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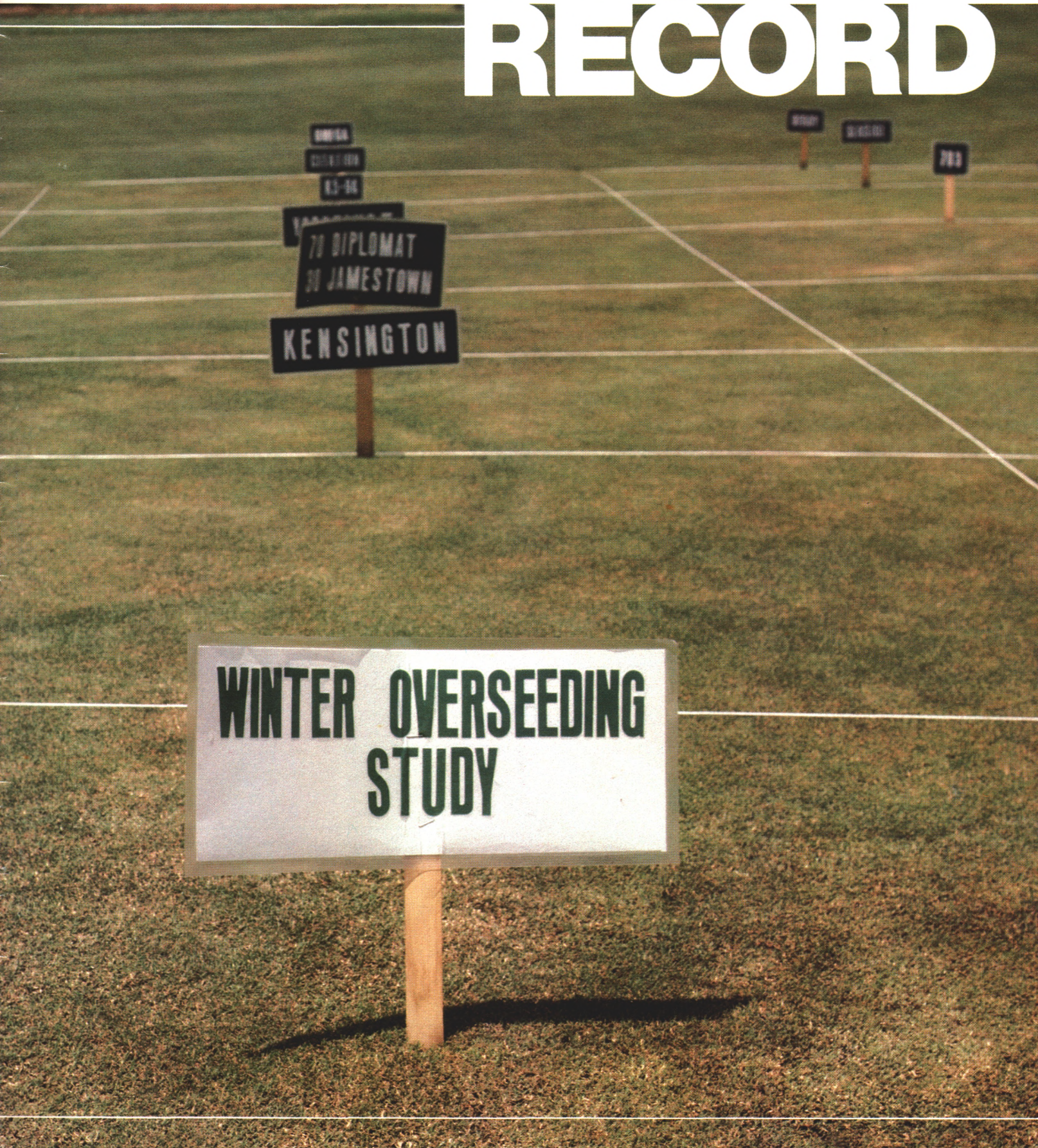

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Cover Photo:
Overseeding studies in the past have concentrated on grass species and seeding rates. For the future, we must look more at management practices.

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Some Ideas for Easing The Southern Transition Blues

by DR. DOUGLAS T. HAWES
Director, Mid-Continent Region, USGA Green Section

"And he gave it for his opinion, that whoever could make . . . two blades of grass to grow upon a spot where only one grew before, would deserve better of mankind . . . than the whole race of politicians put together."
Jonathan Swift (1667-1745), *Gulliver's Travels*

SOUTHERN superintendents indeed deserve better of mankind for growing one blade of grass on top of another. While accomplishing this neat trick, they must keep the bottom one (bermuda) alive and the top (cool season) one in excellent putting green condition. Then, eight months after having covered the bottom grass, they must make it reappear again (as if nothing had happened) as a dense, smooth putting turf. If he were alive today, Jonathan Swift would certainly elevate the southern golf course superintendent well above the whole race of politicians.

Southern superintendents with bermudagrass greens must overseed every fall in order to provide a green, renewable playing surface for the winter. The grasses used for this purpose are called by a variety of names, such as wintergrass, overseeding grasses, or simply the overseeding. On the other hand, the term "spring transition" refers to the dying (or dieback) of the overseeding and replacing it with renewed bermudagrass growth in the spring. Fall (perhaps summer) is really the time to begin working for a successful spring transition! The seed selected and the preparation of its seedbed will greatly influence next spring's growth. Vigorous dethatching, or verticutting, to remove organic material, living and dead, plus scalping at overseeding time, may so severely weaken the bermudagrass that there is a greatly reduced chance of its surviving until spring transition. Shade, diseases, nematodes, and poor nutrition may all be working against it.

Spring transition may occur very gradually or abruptly. The goal is to have such gradual transition that, after it has occurred, the golfers are still asking when it will take place. They remember too well the years when it occurred abruptly. Overseeding bermudagrass greens creates, for most superintendents in the South, their two most critical problems. One, providing the golfers with a successful overseeding in the fall, and two, providing them with a successful transition back to bermudagrass in the spring.

There are three major types of bad spring transitions:

(1) Death of the bermudagrass by an extremely cold winter;

(2) Severe thinning of the bermudagrass by long and strong competition from the overseeding;

(3) Sudden death of the overseeding.

The worst transitions occur when you have number one or number two conditions and then there is a sudden death of the overseeding.

In order to prevent death of the bermudagrass, one needs to maintain it as a very healthy turf before overseeding. Be sure not to damage it too severely when preparing to overseed. The most successful programs accomplish verticutting, aerification, and dethatching at least a month prior to the seeding date. Then the actual overseeding is often preceded and followed by topdressing. Aerification just prior to overseeding usually results in favored germination and growth of the seedlings in the aerifier holes and thus a tufted or checkerboard appearance results.

Bermudagrass winter survival is best on loose, porous soil mixes such as those found in greens built to the USGA specifications. Not only do such mixes encourage deeper rhizome development, but there are also less disease problems in well-drained soils. Late summer aerification assists in winter survival in a like manner. The rhizomes are the important part of the plant, as far as winter survival is concerned. The deeper the rhizomes, the better their ability to survive. The depth of the rhizomes appears to be increased by aerification of the soil. The more large air spaces in the soil, the deeper the rhizomes. Thus, late summer and early fall aerified bermudagrass survives cold winters better.

New bermuda growth from a stolon and a rhizome. In severe winters, only the rhizome will survive.

Everyone managing overseeded bermudagrass greens should realize that bermudagrass will not gain strength after overseeding. It will merely grow weaker from competition and winter dormancy until it has put up new shoots in the spring, which have survived on the putting surface. To insure good health before overseeding, soils should contain adequate potassium. Iron added to late summer and fall spray programs improves winter survival in dry winters. The amount of shade from trees must be reduced at the end of each summer, a month or more before overseeding. Low light intensity prevents bermudagrass from building up adequate food reserves before entering winter dormancy. Diseases of late summer and early fall must be kept under control to insure a vigorous, healthy plant before winter.

Rates for Overseeding and The Grasses

What about the effect of seeding rate? You must not forget priorities. You

overseed to provide a playing surface that in some areas may be the putting surface for eight months. You therefore must choose the rate that gives the best playing surface for the grass species or combination of species you are using. There does not appear to be any data that proves that an acceptable range of seeding rates, either a light or a heavy rate of seeding, will insure bermudagrass survival in spring. However, Charles White, the Green Section's Southeastern Director, says courses using only 20 to 25 pounds of a perennial ryegrass blend per thousand square feet are having better spring transitions than those using the higher rates of 30 to 35 lb./M. However, these courses lose two to four weeks of good playing surface in the fall because of slower surface establishment at the lower seeding rates.

Have you chosen the correct species, cultivars, mixtures? The plant breeders and seed companies have not provided us with the ideal grass as yet, but they do provide plenty of choices. The various grasses used, often in combination (but sometimes alone) are bentgrasses, fine fescues, perennial ryegrasses, annual ryegrasses, *Poa trivialis*, and Kentucky bluegrass. The preference in recent years has been for perennial ryegrass alone or in combination with one of the other grasses.

The ideal overseeding grass must germinate quickly, establish rapidly, tolerate frequent close mowings, heavy traffic, and frost, and fade away unnoticed as the bermudagrass comes on in the spring. Needless to say, finding a turf species that will take all sorts of abuse and then fade away gently and quietly is not to be expected. Those who overseeded greens in the northern half of the bermudagrass belt this year probably tried to pick a turf species or cultivars that will not persist in the spring as well as perennial ryegrass has in recent years. However, this will probably be a short-lived trend, as the quality of putting surfaces will be less superior and one will quickly forget the poor transition in 1982 and go back to the valuable qualities perennial ryegrass offers. It should be noted, though, that a broad genetic base of more than one turf species and several cultivars gives more security from dangers of disease and severe cold weather, and also tends to give a more gradual transition in the spring.

It is true that the new perennial ryegrasses do offer a tremendous amount of competition to the bermudagrass in the spring. However, maintenance can be adjusted to compensate for this added vigor. More frequent and more vigorous vertical mowing will thin perennial ryegrass stands. The rapid germination and establishment possible with perennial ryegrass, plus its ability to tolerate close mowings, heavy traffic, and frost, make it a near ideal grass for overseeding. It can provide an excellent putting surface and has a dark green color liked by those playing golf.

None of the remaining species competes with *Poa annua* (annual bluegrass) as effectively as perennial ryegrass. *Poa trivialis* has a nice fine texture and masks the presence of *Poa annua*. *Poa trivialis* holds its color well in cold, wet winters and is not quite as competitive in the spring with bermudagrass as is perennial ryegrass. However, it has poor wear tolerance and a slow establishment rate.

Creeping bentgrass has most of the overseeding characteristics of *Poa trivialis*. However, the color of some cultivars does not allow masking of *Poa annua*. Some golfers and superintendents claim it provides a superior putting surface in the spring provided traffic is not too heavy. Both creeping bentgrass and *Poa trivialis* do better in severe cold winters than perennial ryegrass.

Both fine fescues and annual ryegrass are noted as dying too rapidly in the spring to provide a smooth transition. The annual ryegrass is the worst of the two and also has blades too coarse to provide a high-quality winter playing surface. Kentucky bluegrass is very slow to establish, but provides excellent color in cold winters and a gradual transition in the spring.

Managing the Spring Transition

Although winter management of overseeded greens may not appear an important part of spring transition, it can have a definite effect. Failure to move the hole location frequently enough, excessively high nitrogen rates, over- or under-watering, and triplex mower ring have all contributed to a loss of bermudagrass under the overseeding.

The new perennial ryegrass cultivars have changed the approach of spring management of the overseeding. In the past, bad spring transitions, most commonly referred to as "sudden death," occurred before the bermudagrass was ready to grow. Now, however, superintendents find it difficult to get rid of the overseeding crop. Failure now often refers to a choking out of the bermudagrass by the overseeding. Thus, constant thinning of the overseeding becomes a critical part of spring management.

Once bermudagrass begins to green up on areas of the golf course not overseeded, it is time to begin spring management. One of the most disastrous things superintendents can do is to avoid thinning and aerifying the overseeded greens because of upcoming spring tournaments. By failing to thin the overseeding and to aerify at the proper time, he does not allow the bermudagrass to break through and thus to regenerate itself. When the tournaments are finished and he does take the necessary steps, the bermudagrass may be too weak to adequately reestablish itself and give the desired cover.

Too rapid a removal of the overseeding in early spring is also a problem. Viable bermudagrass may be there, but cool temperatures may prevent it from providing a satisfactory putting surface. There is no sure cure for the transition blues. There are only techniques for reducing the risk of an abrupt transition.

Good aerification is an important factor in bermudagrass survival, not only in the fall, but in the spring as well. One needs to aerify overseeded areas soon after bermudagrass greenup in non-overseeded areas. The purpose of aerification is to get bermudagrass shoots up through the overseeding and warm air into the soil. One can use soil temperature as a guide. Pick a time when it is at or close to 50°.

Light, frequent verticutting may be the best tool the superintendent has to manage the spring overseeding. This needs to be done weekly in the spring and, as warm weather becomes routine, double verticutting will be in order. Verticutting, combined with close mowing and brushing, reduces the density of the overseeding and allows more light through to the bermudagrass while also creating openings through which the bermudagrass can grow.

Transition is going to occur at some time between March 15 and June 15. Exactly when it will occur one can never be sure. If one allows it to occur naturally without mechanical thinning of the overseeding, failure is almost assured. The superintendent must aid transition by holding off on nitrogen in early spring and by mechanically thinning the overseeding.

One of the more serious problems encountered by bermudagrass, when breaking dormancy in the spring, is an early spring warmup followed by a hard freeze, which kills the new shoots. This

Double trouble. A small green and an overdose of preemerge herbicide used for goosegrass control.

For a successful overseeding and spring transition, this 328 bermudagrass green was thinned a month before overseeding time.

forces the grass to send up new shoots from the rhizomes and thus reduces the food reserve still further. Individual plants may not have enough food energy to recover. Severe cold winter temperatures occasionally negate all attempts to prevent loss of bermudagrass.

Some research has shown that bermudagrass may lose all of its root system in the spring as it begins to green. Therefore, one can assume that keeping the soil moist is going to be quite critical in getting bermudagrass through stress periods as it is greening in the springtime. The practice some superintendents use of letting the greens dry to promote loss of the overseeding may actually be detrimental to bermudagrass.

During wet, cool springs, superintendents should make applications of fungicides reasonably regularly. Diseases may not be visible on the overseeded grasses, but they can be working, nevertheless, on the bermudagrass beneath. Drenching in a fungicide occasionally during long periods of cloudy, wet weather may prevent loss of bermudagrass.

The preemerge herbicides, so necessary for crabgrass and goosegrass control, may also contribute to premature loss of the overseeding and damage to the bermudagrass breaking dormancy. One needs to think twice before applying these materials and, if applying them, to be sure the rate is correct and overlapping is kept to a minimum. A slightly less than recommended rate, after aerification, followed a month later by a half rate, is an often-taken, wise approach.

Once sure that the bermudagrass base is strong and healthy, one can encourage it by fertilizing and complete the changeover rapidly. However, be sure that not only the bermudagrass is ready but that the weather is ready, too. If the weather suddenly turns cool, you may find the fertilizer encouraging the overseeding rather than the bermudagrass.

Once most of the overseeding has been eliminated, raise the height of cut slightly and topdress. This will aid bermudagrass recovery and speed the transition to a solid bermudagrass surface. The topdressing encourages stolons to root and provides a smoother putting surface.

There is no sure cure for the transition blues. Ten years ago, Holman Griffin, of the Green Section, summed it up nicely by writing, "A delicate touch is required for an easy transition. Each spring is different." Here's to your success in 1983!

The Winter Golfers Cometh

Ice in the cup! Can golfers play today?

by Paul W. O'Leary
Towson Golf and Country Club, Towson, Maryland

MOST GOLFERS in the cool temperate zone put away their clubs for the winter. Nevertheless, a few all-weather golfers are daring enough to venture onto the course into the ice, snow, wind, and frigid temperatures. They consider the weather exhilarating. The conditions offer a special challenge to be conquered. These golfers even have special equipment for their winter sport: colored low-compression golf balls, hand warmers, and electric gloves. Unfortunately, few all-weather golfers realize the damage they can cause by playing at this time of year.

Winter golf can severely injure the grasses — particularly on the putting greens. It is a form of mechanical damage, and it can delay smooth, true putting surfaces until well into the regular playing season. Not surprisingly, most golfers want smooth putting greens from the early spring through the fall. Winter play can, and frequently does, destroy efforts by the golf superintendent to create such conditions. My goal and that of most superintendents has always been to have the best putting greens possible during the regular golfing season.

Several problems are caused by winter play on the putting greens. If the greens are frozen and begin to thaw during the day, the putting surface will become too soft and wet to withstand very much traffic. Walking on the green causes footprinting and rutting that disrupts the trueness. The rutting will often refreeze and cause bumpy greens in the spring. This can only be corrected by topdressings to smooth the surface. While our topdressing program calls for light, frequent applications, we must use more material per application to alleviate the untrue putting surfaces. The extra topdressing adds to maintenance costs. It is an important part of the program, however, if we are to provide ideal playing conditions at the very beginning of the golfing season.

Winter play can also damage the root systems of the grasses. During the winter, roots are usually present in the upper several inches of a putting green soil. If a surface thaw should occur, foot traffic can sever roots at the frost line. The greens will then require extra care next summer if the root systems do not recover. Another form of hidden, unseen damage can also occur. When soils are thawed, wet or saturated, and subjected to constant traffic, they rapidly lose their texture, their ability to remain friable, and they easily become tight and compacted. This too restricts root systems and growth next summer.

Since they are dormant, grasses are unable to recover from any type of damage caused by the winter golfer. *Poa annua* usually enters these areas in early spring. Any increase in *Poa annua* is most damaging to the quality of a green. The permanent grass population of the green is reduced and maintenance headaches increase. This damage may be seen for many years and is a reminder of the effects of winter play.

After I stated my arguments against winter play on our regular greens, the Board of Directors at my club asked

for alternatives. The first consideration was alternate greens. These "greens" would be an area in the approaches to our regular greens cut at fairway height with an oversized hole. The Golf Committee, however, felt such "greens" were unacceptable for the members to enjoy.

THE MEMBERS stated their opinions about using the regular greens. Some golfers wanted to play the regular greens only when they became frozen. The problem with this approach is determining if the soil is frozen enough to make it through the day. It is not unusual in the cool temperate zone for the putting greens to be frozen in the morning, only to have temperatures in midday rise to permit a surface thaw. All of a sudden, those frozen greens become pot-marked with foot traffic by the end of the day.

Another theory was to play the putting greens when they became frozen, but have the flexibility to switch to alternate greens when thawing occurred. Again, this proved unacceptable because of circumstances requiring golfers to begin their rounds on the regular greens and then switch to alternate greens halfway through a stipulated round.

A fourth consideration came from an article by the USGA Green Section. The idea was to create a shorter course within the framework of the existing layout. The article covered many points that seemed workable in our situation. The main concern, again, was the quality of the putting greens within this design.

While a shorter golf course was being considered, I discussed our winter play situation with several superintendents in my area and with the USGA Green Section representative. Through these discussions came the idea to use our bentgrass tees as winter greens! Play could be initiated from rough areas in front of the regular greens and routed down the fairways to the tees. This would achieve the shorter winter course design and eliminate the construction of 18 winter greens. The preparation of tees could follow the regular maintenance schedule, thus keeping our monetary commitment within budget.

THE MAINTENANCE program for the teeing ground in the fall remained consistent with previous years. The tees are vertically mowed and aerified. These operations are followed with a heavy topdressing of three to four cubic yards per 5,000 square feet. This does an excellent job of leveling the surfaces on all the par-4 and par-5 holes. The par-3 tees, however, were still deeply scarred by divot marks making them unsuitable for putting. Our concern over the par-3 tees necessitated hand topdressing. Play should be limited on these tees in the late fall to minimize scarring. Several light topdressings in the fall further helped to keep the teeing grounds firm and smooth. Our regular mowing height of one-quarter inch was consistent through the regular season and the tees were ready for the change to "winter greens."

The switch to the winter course was made in early January and continued through mid-March. Two hole locations were placed in each tee. Each group would change the flagstick to the other hole to minimize wear. The winter players were able to enjoy the golf course and we were able to provide them with a reasonable putting green.

Our winter course was moderately successful in its first year of play. We hope to improve the winter design and the conditions of the winter greens each year, so our membership, at least those hardy few, can enjoy their golf course year-round.

Foot traffic — foot damage.

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I certify that the statements made by me are correct and complete.

Robert Sommers, Managing Editor

Bent-Poa Roughs . . . A Modern Dilemma

by JAMES T. SNOW
Director, Northeastern Region, USGA Green Section

IT IS NOT too hard to think of situations where one action, taken to reduce labor or costs, actually creates a secondary problem, which eventually must be resolved with more work and expense. Such is the case with the contouring of fairways. Changing mowing patterns to create sculptured borders for fairways has become increasingly popular in recent years, and hardly a course has not been affected. The purpose of contour mowing is usually twofold — to create a visually pleasing and strategically challenging playing ground and to reduce the size of the fairways so that maintenance costs can be reduced.

Many 18-hole golf courses have gone from maintaining more than 40 acres of fairways to something less than 25 acres. It shouldn't take long to see that a substantial reduction in the size of the fairways can translate into savings in costs for fertilizers and pesticides and savings in time and labor when mowing smaller fairway areas.

*(Above) This bent-*Poa *rough was scalped and then overseeded with Kentucky bluegrass and perennial ryegrass.*

(Left) Fairway contour mowing left this unsightly and non-uniform rough.

Since most golf courses start out with relatively wide fairways, a contour mowing program usually involves a simple narrowing of the fairways in areas designated by the golf course architect or other individual responsible for determining the new patterns. It's a simple process — just let the grass grow up to rough height! No construction. No scalping. No expense.

Or is it so simple? For golf courses whose fairway turf is predominately Kentucky bluegrass, there is really no problem. The bluegrass grows to a higher height and provides an outstanding rough. However, most golf course fairways cut below one inch contain little Kentucky bluegrass. They are instead some combination of bentgrass, *Poa annua*, and perhaps perennial

ryegrass. Thus, when new fairway contours are established, it is this bent-*Poa*-rye mix that suddenly goes from being cut at one-half inch to one inch to a height of two or three inches, or even more.

No matter how you look at it, this type of turf does not produce a very satisfactory rough. Bentgrass and *Poa annua*, when they are cut at rough height, become puffy and thatchy and subsequently suffer from disease or scalping injury. Perennial ryegrass eventually develops into unsightly clumps that are difficult to mow. Even when these grasses can be kept in reasonably good condition through dethatching or aerification, they still produce a turf that is different in color and texture from the Kentucky bluegrass that predominates in the original rough areas. If nothing is done, this line of demarcation between old rough and new rough can remain visible for years. And because the bent-*Poa* rough looks so much like the fairway turf, it is often difficult to see from a distance just where the fairway ends and the rough begins. Thus, part of the reason for contouring in the first place is lost.

THE TRICK, then, is to establish Kentucky bluegrass in fairway areas that are allowed to grow to rough height after contour mowing patterns are created. Again, this may sound easier than it actually is. To slice and seed Kentucky bluegrass into established bent-*Poa* turf cut at two to three inches is practically hopeless.

Some have avoided the issue by overseeding perennial ryegrass into these rough areas. The ryegrass will usually germinate and develop in spite of the competition from the bent-*Poa* turf, and it certainly *looks* like Kentucky bluegrass. However, perennial ryegrass does not have the same growth characteristics as Kentucky bluegrass and often proves unsatisfactory in the long run. It does not have the capacity to spread, and so develops into unsightly and unplayable clumps as time passes. Thus, ryegrass should not be used in a monostand for rough areas unless overseeding will be done every few years.

Then what's the answer? The secret to establishing Kentucky bluegrass in bent-*Poa* turf lies in eliminating the competition. The extreme solution is to remove the bent-*Poa* turf with a sod-cutter and reestablish to bluegrass with either sod or seed. For most golf courses, this would be feasible only in very limited areas.

A more practical approach is to allow the bent-*Poa* turf to grow to a height of several inches and then scalp the area back down to about one-half inch and remove the debris. The area can then be overseeded with bluegrass or a combination of at least 80 percent Kentucky bluegrass and no more than 20 percent perennial ryegrass. Overseeding is usually accomplished by slicing and seeding in several directions, by aerifying several times and broadcasting the seed, or by a combination of both methods. A dense stand of Kentucky bluegrass need not be obtained from this effort, since the bluegrass has a

great competitive advantage over bentgrass and *Poa annua* mowed at two to three inches. With time, the bluegrass will come to dominate the turfgrass stand and a very satisfactory rough will be obtained.

An alternative to the scalping technique is to kill off the bent-*Poa* turf with Roundup and then renovate the area using one of the methods described above.

NARROWING FAIRWAYS for contour mowing is not the only practice that has created bent-*Poa* rough areas. Another trend has been the establishment of uniform collar widths around greens, often one width of a triplex greensmower. This has been done to cut down on the time needed to mow the collars and to reduce the total area that needs to be treated as intensively as the collars should.

Since the turf adjacent to the collars is often mowed at rough height, narrowing the collars has produced bent-*Poa* rough just a few feet from the edge of the green. The problems and solutions with this situation are nearly identical to those in rough areas adjacent to fairways. However, when the bent-*Poa* roughs adjacent to collars become diseased and scalped, they leave unsightly rings of unplayable turf in areas where delicate chip shots are often required. Thus, they are usually considered higher priority areas and more frequently are stripped and resodded to Kentucky bluegrass. However, any of the renovation methods already discussed can also be successfully adapted to these bent-*Poa* rough areas.

The establishment of Kentucky bluegrass in bent-*Poa* roughs may not be a pressing concern at many golf courses, but this type of renovation work need not be expensive. More important, it can contribute significantly to the appearance and playability of areas that receive a substantial amount of use by most golfers.

*A wide collar of bent-*Poa *turf was narrowed, leaving a patchy, poorly defined rough area.*

The Bermudagrass Stunt Mite

by DR. JAMES A. REINERT
Professor of Entomology, University of Florida

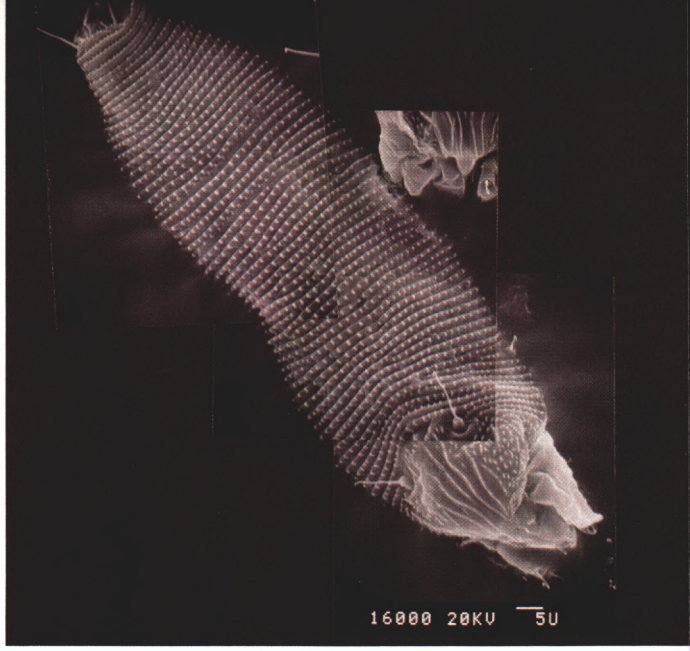

Figure 1. The bermudagrass stunt mite at extremely high magnification with the scanning electron microscope. (Photo courtesy of Dr. H. L. Cromroy, University of Florida, Gainesville.)

BERMUDAGRASS is widely used for sport turf throughout the southern part of the United States and much of the tropical and subtropical regions of the world. Florida has 728 golf courses covering approximately 69,200 acres. In 1982 the cost of maintaining them reached $200 million, according to current University of Florida estimates.

The bermudagrass stunt mite, *Aceria cynodeniensis* (Hassan) Kiefer *(Figure 1),* is an important pest to bermudagrass. It is particularly a problem on golf turf in Florida and to recreational turf throughout the South. This mite is probably native to Australia, where bermudagrass has become a naturalized plant, but now it is widespread, occurring in New Zealand, North Africa, and North America. The host-specific eriophyid mite was first found infesting bermudagrass lawns in Phoenix, Arizona, in 1959. Soon it spread to California, Nevada, New Mexico, Texas, Georgia, Alabama, and Florida. It was first reported in Florida in 1962, at Patrick Air Force Base, Cocoa Beach, and Opa Locka. Now the mite has been found throughout Florida.

Bermudagrass stunt mites are whitish-cream in color, wormlike in shape *(Figure 1)*, and 165-210 microns (about 1/125 inch) in length. Without a vivid imagination, even a 10-power hand lens is inadequate to see this mite. Microscopic examination at 30-50 power is needed.

The eggs are laid under the leaf sheath. After hatching they pass through two larval stages before molting as adults. All life stages are found together under the leaf sheath, and there may be a few to a hundred or more mites with numerous eggs under a single leaf sheath. Dr. G. D. Butler, Jr., observed that the period for development from egg hatching to adulthood takes five to six days. The life cycle is probably within the range of seven to 10 days, depending upon the temperature.

Bermudagrass damaged by this host-specific eriophyid mite first shows a slight yellowing of the tips of the grass blades, followed by a shortening of the internodes, producing a rosetted and tufted growth or witch's-broom effect *(Figure 2)*. When an infestation is severe, there is almost no green growth from the grass, and the tufts become a mass of large knots that die, causing brown, thin areas in the turf *(Figure 3)*. These dead or heavily damaged areas often become infested with weeds, thus creating other management problems.

Over 49 toxicants (insecticides and miticides) have been evaluated in field experiments for control of the bermudagrass stunt mite. Experiments were conducted in Arizona by Dr. George Butler and associates from 1961 through 1965, and more recently in Florida from 1971 to the present by Dr. James Reinert and Dr. Harvey Cromroy. The chemicals evaluated and their level of effectiveness are given in *Table 1*. Only nine toxicants have shown any control in these tests. In recent field experiments (1981-1982) UC-55248 and Vydate® have shown excellent results in Florida *(Figure 4)*. Vydate may be the only new candidate for EPA labeling, however, since development of UC-55248 has been terminated by the manufacturer. The addition of a wetting agent to the spray tank mix has improved the level of control produced in these field experiments.

Diazinon is the standard recommended treatment for this eriophyid mite. A treatment rate of four pounds active ingredient per acre (4.8g/ha), with a second application at the same rate applied seven to 10 days later is required for control. One golf course in Miami spent $25,000 for bermudagrass stunt mite control in 1974 and an additional $17,000 the following year. Several golf course superintendents in South Florida estimated a cost of $6,000 to $9,000 per 18-hole golf course for chemicals and additional fertilizer (no labor or equipment costs included) to control bermudagrass stunt mite damage in 1981.

Diazinon cannot be depended upon solely, since repeat applications are required, yearly treatment costs are high, pesticide-resistant mite populations may develop, and poor control with diazinon is often reported. Alternate means of control must be considered, including the use of host-resistant cultivars and proper selection of cultural practices.

A good alternative to chemical control is to develop varieties of bermudagrass that are resistant to the bermudagrass stunt mite. Cultivars have been evaluated for mite susceptibility under field conditions by Baltensperger and Butler, in Arizona, and in the greenhouse by Johnson and Reinert et al., in Florida. Of the 108 genotypes evaluated, most

Figure 2. Bermudagrass injured by bermudagrass stunt mite. A. (above) Early infestation. B. (below) Early damage showing shortened leaves and reduced internode length. C. (bottom) Late stage damage.

Figure 4. Test plots on an "Ormond" bermudagrass tee severely infested with bermudagrass stunt mites.

Figure 3. Apron and slopes of a green showing bermudagrass stunt mite injury.

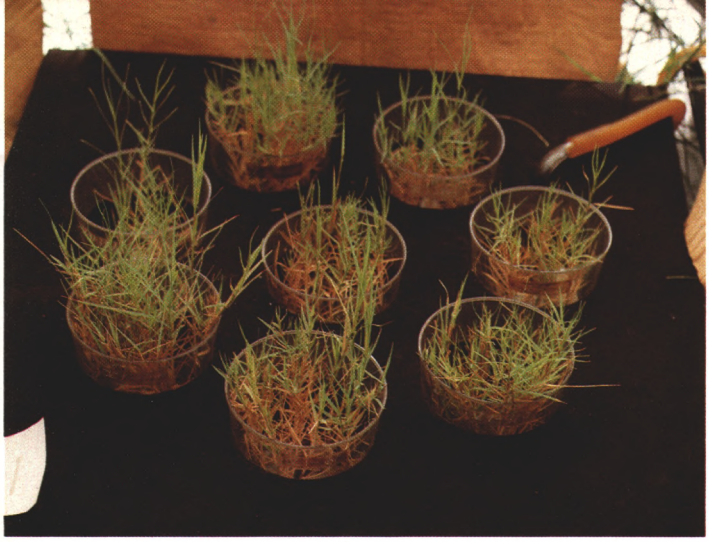

Figure 5. (Left) Greenhouse experiment to evaluate several bermudagrass genotypes for resistance to the bermudagrass stunt mite.

Figure 6. (Below) Bermudagrass stunt mite damage around base of tree. Areas around trees, shrubs and other obstacles on the golf course are often missed when pesticides are used.

TABLE 1

Toxicants Evaluated for Bermudagrass Stunt Mite Control and Their Effectiveness.

Toxicant	Response in Field Tests* Arizona	Florida	Toxicant	Response in Field Tests* Arizona	Florida
Diazinon	+++	+++	Dyfonate® (fonofos)		—
UC-55248		+++	Dylox® (trichlorfon)		—
Vydate® (oxamyl)		+++	Ethion	—	
Temik® (aldicarb)		+++	Eradex® (thioquinox)	—	
Baygon® (propoxur)	++	—	Folcid® (captafol)	—	
Banol® (carbanolate)	+		GS13005 (methidathion)	—	
Dursban® (chlorpyrifos)	++	—	Kelthane® (dicofol)	—	—
Nemacur® (phenamiphos)		+	Korlan® (ronnel)	—	
Trithion® (carbophenothion)		+	Lindane	—	
Acaraben® (chlorbenzilate)		—	Malathion	—	
Acarol® (bromopropylate)		—	Metasystox-R®		
Akton®		—	(oxydemeton-methyl)	—	
Aspon® (propyl thiopyrophate)		—	Mocap® (ethoprop)		—
Azodrin® (monocrotophos)		—	Morestan® (quinomethionate)	—	
Brofene® (bromophos)		—	Omite® (propargite)		—
Bux® (metalkamate)		—	Orthene® (acephate)		—
Captan	—		Phostex®	—	
Carzol® (formetanate)		—	Phictran® (cyhexatin)		—
Cygon® (dimethoate)	—		Sulfur	—	
Dasanit® (fensulfothion)		—	Tedion® (tetradifon)	—	
DDT	—		Thiodan® (endosulfan)	—	
Delnav® (dioxathion)		—	Tirpate®		—
Dibrome® (naled)	—		Torak® (dialifor)		—
Dimilin® (diflubenzuron)		—	Vendex® (fenbutatin-oxide)		—
Di-Syston® (disulfoton)	—	—	Zectran® (mexacarbate)	—	

*(+++) = good control, (++) = control, but not in all tests, (+) = poor control, (—) = no control.

were severely damaged, but several appeared to be resistant, while others showed some damage. Cultivars and their response to this mite are presented in *Table 2*. Most of the commonly grown cultivars are susceptible to damage; Tifdwarf and Midiron are the only two cultivars that did not show mite damage in lab and field experiments. FB-119, a mite-resistant common-type bermudagrass selection, is being developed for release by the Florida Agriculture Experiment Station. In laboratory and field tests, FB-119 was completely resistant to the bermudagrass stunt mite *(Figure 5)*.

HOST-RESISTANT cultivars should be used whenever possible and practical, not only for this pest, but for other insects, mites, plant pathogens, and nematodes. All major turfgrasses lack certain desirable characteristics, including pest resistance, and breeding for insect resistance is impeded by the lack of research funds, personnel, and adequate methods of screening germplasm. Entomologists, nematologists, plant pathologists, and turfgrass breeders need to join forces in developing new varieties of turfgrass resistant to one or more of the major pest problems.

Damage by the bermudagrass stunt mite can best be prevented by several management practices. First, correct identification of the pest is necessary. Quite often the turf damage is the result of combined infestations of several turf pests. Nematodes and bermudagrass scale are often present in bermudagrass that has been damaged by stunt mites, and they may have contributed significantly to the turf damage. Moreover, when bermudagrass is under stress from either lack of water, nematodes, bermudagrass scale, or other turf pests, it is less able to withstand the mites and, therefore, more vulnerable. Soil with poor water-holding capacity may also be a contributing factor.

When bermudagrass is treated with insecticides to control this mite, the second application seven to 10 days later is very important. It is necessary to control the young mites that hatch from eggs that were present during the first treatment but not affected by it. Thorough treatment of the whole infested area is important. Often turf areas around trees, shrubbery, and other obstructions, around bunkers, or along canals and lakes are not treated. These areas that are missed will act as reservoir areas for mites to reinfest the whole golf

TABLE 2

Response of Bermudagrass Cultivars to Bermudagrass Stunt Mite.

Cultivar	Response*	Cultivar	Response*
'Bayshore' (Gene Tift)	SS	'Texturf 1F'	SS
'Everglades No. 1'	SS	'Texturf 10'	SS
FB-119 (Franklin)	R	'Tifdwarf'	R
FB-137 (No Mow)	SS	'Tiffine'	SS
'Midiron' (P-16)	R	'Tifgreen'	SS
'Midmo' (S-16)	S	'Tiflawn'	SS
'Midway' (E-1)	S	'Tifway'	S
'Oklan'	U	'Tifway II'	U
'Ormond'	SS	'Tufcote'	SS
'Pee Dee'	U	'U-3'	S
'Royal Cape'	S	Uganda	S
'Santa Ana'	U	'Vamont'	U
'St. Lucie'	SS	Common	SS
'Sunturf'	SS		

*R = resistant, S = susceptible and showing some damage, SS = very susceptible with rosetting and severe damage, U = unevaluated, cultivar has not been tested.

course. Treatment with hand equipment or a spray hose attachment may be necessary for these areas. *Figure 6* shows an area around the base of a tree on a golf course where the bermudagrass had been severely damaged approximately a year after the Ormond bermudagrass on the course had been treated with diazinon. Damage showed up here first because of the added water stress, due to the shallow roots of the tree and the residual population of mites that were left in the untreated oval area around the base of the tree. Canal, stream, and lake banks also harbor residual mite populations, but the damage does not show up as well since there is no added water stress in these areas *(Figure 7).*

Mites can easily spread from an infested area. Like most eriophyid mites, the bermudagrass stunt mite can be carried by the wind. It is also capable of hitching a ride on other insects present in the bermudagrass. They can probably be moved by armyworms, webworms, and leafhoppers, and they have been seen attached to mole crickets that have recently flown from an infested area (Reinert, unpublished data). They are also easily dispersed in grass clippings. Mowers cut the rosettes and scatter the infested grass over wide areas of healthy turf. The infested grass sprigs can also be blown by the wind. Tires on equipment, even golf carts and golf shoes, may serve as vehicles of spread, since the infested grass would drop off from time to time.

Proper fertilization and even high rates of fertilizer applied with ample water can allow the bermudagrass to outgrow bermudagrass stunt mites. Rosettes and other symptoms will be present, but no loss of stand will occur, because the grass apparently is growing faster than the mites can kill it.

Host-resistant cultivars should be used whenever possible to eliminate or at least lessen the potential of injury.

In conclusion, the turf manager can, through good management practices and the use of host-resistant cultivars, reduce the potential of injury by the bermudagrass stunt mite. When populations reach damaging levels, they can be controlled with chemical treatment.

Figure 7. Populations of the bermudagrass stunt mite are often left untreated along lake, canal, and stream banks which can reinfest adjacent treated areas of bermudagrass.

FOR GREEN CHAIRMEN, SUPERINTENDENTS, CLUB OFFICIALS:

The Green Section 1983 Educational Program

Thursday, February 24, 1983, Atlanta, Georgia

For the third consecutive year, the USGA Green Section's annual Educational Program will be held in conjunction with the Golf Course Superintendents Association of America International Turfgrass Conference and Show. The place is the George L. Smith II Auditorium, Georgia World Congress Center, Atlanta, Georgia.

The program, "Going Five Rounds with Four Controversial Issues," promises to be a spirited one. It is open, free of charge, to all attendees at 8:15 a.m. on Thursday, February 24, 1983. Attendees will also be admitted to the Equipment and Trade Show all day Thursday. Advance registration is recommended and may be made by writing to USGA Green Section, Golf House, Far Hills, New Jersey 07931.

8:15 - 8:30 Welcome and Introductions

Chairman, USGA Green Section Committee

8:30 - 9:15 Golf Courses of the Future

Are today's "new golf courses," i.e., gallery architecture, TV considerations and "the natural look," only a fad or are they the wave of the future? What about "target area" mowing? Do these considerations actually reduce maintenance costs?

Frank Hannigan, ABC Television, Special Projects Director, USGA
James A. Wyllie, President, GCSAA, Ontario, Canada
Paul N. Voykin, CGCS, Briarwood CC, Deerfield, Illinois

9:15 - 9:35 The Game — and the Golf Course Superintendent

A former U.S. Amateur Champion, a Walker Cup player and Captain, and now President of the USGA shares his views on the role of the golf course superintendent.

William C. Campbell, President, USGA

9:35 - 10:20 Ups and Downs with the Stimpmeter

Some have called the Stimpmeter "anti-grass" and a weapon aimed at the golf course superintendent. Others believe it is a major step forward and another professional tool for the superintendent to use. Hear both sides of this story and make up your own mind.

Julius Albaugh, Superintendent, Westmoreland CC, Wilmette, Illinois
Frank Thomas, Technical Director, USGA
Robert V. Mitchell, CGCS, The Greenbrier, White Sulphur Springs, West Virginia
Stanley J. Zontek, Director, North-Central Region, USGA Green Section

10:20 - 10:30 Break

10:30 - 11:00 The Soils Controversy — Mixes for Green Construction and Topdressings

So much has been said. So many claims have been made. So much "research" done — it's time to clear the air again in regard to soil mixes for putting greens and topdressings. Here are the facts.

Dr. Marvin H. Ferguson, President, Agri-Systems of Texas, Former National Director, USGA Green Section

11:00 - 11:45 For Good Golf — How Green Does a Golf Course Have to Be?

No one willingly wants a "brown" golf course. But "green" golf courses are not necessarily (or automatically) good ones for golf. Or are they?

John A. Zoller, Executive Director, Northern California Golf Association, former golf course superintendent
Dr. James R. Watson, Vice-President, The Toro Company, Minneapolis, Minnesota
Stephen G. Candenelli, CGCS, Country Club of New Canaan, New Canaan, Connecticut

11:45 The Green Section Award Presentation —

"For Distinguished Service to Golf Through Work with Turfgrass"

William C. Campbell, President, USGA
Harry W. Easterly, Jr., Senior Executive Director, USGA
Chairman, USGA Green Section Committee

12:15 Adjourn

USGA GREEN SECTION RECORD
NOVEMBER/DECEMBER 1982

TURF TWISTERS

IT'S NOT DEAD!

Question: How does golf car traffic damage bermudagrass in winter when it is dead? (Mississippi)

Answer: When bermudagrass goes dormant, only the foliage dies. The crowns and roots are still very much alive. Therefore, stress from traffic is detrimental to bermudagrass during dormancy due to the lack of recuperative ability. Also, as freezing and thawing of the ground proceed in winter, the crowns and roots can be bruised and crushed from traffic.

THE EARTH'S SOD

Question: We have a difference of opinion here regarding the handling of sod. What is your recommendation regarding the optimum thickness of cut sod, and what's the best way to move it, i.e., in rolls or as flat pieces? (Idaho)

Answer: To a large measure, the thickness of sod cut will depend on the quality, type, and purpose for which the sod will be used. In most cases, a thickness of three-quarters inch seems about right as long as the sod and soil hold together and handle well. It will root rather rapidly at this cut and produce a smooth surface. Thicker sod, on the other hand, will not "peg down" as fast, but will not require the pampering and close attention that thinner sod does during initial establishment. It will usualy not produce as true a surface, either.

As to means of transport, flat sod pieces are best for quality work (putting greens). Flat sod pieces do not have the problem of stretching and distortion one finds when sod is rolled. The flats not only fit better and tighter, but, when cut about 18 inches long, one person can easily handle each piece.

IN THE NORTHERN CLIMES

Question: Does winter golf harm the regular greens? Also, what can be done to remove frost from the golf course on mornings when the members want to play? (Minnesota)

Answer: Let's face it, winter play can hurt! It certainly doesn't do any good. Agronomically, it is one of those things that on one day causes little, if any, damage, but the next day causes real and permanent damage. It depends on soil types, soil moisture, weather conditions, and how much golf is actually played. (Be sure to read the article "The Winter Golfers Cometh" by Superintendent Paul O'Leary, in this issue.)

As to frost removal, there are only two safe ways:

1) If the temperature is near the freezing point (and rising), run the irrigation for two to five minutes.
2) Hold up play until the sun and warmer temperatures melt the frost.