanding and planning. It is by far the most effective way of establishing a new and uniform turfgrass cover over a large area. Several clubs have tried this method during the last several years with outstanding success in establishing a permanent turfgrass cover.

When Dick Silvar was Superintendent at the Knickerbocker Country Club, Tenafly, N.J., he carried out a scorched earth program and reported as follows:

"Club members experiencing and being inconvenienced by a scorched earth program will very quickly become experts in identifying **Poa annua** plants in all stages of growth. If you can change from 90 per cent **Poa annua** and 10 per cent bentgrass to 90 per cent bentgrass and 10 per cent **Poa annua** in a very short period of time, you have won a major battle. This can be done if the program is carried through to completion. Programs are often started and, because of inconvenience to the members, are abandoned and **Poa annua** soon takes over again."

At The Country Club in Salt Lake City, Utah, Superintendent Deloy Wilson has also carried out a scorched earth program. "The effectiveness in establishing a new permanent turf," he reports, "seems directly related to the knockdown or kill of the old turf (**Poa annua**) before

overseeding. Eliminate the competition and the new grass will thrive and establish itself very well."

Sherwood Moore, when Superintendent at Winged Foot Country Club, Mamaroneck, N. Y., developed a successful scorched earth renovation program much along the following lines:

1) Treat all areas to be renovated with a non-residual contact herbicide such as sodium arsenite at 20 pounds per acre. Repeat this treatment in three or four days. (Note: sodium arsenite is most effective if soil moisture levels are low and air temperatures above 80°.) The use of a butane flame has also been employed to knock down original vegetation.

2) One week after the initial sodium arsenite application, aerify thoroughly; i.e., at least six to eight times for thorough seedbed preparation.

3) If liming is required, accomplish at this time.

4) Operate a thatching machine over the entire area. Adjust so that soil penetration is achieved, (½ inch depth or more). The thatching operation will break up the aeration cores and help prepare a better seedbed. Follow this with an old set of fairway mowing units to break up the remaining soil cores and produce a smooth finish.

5) Apply a complete fertilizer and seed the treated areas.

6) Drag or mat the fairways after seeding. This helps in better seed placement and provides a light soil covering for the seed.

7) Carry out an adequate and proper irrigation program.

The scorched earth program does inconvenience the membership. Fairways renovated in this manner should not be opened to play for at least four to six weeks or longer depending on seed development. However, up to the time of seeding (while burning the existing turf, aerifying and dethatching) the fairways are playable. The four- to six-week restriction on play seems a small price to pay for years and years of excellent fairway turf in the future.

The Importance of Timing

Proper timing is critical in carrying out a successful renovation program. If your object is to establish good cool-season grasses, the work should be started early enough so that overseeding may be completed about mid-August. If you wish to establish a bermudagrass fairway turf, overseeding should be completed by mid-June.

The second critical factor lies in the amount of seed and fertilizer applied. During a fairway renovation project, there is no virtue in "sparing the seed." If you are going to the trouble and expense of carrying out a renovation program, be sure to sow a sufficient amount of good seed to insure a substantial coverage.

Seed mixtures and seeding rates are always controversial subjects. We would recommend contacting your local USGA Green Section representative for his specific recommendations for your conditions. In general terms, we would suggest sowing at 1½ times the "normal rate" when overseeding.

Adequate fertilization and pH levels are also essential in establishing a new turfgrass cover. It is just as important to avoid starvation as it is over-fertilization.

The fourth critical factor is irrigation. In order to grow any type of quality turf, the irrigation system must be capable of providing adequate coverage and the proper precipitation rate. Overwettness will only stimulate weed and **Poa annua** invasion. Inadequate irrigation will prevent the permanent grasses from developing a solid, tight sod. Irrigation is critical.

How Can We Keep Poa Annua Out?

Once a permanent turfgrass population is established on the fairways, constant vigilance must be maintained over the turf management program to prevent **Poa annua** reinvasion. We have the materials today to manage permanent turf and to keep it relatively free of weeds and undesirable grasses. New pre-emergence herbicides (such as Bensulide, DCPA, H-9573, Siduron, etc.) as well as some of the old materials such as calcium arsenate are effective in checking weed invasion. Post emergence materials such as Dicamba, Mecoprop, sodium arsenite, etc., can be effectively used in maintaining a permanent and desirable turfgrass population.

Today's golf course superintendent has the knowledge and materials available to insure the success of a fairway renovation program. Not only for today, but also for the years ahead. He appreciates that every cultural practice, fertilization, irrigation, fungicide, insecticide, and herbicide application must be weighed and analyzed in relation to its effect on the permanent turf. He knows the importance of long range planning and continuity of effort as well as the value of economical operation.

Cool Season to Warm Season Turfgrasses

by **M. S. BECKLEY**, Former Farm Advisor, University of California Extension Service

To keep the golf course in play and change the turfgrass cover on fairways at the same time is a challenge. We did it at Almaden Country Club.

Almaden is located on the west side of the Santa Clara valley near San Jose, Calif. Most people believe cool temperatures prevail everywhere in the San Francisco bay area and, therefore, cool-season grasses should thrive. This is not the case. In fact, our climatic conditions straddle the temperatures of both warm- and cool-season grasses. In many of our small valleys, July, August, and September temperatures hover between 85 and 95 degrees or more, and they last for weeks at a time. Night temperatures follow the same relative curve.

Many golf courses in these foothill areas have experienced the loss of fairway bluegrasses, fescues, and bents each summer. They are rapidly replaced by **Poa annua** and other weeds. Heavy traffic (over 200 rounds a day) and questionable maintenance practices added to our problem. In addition, alluvial fine clay soil is native to the area and is easily compacted. Our golfers were fed up with poor, almost unplayable fairways from July through October. Club management sought a better answer.

By northerners, bermudagrass is perhaps the most maligned of all turfgrasses. In spite of its proven ability to resist heavy traffic and still provide excellent year-round golfing turf, most "northern golfers" (especially those owning homes adjacent to the golf course) resist and resent its loss of color in winter. But bermudagrass was the choice, the only logical choice for better fairways at Almaden. A successful information program was instituted for the membership at the club, and before long the fairway renovation program was approved. There was one stipulation. All 18 holes must remain open for play throughout the project.

This was a tremendous restriction from an agronomic point of view, but economics and the responsibilities of club management made it imperative. A cooperative spirit soon developed between the golfer and those striving to give him better playing conditions. Neither were without some inconvenience.

Although I had tested hybrid bermudagrass varieties on the course for several years, it was decided to plant the fairways with common hulled bermudagrass at 80 pounds per acre. In our area, seeding is much easier to accomplish than sprigging. We would start our program in May and continue it through August.

The use of sodium arsenite is restricted in California. We were not able to use it as a knockdown herbicide. Instead, in order to eliminate as much competition as possible for bermudagrass seedling turf, a pre-emergence crabgrass control program was instituted in late

Top-dressing our newly seeded areas with fine sawdust.

January, 1968, using 25 pounds (50-W) DCPA (Dacthal) per acre. An attack on the broad-leaf weeds was made with 2, 4, 5-TP.

The final plans were developed by B. R. Gillis, project manager for the Del E. Webb Corporation; Edward Hardy, Club Manager; Bill Bengeyfield, USGA Green Section, and the author. The program was divided into seven distinct steps:

1) Where the turf was thin and severe soil compaction existed, the area was heavily aerified with large aeration spoons.
2) Using an old gang fairway mowing unit, the area was mowed vigorously to break up the plugs.
3) A four-foot wide dethatching machine attached to the power takeoff of our tractor was then employed. The vertical blades were set two inches apart and the area was crossed a minimum of two times at right angles. The vertical blades cut into the soil to approximately a ½-inch depth.
4) Where excessive trash accumulated following the vertical mowing treatment, hand or vacuum units were used for its removal.
5) Hulled bermudagrass was sown at the rate of 80 pounds per acre.
6) With a top-dressing machine, a ¼-inch layer of fine sawdust was laid over the seeded area.
7) Once seeded, the areas were watered by hand at least four times a day and continued for 10 days.

The irrigation phase of the work was extremely important. One man was charged with the responsibility for watering all the seeded areas, and at no time was the water application to exceed 15 minutes. This practice avoided overwatering fairways and interference with play.

Those areas that would normally receive heavy compaction from channeled traffic were roped off and given some degree of protection. The golfers respected these areas and carefully removed their golf balls from them. This assured better germination and bermudagrass development. Ten days following the seeding, all areas were fertilized with a complete fertilizer at the proper rate. Fertilization was repeated each month for three months.

Germination of the bermudagrass seeds took place within five to seven days. The plants emerged from the vertically mowed furrows and developed runners that closed the area between the cuts. Within 30 days the area was well covered with bermudagrass turf.

The cost of the entire summer project was $9,000 for labor (in excess of the permanent staff) and $4,000 for materials. During May, June, July, and August we were able to renovate and seed 15 fairways.

The club is very pleased with the results, and we intend to continue our fairway renovation program in the future. We have proven to ourselves that the best results are obtained when any competition to the seedling turf is greatly reduced or eliminated.

I believe there are six prime factors involved in the success of our fairway renovation program at Almaden Country Club. They include (1) adequate financing, (2) development of a sound master plan, (3) the choice of common hulled bermudagrass seed for the fairways, (4) proper seedbed preparation in addition to adequate nutrients, moisture and soil for good germination, (5) proper timing of seeding, i.e., May through August, and (6) the cooperation of members and staff in making the program work.

Bermudagrass Fairways in the Southeast

by JAMES W. DUDLEY

As a background to the establishment of our bermudagrass fairways, I think it is significant to note that our golf course was designed by Donald Ross and built during the late 1920s. Consequently, we were never able to spend the money for labor and equipment that is used in

Seedling bermudagrass on its way in thatching grooves.

the modern golf course. For example, we didn't have a roadscraper to level the fairways. My father, who built the golf course, told me that they used large railroad ties hooked together in unison for leveling purposes.

I think it is interesting also to note that originally, no seeds were ever sown on our fairways. We were entirely dependent upon whatever "cotton patch" bermudagrass volunteered. Fertilizers at this time, when money was available, were usually in the form of nitrate of soda and a small amount of guano.

Our fairways made no appreciable progress until 1952, when financial conditions were such that we could devote part of our budget to fairway maintenance. It was at this time that we made soil tests and started applying complete fertilizers plus lime to better establish the grass we had.

As far as weed control was concerned, the only methods that we knew of were a mattock and hoe for dallisgrass control and nitrate of soda as a caustic measure for crabgrass.

Since 1952, our fairways are 100 per cent bermudagrasses of many varieties. We have been able to accomplish this through diligently following established methods and practices learned through Green Section visits and seminars. Various selections have been brought in from the Southeast and observed in our nursery before planting on the course.

Establishment and Fertilization

In general when using seeds we tried to establish them between May 1 and June 1 and not after July 15. Stolons can be planted throughout the summer, and sodding can be done anytime. Soil tests indicate that in most cases our soils need approximately one ton of agricultural lime per acre and 1,000 pounds of a complete fertilizer, such as 6-12-12, disced into the seedbed. This does an excellent job of getting the new seedlings off to a fast start. The lime and fertilizer are worked into the soil three to four inches deep.

When stolonizing, we used 200 bushels of stolons to the acre. The seedling rate has usually been 40 to 60 pounds per acre.

After the grass is established, our fertilizer program consists of 45 pounds of nitrogen per acre using a complete fertilizer such as 10-10-10 in the spring, preferably May 1. In the middle of the summer an application of some type of nitrogen at 45 pounds per acre is made, and then a follow-up in September of another complete fertilizer, such as 16-4-8, at the rate of 300 pounds per acre. Our fairway fertilization goal for the year is to supply between 120-160

pounds of nitrogen, 60 pounds of phosphorous, and 80 pounds of K_2O equivalent per acre. The combinations we use usually depend upon what is available at the best price.

Herbicide Program

Our weed eradication program begins in early March with an application of pre-emergence chemical on those fairways that are heavily infested with weeds the year before. Usually we find weeds in the compacted and shady areas, and our greatest problem is with goosegrass. This year we treated approximately 15 acres with pre-emergence chemical. I would say we were 75 per cent effective.

I think it is significant to state at this point that in no case did we get complete control, and consequently we have had to follow up with post emergence treatment. Our post emergence consists of three to four pounds of DSMA or MSMA per acre of actual material, plus one-half pound of 2, 4-D in 50 gallons of water. Treatments are about 10 days apart and three to four treatments keep our fairways fairly clean of most obnoxious weeds during the year.

Poa Annua Control in Bermudagrass

In general we have found that the above program has produced satisfactory results for us. We still are faced with the problem of **Poa annua.** While it affords us some winter color until the bermudagrass emerges, it hinders this emergence to some degree and, of course, we never know how many seeds are tracked onto the green with the resulting problem.

This past year in two fairways, we used one quart of Paraquat in 30 gallons of water per acre and eliminated **Poa annua** that was growing. The bermudagrass must be dormant to spray this chemical and it is best to treat after two or three hard frosts. The reason for treating in December or January is that the **Poa** has not stooled out and will not leave unsightly areas as when sprayed in March.

These two fairways filled in much faster with the **Poa annua** eliminated than they did in the past. Reduced rates have been used with satisfactory results. Do not spray overseeded greens or cool-season grasses with this chemical or they will be eliminated.

We have found that with the many different types of bermudagrass that we have in our fairways, a "close knit" strain of common bermuda is easier to maintain than the hybrids. However, on stress fairways where shade or other factors, such as root encroachment from trees, are a problem, the hybrids, such as 419 and 328, are much more vigorous and weed free.

Damage To the Golf Course

by JAMES L. HOLMES

This is the time of year when the golfing public should be made aware of the damage that golf courses and golf course turf suffers both because of their activities and the activities necessary for maintenance.

If "damage" is brought to their attention, it is hoped that most of this damage will remain as potential, rather than becoming actual. Perhaps the best way to approach this problem is to divide and discuss damage under the following headings: traffic, golf carts, vandalism, snowmobiles, flooding, desiccation, and ice sheet cover.

Traffic

Even though one type of damage to a golf course could be included under the broad heading of "traffic," it is broken down in order to expand upon various types. First, player traffic causes most extensive injury. Constant and heavy play on a given area frequently destroys turf. Teeing turf is most severely damaged, followed by turf on greens, and then fairways.

The one single factor of extracting divots, especially on tees and fairways, is an example. The United States Golf Association has steadfastly maintained that all divots die or are displaced by mowing equipment and many bare spots are left throughout the course. Even though divots may be replaced it is necessary to plug many divot scars or topdress such scars with soil and seed. That is done at the best maintained golf courses where the membership insists upon a complete turf at all times.

Foot traffic can be severely damaging to turf on putting surface and collars, especially when soil is overwet, or frost and ice is leaving the ground in spring.

The most important time to close the course to all play is when soil in greens is thawing and the upper one to three inches has melted with solid ice beneath. This will happen only on a few days in spring, but invariably occurs on a nice, sunny, warm weekend when the golfer, who has played very little during the winter, is ready to go.

Other serious foot traffic damage occurs in funnel areas such as between greens and trees and on collars between the putting surface and greenside bunkers. Any design or redesigning attempts take into consideration the necessity of dispersing foot traffic as much as possible.

Equipment necessary to maintain the golf course can be and often is excessively damaging to turf. Much of this results from the fact that mechanization is absolutely essential in order to effectively and economically operate and maintain a modern golf course. Much of this equipment is quite heavy, and even though wide flotation tires are regularly used, rutting and other heavy equipment-type damage occurs.

Even though heavy maintenance equipment is known to be damaging to turf it simply must be used. This type damage, along with player damage, simply must be lived with.

In the broadest sense, the other type traffic damage we must consider is temperamental or intentional—putters being driven into the putting surface, and litter, such as cigarette and cigar butts, bottles, cigarette packages, golf ball boxes, and various assorted discarded paraphernalia which is strewn over the golf course. Nonetheless, this is a serious problem and it is costing the golfing public dearly.

At some clubs, interested members pick up litter during a round. Golf carts, used by men of this type are frequently loaded down with litter and refuse at the end of 18 holes. If all members were as careful, or took as much pride in their own golf course, litter would be no problem. In any event, it appears that we must live with a certain amount of careless individuals who believe that the rest of the world must clean up their garbage. The litter bug must be included along with the temperamental or intentional damager of his golf course.

Snowmobiles

The use of snowmobiles on golf courses is relatively new. However, last winter numerous calls were received from interested club members requesting information on possible "snowmobile damage." A study over the past couple of years leads to the conclusion that improper use of snowmobiles can be damaging to turf on tees and greens, and to **Poa annua** grass no matter where it exists. As a result of our observations, we have arrived at the following conclusion:

1. Do not allow snowbobiles to pass over greens or tees at any time.
2. Anywhere **Poa annua** is the predominant turf, restrict use of snowmobiles as much as possible.
3. Do not allow use under any circumstances in less than six inches of snow.

4. Never allow snowmobiles if snow is melting, or following a rain regardless of depth of snow.
5. Prohibit use completely when snow is melting in spring.

It seems obvious that restrictions must be placed on the use of snowmobiles on golf courses: that is, if you wish to eliminate serious damage which can occur in trail areas or at given times throughout the winter.

Golf Carts

A great deal has been said and published regarding turf damage resulting from the use of golf carts. It is recognized that golf carts can be excessively damaging to turf. Much has been done to reduce this damage, such as restricting cart use when courses are overwet or golf turf is wilting. At most courses cart paths have been installed in heavy funnel areas or where it is simply impossible to maintain turf because of "funnel" cart use. Further, it is becoming common to install cart paths throughout the playing areas. The trend actually is toward extending paths from the first tee to the 18th green.

Vandalism

Vandalism can be placed under two general headings: occasional or planned.

Occasional vandalism occurs where courses are not fenced in or otherwise protected. The unknowing public strolls over the golf course and occasionally takes a flag and flag stick, or a "pretty tee marker" simply because they are not aware of their place or value. This type of vandalism results from what you might consider the ignorant public and by people who have no desire to damage the golf course.

On the other hand, planned vandalism is of a vindictive nature and the persons responsible have a definite purpose. Regardless of precautions taken against this type of vandalism, such as installation of fencing or use of private policemen, such vandalism is relatively difficult to stop. Fencing and the use of private policemen or "night watchmen" is a deterrent, and an increasing number of clubs, especially in urban areas, are resorting to this practice. Night watchmen and trained dogs are being tried in the East.

It would take the rest of the magazine to list all the types of destructive acts committed on golf courses, and no doubt every reader will have seen some vandalism and will be aware that this problem is real and increasing. It is advisable for those courses in areas where vandalism is a problem to include a reasonable amount in their budget to cope with this problem.

Desiccation

Desiccation is the one single factor which kills the most grass, especially on putting surfaces, in the northern part of the country. Death to turf through drying or desiccation occurs in late February or early March, shortly before watering systems are placed in operation. Desic-

Flooding can damage turf as well as limit maintenance work.

cation follows three to five days of high temperature, occasionally in the 80s and high velocity southwest winds. Frequently wind gusts may exceed 60 miles per hour.

Most golf course superintendents have become aware of this problem and either have access to a large spray tank and water-down greens with at least 500 gallons of water per green, or will turn on watering systems, water all greens, then immediately drain back the system. Even if some breakage to the system results, in their opinion it is simpler to repair limited water system breakage than to re-establish anywhere from one to 18 putting surfaces. Desiccation must be closely watched for at times when it is known to occur, and every effort should be made to compete with this serious problem.

Flooding

A suitable golf course simply cannot be maintained in an area which regularly floods. If it has not been possible to control flooding, the club should be moved to a location which does not flood. If an area completely floods, turf will suffer and playing conditions will be poor, or else play will be impossible for a number of days during the season. There is nothing which more grossly damages turf or which places greater limitations on maintenance than flooding. Flooding does not refer to casual standing water or the flooding of a couple fairways because a creek overflows occasionally, but the regular overflow of any water contributary resulting in water or ice covering an extensive golf turf area for an extended period of time.

Ice Sheet Cover

The next greatest "kill" to golf putting turf results from a solid ice sheet cover. Just what happens, or the physiology of turf kill has yet to be determined. In order to be deadly this ice sheet cover must be solid from the soil surface up to and encompassing the entire grass blade. If the ice is rotten or has holes throughout, or there is loose snow beneath the ice, it appears that little or no damage occurs. Those who have lived with this problem limit an ice sheet cover to 25 days. Or, after it has been in place for 25 days it is removed. Removal is accomplished through topdressing with a dark material such as a natural organic fertilizer or a soil mix. This is the most widespread practice and is quite effective. Also, mechanical devices such as front end loaders or iron bars are used to break up ice or punch holes through the ice.

There is a definite trend by golf course superintendents to either topdress heavily or apply a natural organic fertilizer at high rates in late fall before ice formation starts. Application of either of these materials tends to reduce the formation of a continuous ice sheet. It may be effective in that a "layer" which might be considered similar to snow under ice is present. In any event, this practice of heavy topdressing or use of a natural organic fertilizer in late fall is increasing. It suffices to say that if a solid ice sheet is in place for longer than 25 days, it should be removed or extensive damage to turf will most likely result.

General

A number of things can cause damage to the golf course: such as diseases, insects, nematodes, etc. But, by and large, these are of biological nature and each individual one would take a report of this size for comment. When one is aware of the many things which can be damaging to the golf course and the turf thereon, it is quite amazing that golf courses have been and are maintained at the high standards and levels currently existing. Indeed, this is a testament to the golf course superintendents or the men who are responsible for the superb playing conditions that golfers expect today.

Conclusion

Most damage to the golf course results from players and player traffic. Obviously, without golfers there would be no golf courses. But courses would be much easier to maintain without them. Most money is spent on and most effort is put into competing with or overcoming damage done to playing turf by the player. Considerably less damage would result if players were more conscientious and made an effort to take better care of their course. Actually, every single golfer pays for the damage he does to the golf course through increase in daily fees or dues. Damage from use of mechanical equipment is an occupational hazard because economy of operation dictates that such equipment must be used.

Damage not directly related to traffic, such as flooding, desiccation, and ice cover as discussed, are problems more pertinent to the golf course superintendent. He must make himself familiar with them and take efforts to overcome or circumvent them. It is a testament to the turf-keeping profession that golf course superintendents have been able to compete effectively with the golfer as well as with nature.

A Green Chairman... a Vertical Mower... and Happiness...

by **F. A. LAYTON**, Superintendent, Cypress Point Club, Pebble Beach, Calif.

Once upon a time I had a green chairman who had an obsession with grain on greens. We used all the combs, brushes and rakes available at the time, and we even invented a few of our own. None did the job as we wished.

Then a machine came into production specifically designed to mow putting green turf vertically. I called his attention to this new machine and suggested that we buy one. He agreed. The machine was delivered during the winter, and since the grass was dormant at this time, we postponed its use until early spring.

The day finally arrived when we were to try our mower. There didn't seem to be much information about the height we should set the machine so that it would do a good job. We just made a guess adjustment and ran the machine in a north and south direction.

It was soon obvious that the mower was set too high, so we lowered the cut and tried again. Once again it seemed that we were too high; we lowered the machine a second time. Now we were getting something done!

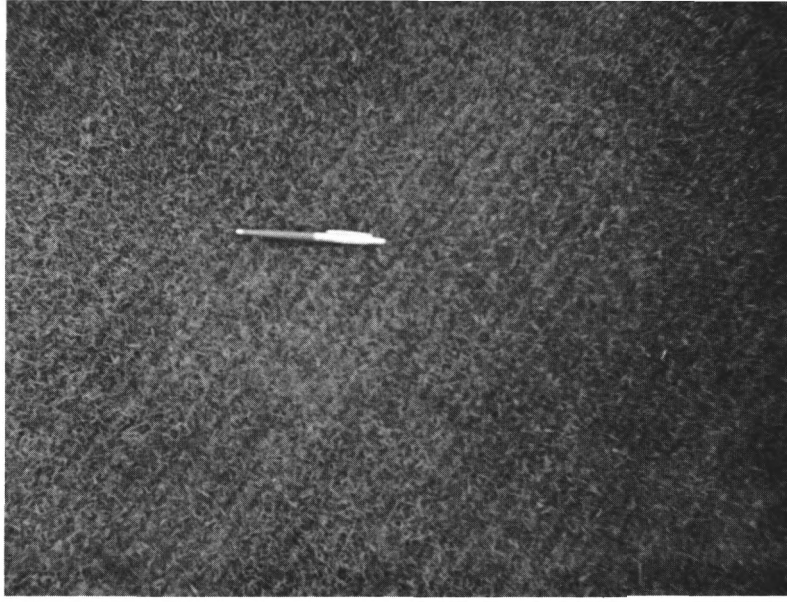
We ran the machine over the green twice at right angles to each cut. We then mowed the green and were pleased with the results. There were a few spots that were quite badly scored, but we figured they would heal over quickly, and so we continued with our job.

We finished all greens the next day, and then I went back to check those that were done the previous day. They were quite brown, but I knew this would soon pass. However, after another day the greens looked worse than ever. I was checking them each day now very closely, even getting down on my hands and knees and using a magnifying glass.

Greens in this condition certainly proved a problem. What to do? I knew what I wanted to do: dig a hole and bury them, but of course this was out of the question. Ten days later there was evidence of new growth, only about 1/32 of an inch, but a start. They finally healed and we had nice looking greens once more.

You may well imagine my surprise when, about one month later, the green chairman said

The action during one of the light but double vertical mowing operations at Cypress Point Club, Pebble Beach, Calif. Fred Layton, Superintendent, looks on.



How light is "light vertical mowing"? Author Layton says to "just touch the grass blades."

some of the greens were developing grain and we should run the machine again. I counted to 10 (slowly), and started to mention color and general appearance of the greens. I did not get very far. He admitted that the greens did look off color for a while, but they putted nicely and that was the important thing. The appearance of the greens now was in second place.

The next day we went to the far dark corner of the barn (where we had stored the machine for the rest of the summer) and brought the monster out of hiding. We dusted it off, and just to make certain we did not have a repeat performance, we raised the machine to a higher cut. We followed our original plan of mowing in two directions on each green. The results were not too bad, but still with considerable discoloration. We then returned the machine to its dark corner because this would be the last it would be used that summer.

Some people are obstinate. About one month later this man wanted the machine run again. I did not care too much for the idea because we had a member-guest tournament in about 10 days and I couldn't see the greens in such a condition at this time. But the green chairman was a nice fellow and so we would give him his wish, with reservations.

We raised the height of cut until we were just into the grass and let it go at that height. The result was that we removed the grain but had no drastic change in color. We (the crew and 1) were very well pleased with the results. Judging from the comment from the members, they, too, were very happy with the condition of the greens.

A short time later—you guessed it—"Let's run the machine again!" We left the machine at the higher cut and again had no discoloration or deep score marks. This, then, must be the way the machine should be run. Not too deep a cut, but use it more often. We used the machine once more that year, and because winter was coming, we called it quits. We would start again the next spring.

During the winter I gave the vertical mower some additional thought and came up with the following schedule. First, we would apply fertilizer to the green. Then about 10 days later we would use the machine.

The first cut would be fairly deep, about 1/8 inch. The greens were mowed at $\frac{1}{4}$ inch, so we were removing about half the grass.

Then, when the greens had about two weeks to heal we would top dress them. From then on we would fertilize each month and a week later we would run our machine. The height of cut would be at about 3/16 inch. I mention figures here, but we still go more by what the results look like, not by a measured setting. I believe it is called "the eyeball adjustment."

This program was started 15 years ago. It was not so much my idea, but rather at the insistance of the green chairman. At the time I'm certain neither of us thought it would ever evolve into what it has become today. He has since moved away. The program was standard operating procedure quite some time before he left.

Although it started a long time ago and we have tried certain variations, we still come back to our original plan: not too deep a cut at one time and run the machine more often; monthly in most cases. There are many times when you will see the greens and will conclude that they do not need verticle mowing. We have found this to be negative thinking. One of the keys to the success of the program is the regularity of operation:

Twice over lightly, and each month of the growing season.

TURF TWISTERS

SLOW DOWN

Question: Is there a chemical available that can retard the growth of grass, thus limiting the number of mowings required to maintain ditch banks, tree bases and other hard to mow areas? (New Jersey)

Answer: Yes, Maleic hydrazide when applied in the early spring (just after green-up) when the grass is approximately 3 inches tall will suppress growth. The maleic hydrazide should be applied at the 8-pound rate. The area is mowed 7 days after treatment and should not require mowing for two or three months.

SPEED UP

Question: I applied an arsenical for **Poa annua** control last spring and recieved some injury to my bentgrass. What is the best way to negate the effect of the arsenical? (Michigan)

Answer: An arsenical toxicity is best overcome by an application of phosphorus. This can be applied in the form of an inorganic phosphorus at the rate of one pound per 1,000 square feet or as a liquid spray. A 10-20-10 liquid fertilizer applied at 2 gallons per acre in 50 gallons of water has worked well for superintendents in the Midwest.

We have found that arsenic toxicity usually occurs in low, poorly drained areas. Drainage in these areas should be improved before any arsenical is applied. Slit trenching is an ideal means of improving drainage in these low spots.

STAY EVEN

Question: I am managing a new course which is to be opened in July. We expect a very heavy play and our greens will average a little over 7,000 square feet in size. Do you feel a two-cup system would be of benefit to us? (Virginia)

Answer: The question is a controversial one in that some superintendents say the two-hole system encourages more traffic on the green because of the necessity to walk across the green to place the flag in the other cup and then return to pick up clubs or cart. On the other hand, many superintendents feel that this system more evenly distributes traffic over a larger area; therefore, less wear is encountered in any one day.

The one thing we know for sure is that frequent cup changes (usually daily) with a planned system of rotation around the green surface with occasional special placement for special conditions such as wet weather, injured turf, etc., means better greens as well as better putting surfaces for the golfer.

You must use your own judgement as to whether or not the two-cup system would be beneficial under your conditions because there are certainly no hard and fast rules which apply in all situations.