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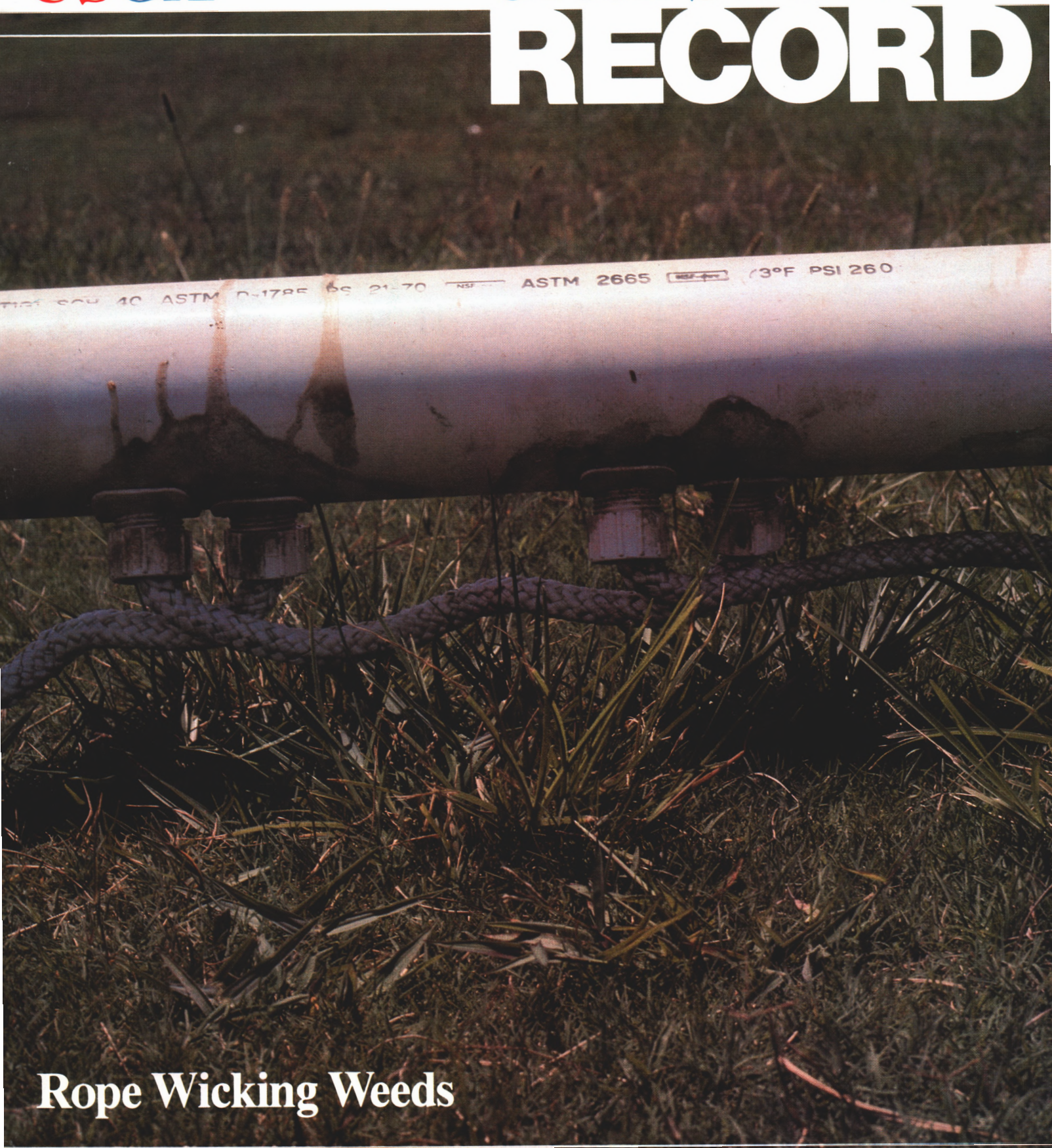

Rope Wicking Weeds

USGA®

Green Section RECORD

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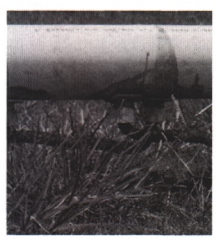

Cover Photo:
A rope wick applicator can apply herbicides to weeds that rise above the bermudagrass turf.

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Squeeze bottle application of Roundup (Glyphosate).

Those Irrepressible, Incredible, Impossible Grassy Weeds!

by STEVE M. BATTEN
Agronomist, Southeastern Region, USGA Green Section

ALMOST EVERY golf course has them. Millions of dollars are spent annually and thousands of hours devoted to their control. And yet, after all the effort and expense, these irrepressible grassy weeds are incredibly difficult, if not impossible, to control in our golf course environment.

The most difficult are those that spread by stolons or rhizomes. The largest group are the turfgrass species that invade the golf course domain of more desirable cultivars or species for a particular area. An example is the encroachment of bermudagrass or bentgrass into areas where they are not wanted. Both cool-season and warm-season grasses are guilty of the habit.

Other turfgrasses that have a bunch-type of growth, like tall fescue, perennial ryegrass, or annual bluegrass, are equally guilty. They frequently cause problems around aprons of greens where the fine touch of a chip shot is required to save par. Their bunch-type growth can cause a golf ball to nestle down low or rest up next to an individual plant.

And then there are a large number of non-turfgrass species that can be classified as "Impossible Weeds." A few of the most common are torpedograss, smutgrass, and creeping sedges such as purple nutsedge. Goosegrass is also in this category, and there are regions of the United States where it has a perennial growth habit.

Nearly all of these weeds, with the exception of smutgrass, can be found on the closely mowed turf of fairways, tees, and greens. Smutgrass is primarily found in roughs. The old rule of thumb that a healthy, dense turf prevents weed encroachment doesn't apply to the Impossible Weeds. They thrive under good fertility conditions the same as desired turfgrasses. Have you wondered if there is any hope for fighting against these weedy pests? Well, there are methods of control, and they range from cultural practices to non-selective chemical control.

Cultural practices include scalping, deep-set vertical mowing, turning off irrigation, hand removal, excavation, and even starvation by eliminating

normal fertilization. While these may seem drastic, a change in routine cultural practices will often result in weed reduction by allowing the desired grasses to gain the upper hand. This type of control does not provide eradication, but merely suppression. After all, not every control must produce a complete weed kill.

Chemical control varies as much as the cultural practices. The most common non-selective herbicide used today is Roundup (glyphosate). Spot treatments can be made with hand-held sprayers, plastic squeeze bottles, hypodermic syringes, and even paint brushes. Spot applications may be expensive in terms of labor, but they can be effective in providing annual reduction of weeds in specific areas such as around greens and tees. Spot application requires the judgement of a person to determine what is a weed or where to place the herbicide. For this reason, this type of weed control is hard to automate or conduct with large tractors or maintenance vehicles.

However, there are methods to selectively place herbicides such as Roundup with large implements. One which is gaining in popularity is the use of a rope wick applicator. Rope wick applicators can paint the top half of tall fescue or smutgrass above the growing height of desired turfgrasses. Weed kill results by the translocation of the Roundup. Multiple applications at two- to three-week intervals will provide control.

Many golf course superintendents are building their own rope wick applicators with PVC plastic pipe and wicks with connectors purchased from sprayer parts distributors. These are custom-designed units that vary in width and size depending on the golf course terrain and the unit used to pull the applicator. They are very efficient in terms of the amount of Roundup applied per unit area. The strength of the Roundup solution will vary, but a 33 percent solution seems to be the most popular for small rope wick applicators.

Mixing correct labeled rates of herbicides or combinations of herbicides in small containers can be difficult. A stock solution can be mixed for each day's spraying activity, but this is dangerous because temporary storage has to be provided, and the containers may not be properly labeled. A syringe could be the answer to measuring small amounts of herbicides. Just remember that 1cc is equal to 1ml, which can then be converted to ounces.

If large areas, such as fairways, have to be spot treated for weeds, then a 100-gallon spray tank can be used for mixing the herbicide. The herbicide can then be applied with hand-held sprayer nozzles and a multiple-hose system. This would involve a group of three or more sprayer operators walking behind a single spray tank. A manifold with quick-disconnect hose attachments can be used to connect the hoses. The advantage to this multiple-hose and large-tank system is that it is convenient to use with a wide range of herbicide combinations.

Whatever the herbicide combination or selection, the best method to control difficult weeds is through continual repeat applications. Persistence is the key to the reduction of the Impossible Weeds.

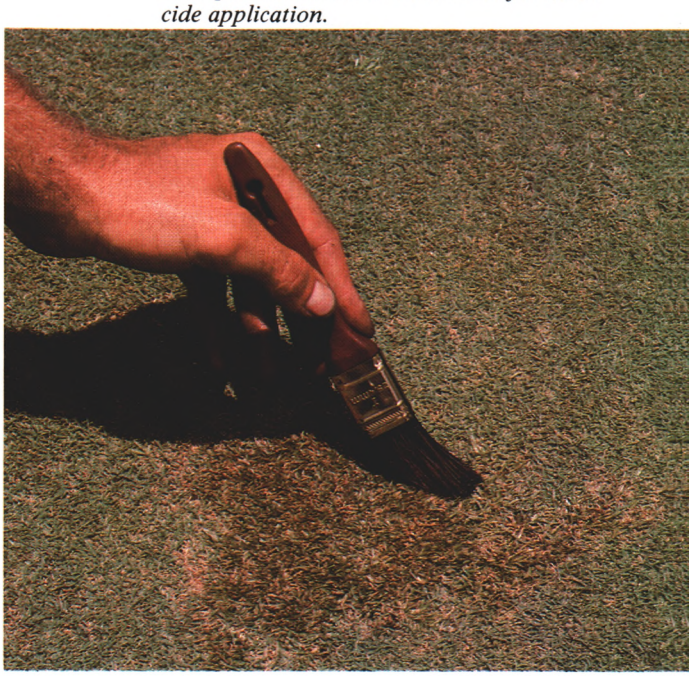
Bermudagrass Control

In warm-season turfgrasses, there are some excellent examples of the Impossibles. In the southern United States, the most common weed discussed on any golf course is bermudagrass. Common bermudagrass will become a weed by strict definition when it encroaches onto greens, tees, and fairways where an improved hybrid bermudagrass, zoysiagrass, or other selections presently exist. Examples are fairway types of bermudagrasses that are often observed on fine-textured bermudagrass greens. The fairway selections have a much coarser texture and produce a rough surface that inhibits good golf ball roll characteristics. Thousands of dollars are spent annually across the southern United States to replant bermudagrass greens that have a large amount of contamination caused by different bermudagrass strains.

Spot application of Roundup for invading bermudagrass offers only temporary control. This, however, may be the only practical control available for replanting small areas in fairways,

Torpedograss encroachment onto a bermudagrass green.

Even paint brushes have been used for herbicide application.



Purple Nutsedge

Torpedograss

Smutgrass

etc. During a putting green replanting program, fumigation with methyl bromide is the best insurance against the recurrence of unwanted bermudagrass selections. When planting a bermudagrass green, a border of eight to ten feet should always be planted around the desired putting surface to provide a physical barrier from encroachment of fairway grasses. Roughing newly sprigged greens by hand immediately after planting will help avoid contaminations that occur during putting green establishment. Common bermudagrass growing in improved hybrid bermudagrass greens is a perfect example of an undesirable turfgrass cultivar becoming an Impossible Weed.

Containing bermudagrass in other turfgrass species is another common problem. Bermudagrass encroachment onto bentgrass greens is cussed and discussed from California to North Carolina, all along the entire transitional zone of the United States. To date, the most effective chemical control has been multiple applications of Tupersan (siduron) on the collars of bentgrass greens. Mechanical edging has proven even more effective as long as it can be scheduled on at least a weekly basis during the bermudagrass growing season.

In zoysiagrass, bermudagrass has become a competitive weed because it has a faster growth habit. Spot treatment of bermudagrass with Roundup is the most common control employed. Repeat applications are often needed for good control. Even then, sod removal may be required after the bermudagrass is treated to prevent recurrence.

Goosegrass

Controlling Grasses in Bermudagrass

Bahiagrass

Of course, there are golf course turfgrasses that become common weeds in bermudagrass. Bahiagrass is one of them. It is a stoloniferous turfgrass that can be a persistent pest in bermudagrass fairways. It is the only golf course turfgrass species that can survive with little or no irrigation, so the tide can turn during drought conditions as bahiagrass becomes more competitive than the bermudagrass. Some weed scientists consider bahiagrass a controllable weed, but it can be found as a weed problem on a high percentage of golf courses from south Texas to south Florida. The reason is that it is often planted in roughs because it provides a low-maintenance turf. Continual five- to seven-day applications of high rates of MSMA are needed to reduce bahiagrass in most bermudagrass fairways. Presently, bahiagrass control is being evaluated with Oust (sulfometuron), and experimental selective herbicide, at Auburn University. Hopefully, Oust and other experimental herbicides will soon improve the containment of bahiagrass to the rough areas of golf courses.

Perennial Ryegrass

Every year during winter overseeding, perennial ryegrass seed escapes onto green and tee slopes and becomes a weed. This is an example of a weed problem created by the introduction of another turfgrass species. Overseeding is necessary on bermudagrass greens to provide winter color and playing surfaces. Preemergence herbicides can help reduce unwanted ryegrass, but they can be very expensive. Post-emergence control with Kerb (pronamide) can be effective on areas where the terrain slopes away from green sites so the herbicide will not wash onto a green. However, after perennial ryegrass matures and begins to tiller, it can be very difficult to control and becomes resistant to normally applied herbicides. The key is to time the Kerb application so that the perennial ryegrass is controlled just after germination. Non-selective herbicides such as Roundup can be applied for ryegrass control if the bermudagrass is dormant.

Smutgrass

About the time that warm weather reduces perennial ryegrass in the roughs, smutgrass starts to become an annual

weed problem in the southern states. Smutgrass forms large clumps in roughs that are difficult to mow. The golf players find it especially objectionable when they get black streaks on their clothing from rubbing next to its seed heads. This is caused by the spores of a fungus (smut) which is common to smutgrass.

Similar to ryegrass control, timing of herbicide application is critical. Aatrex (atrazine), Princep (simazine), and Dowpon have all been used for late fall smutgrass control when the bermudagrass ceases its lateral growth. Because smutgrass rises above bermudagrass, it is an excellent candidate for use of a rope wick applicator with Roundup for control. Four or more applications of MSMA at high rates at monthly intervals has been reported effective in the late spring and early summer.

Kikuyugrass

In some small regions of the United States, there are rhizome-forming competitive weeds in bermudagrass turf that are extremely difficult to control. Kikuyugrass is an example of one that has become a serious weed in Southern California. It has become so prevalent that, in some instances, the question is whether to control the kikuyugrass in the bermudagrass or the bermudagrass in the kikuyugrass. If the judgement is made in the best interest of golfing turf and playing conditions, however, bermudagrass should and will win! Kikuyugrass is a vigorous seed producer and has a very extensive, hardy, rhizome system. The grass becomes very puffy, produces excessive thatch, requires constant close mowing to keep it playable, and is of a wiry nature, making it difficult to mow. Many golfers complain that it makes normal shot making difficult, largely eliminates the "bump and run" type of game, and is tiring to walk on. Nevertheless, there are some who extol its virtues.

Control of kikuyugrass is best when timed during its most active growth period, mid to late summer. Control requires two to three applications of Roundup at three-week intervals, followed by an application of Tupersan. Replanting the controlled kikuyugrass site is then advisable with an improved bermudagrass or ryegrass selection.

Torpedograss

Any turfgrass manager who spends his spare time bass fishing along the Gulf Coast of the United States has seen torpedograss. It is a favorite hiding place for large-mouth bass. Its large rhizomes cause it to creep onto golf course fairways and even into bermudagrass greens. Torpedograss can be found in areas with wet soil conditions, and it is resistant to almost all herbicides except Roundup. Many golf course superintendents have spent time on their hands and knees painting torpedograss with Roundup on the collars of greens. Some control has been reported with Asulox (Asulam), but most rates effective for control will also control or suppress the bermudagrass. Torpedograss can form a turf under rough mowing heights, which is an alternative to its becoming an Impossible Weed.

Goosegrass

There are annual weeds which become perennial in their growth characteristics. Goosegrass, one of the most common annuals on golf courses, becomes a perennial weed in sub-tropical regions of the United States. Reproduced by seeds, a single plant can produce 20,000 to 50,000 seeds per year on three to seven finger-like racemes per spike. Therefore, it is a constant threat wherever bermudagrass turf is thin and weak. Long seasonal growth in these subtropical regions means that the timing of herbicide control is critical. Goosegrass can germinate right up until the time of overseeding, so it becomes a winter weed on green bermudagrass fairways in Southern California, South Florida, and Hawaii. Normal post-emergence control herbicides will discolor the bermudagrass for long periods at a time during the winter months in these regions, so control is based on pre-emergence herbicides or spot application of non-selective herbicides. Hand removal has long been a form of control, especially on greens, but higher labor costs reduce its efficiency in areas of a large goosegrass population.

The best control is early and late summer post-emergence applications of MSMA, alone or in combination with Sencor (metribuzin) at labeled rates. Combined with spring pre-emergence herbicide application and a good fertility program for the bermudagrass, goosegrass can be reduced significantly. Goosegrass isn't just another weed, it is probably the most persistent annual weed in the southern tips of the United States, so perhaps it should be classified at the top of the list of Impossible Weeds.

Creeping Sedges

Not all of the Impossible Weeds are grasses. Creeping sedges, such as purple nutsedge, are found on greens, around bunkers, and in fairways of all turfgrass species. Purple nutsedge has a vigorous rhizome system that is initiated through tubers (nuts) in the soil. These tubers are the key to control. They are affected by fumigation with methyl bromide, so it is imperative to fumigate all sands used for green construction prior to planting in areas where purple nutsedge is common.

Post-emergence control is based on the continual reduction of the leaves and plant with repeated MSMA or Basagran (bentazon) applications. As new shoots recur from rhizomes and tubers, another herbicide application will reduce them. Finally, after enough applications are made with postemergence herbicides, the purple nutsedge is reduced, but not necessarily controlled. Stay with the continual post-emergence herbicide program for several growing seasons and the turfgrass manager will eventually win the battle against purple nutsedge.

Invading turfgrasses and weeds that are difficult to control are just as prevalent in cool-season turfgrasses as warm-season turfgrasses. One advantage to cool-season turfgrasses is that many of them can be reseeded after weed control. Herbicide application techniques are similar for both warm- and cool-season turfgrasses.

There has been considerable interest in many of the new, very selective, experimental herbicides with warm- and cool-season turfgrasses. New herbicides such as Oust (sulfomethron), Glean (chlorsulfuron), and Poast (sethoxydim) are being evaluated for selective weed control at universities in almost every region of the United States. Researchers are finding that there is a considerable difference in the tolerance to these new herbicides among the turfgrass species. This will help us develop techniques for the timing of herbicide applications. There are still better herbicide application methods yet to be discovered with the help and support of turfgrass managers. Improvements in turfgrass cultivars now underway in the breeding programs supported by the USGA and GCSAA will provide better, weed-resistant golf course turfgrasses. With all these continual improvements in controlling difficult turfgrasses and weeds, they soon may not be so impossible!

Sulfur, The Fourth Major Plant Nutrient

by DR. ROY L. GOSS
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WE NORMALLY CONSIDER nitrogen, phosphorus, and potassium as the three major plant nutrients, and they are always listed in that order on the fertilizer bag. Recent research indicates that sulfur should be given a priority rating equal to or greater than phosphorus. Many areas of North America are deficient in sulfur, while some areas have adequate amounts supplied through water or from atmospheric fallout as air pollutants.

The amounts of indirect sources of sulfur available to turfgrasses have declined. Restrictions on the burning of high-sulfur coals and other fossil fuels and the high degree of refinement of fertilizers have practically eliminated sulfur as a contaminant and, thereby, reduced its availability to plants. Without the addition of adequate levels, the plant must take its sulfur from residual levels in the soil, which is mineralized for the most part from organic materials. A constant lowering of the level of sulfur through removing clippings can cause stress in plants, particularly if growth is stimulated with moderate to high levels of nitrogen.

Sulfur is required in plant tissue for the formation of the vitamins thiamine and biotin and the essential amino acid cystine, which is a component of plant proteins. Sulfur deficiency in plants quite often resembles nitrogen deficiency. Amino acids and other nitrogen compounds may accumulate in tissue of sulfur-deficient plants, probably because protein synthesis is not maintained at a rate comparable to that in plants receiving adequate sulfur.

Turfgrasses may not exhibit recognizable sulfur deficiency until tissue levels fall below 0.2 percent. Turfgrasses receiving an adequate level of all nutrients may show wide ranges of tissue levels of the individual nutrients, depending upon genus, species, and possibly grass variety being grown. Reports concerning adequacy of tissue sulfur range from 0.2 percent to over 0.5 percent. There is documentation that shows adequacy for phosphorus ranging from 0.13 percent to as high as 0.55 percent in tissue. This would lead us to believe then that sulfur is as much a major plant nutrient as phosphorus. This has been verified through several years of research at Washington State University's Western Washington Research and Extension Center, at Puyallup, Washington, where tissue sulfur levels ranged from a low of 0.23 percent (average of 0.28 percent) with no sulfur fertilization, and a high of 0.5 percent (average of 0.44 percent) with high sulfur fertilization. We have concluded that minimal sulfur tissue levels for Astoria colonial bentgrass maintained as putting green turf should not fall below 0.3 percent. These highest sulfur levels were obtained in the tissue from applications of 3.5 pounds per 1,000 square feet of elemental wettable sulfur per year.

BENTGRASS fertilized with 6, 12, and 20 pounds of nitrogen and 1.15 pounds of sulfur per 1,000 square feet

per year showed significantly better color than plots receiving no sulfur. It is important to point out that no significant improvement of color occurred at the low nitrogen level with any rate of sulfur, indicating the plants were under no stress for nitrogen or sulfur. Yield of clippings was significantly less at the low nitrogen level. Plots receiving 12 pounds of nitrogen per 1,000 square feet per year exhibited no color difference between the low and high rates of sulfur, but they had significantly better color than those receiving no sulfur. Plots receiving 20 pounds of nitrogen per 1,000 square feet had significantly better color at the highest sulfur level than low or no sulfur.

As much as 30 percent of the plot area was infected by Fusarium patch disease at the higher nitrogen levels where no sulfur was applied. Disease was reduced to an average of 15 percent with applications of 1.15 pounds of sulfur per 1,000 square feet. Disease was further reduced to less than 5 percent with applications of 2.3 pounds of sulfur per 1,000 square feet per year, and no disease occurred in any plot when sulfur was applied at 4.6 pounds per 1,000 square feet per year. Phosphorus and potassium applications reduced disease slightly, but not to a significant degree.

Annual bluegrass was reduced from 60 percent to less than 5 percent with applications of 3.5 pounds of sulfur per 1,000 square feet per year over a seven-year period. Annual bluegrass decline was noted at the end of the third year of sulfur application, and it continued to decline until the test ended.

Phosphorus applications significantly increased annual bluegrass populations at all levels of nitrogen. The highest sulfur levels reduced *Poa annua* populations to less than 20 percent with all nitrogen levels when phosphorus was high. This conclusively proves that higher soil levels of available phosphorus will stimulate annual bluegrass encroachment unless it is suppressed in some other manner.

These tests were conducted on a fine sandy loam with an original pH of 5.7 containing moderately high calcium levels. No lime was applied throughout the test period and pH values dropped as low as 4.0 with a combination of the highest levels of nitrogen and sulfur. It was interesting to note that all high nitrogen plots without sulfur had the same pH with or without applied sulfur.

Sulfur tests conducted on washed sand-based putting green turf did not prevent annual bluegrass from spreading, although plots with highest sulfur levels had significantly less annual bluegrass. This would tend to indicate some other factors are involved. Further investigations are being conducted.

WITH LOWER nitrogen applications the objective of most golf superintendents today, sulfur applications at any level probably will not enhance color unless sulfur is very deficient. In general, one pound of sulfur per 1,000 square feet per year is adequate for nutrition. The advantage of higher levels of sulfur appears to be in its effects on reducing certain turfgrass diseases and suppressing annual bluegrass. Elimination of algae and suppressed earthworm activity were also noted.

On this yellow Astoria colonial bentgrass plot, nitrogen levels were "high" but sulfur levels were at "0."

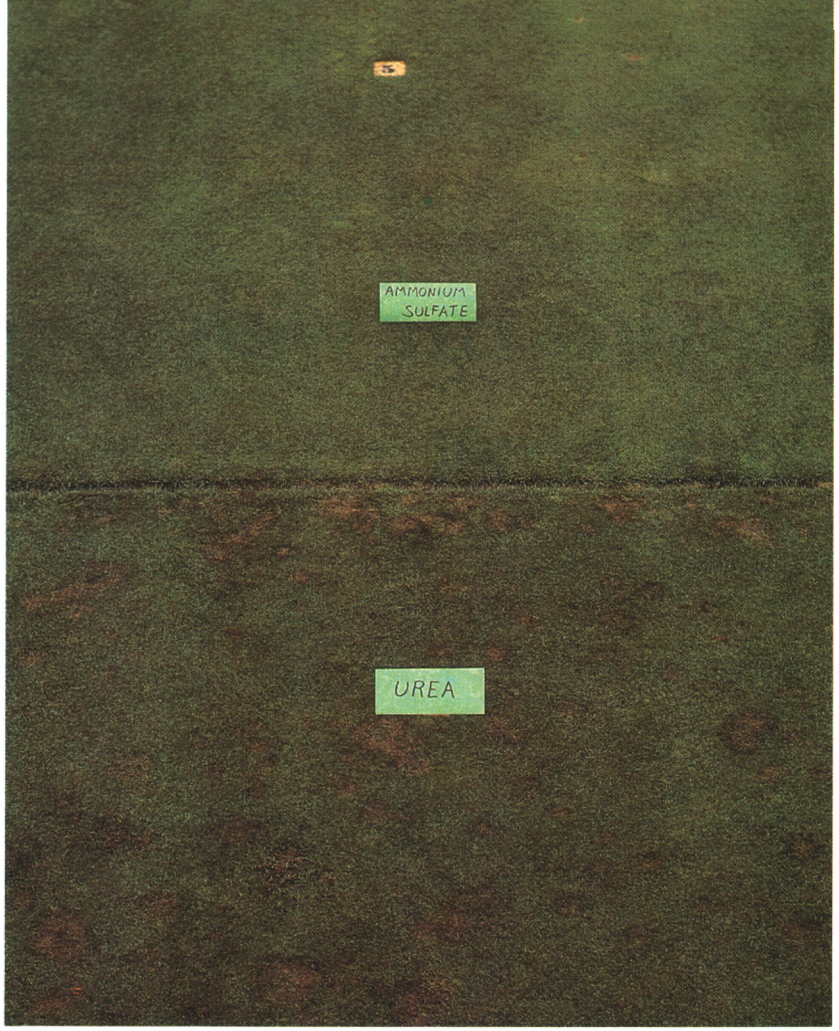
Reduced annual bluegrass seed heads on the "high" sulfur plot but excessive on the "low" plot.

It is advisable that sulfur applications to putting greens be made in one-half pound per 1,000 square feet increments or less, and these applications should be confined to the cooler periods of the growing season when there is soil bacterial activity. Sulfur applications during midsummer should be reduced to avoid the possibility of adverse effects.

Continuous applications of ammonium sulfate will produce essentially the same effects, provided that nitrogen applications are six pounds per 1,000 square feet or higher. It is doubtful that these effects can be achieved from this source of nitrogen at lighter rates.

Golf course superintendents dealing with soil pH values of 7.0 or more may apply higher levels of sulfur, but they should seek advice from turfgrass specialists in their areas or accredited soil testing laboratories.

Several golf course superintendents in the Pacific Northwest who have diligently applied sulfur for several years report significantly less Fusarium patch disease and large savings in fungicide treatments.



(Top, right) Minimal Fusarium Patch appears on the ammonium sulfate plot while excessive on the urea plot.

(Right) No disease on the "high" sulfur plot while there is much disease on the "low" sulfur plot.

Playing Par with Jack Frost

by **CHARLES B. WHITE**
Director, Southeastern Region, USGA Green Section

AS WINTER BEGINS, the golfer lays aside his clubs for a time and settles down to watch football. But, loving the game, our minds quickly return to golf, and our bodies avidly follow. Thus we encounter an age-old problem: morning delays to allow the frost to clear or enable the green surface to thaw. Often a confrontation arises between the golf professional and/or the superintendent on one side and club members on the other. Consider the problems of playing greens in the winter when frost or freezing occurs, and why play must be delayed, or even prevented, for a period of time.

Everyone knows frost must clear off the grass before play can begin, but few people know why. Frost on the grass blades tells us that the water inside the leaves is frozen. Remember that water is the primary component of plant tissue. When this water is frozen, traffic on the turf causes the ice crystals in the cells to puncture through the cell walls, killing the plant tissue. Little damage is done to the crowns (growing points) or roots if only a light frost appears; however, when the frost is heavy, cell disruption may occur at the crown, thus killing the entire plant. Frost damage symptoms include white to light tan leaves where traffic has passed.

Traffic damage can be minimized by melting the frost with a light syringing of the greens when soil and air temperatures are above freezing. The simplest approach is to avoid traffic until the frost melts.

Another dangerous situation exists when the soil is completely frozen to the surface but the grass blades have thawed. Provided there is *no* frost or ice on the grass under this condition, then limited foot traffic creates little damage, if any.

At these times, heavy traffic or golf carts should be restricted from greens, tees and even fairways. This is the most favorable winter condition, because when the soil is frozen it does not allow as much penetration of compaction and spikes, thus preventing damage to the grass roots. Since the blades are not frozen, they retain the resiliency needed to withstand light foot traffic.

Traffic damage on frozen turf areas usually occurs during periods of freezing or thawing. The most devastating situation occurs when the grass blades and the upper one-half to one inch of soil has thawed, but the ground beneath their level remains frozen. Traffic will create a shearing action of the roots, rhizomes, and crown tissues at this time. This is comparable to cutting the plant tissue from the underlying root system with a sod cutter. Complete kill of leaves, crowns, and rhizomes can occur if the temperatures soon drop below 20° F. Symptoms from this severe injury include whitish to dark brown leaves that may mat on the surface.

Once temperatures allow thawing to a depth of three to four inches, the probability of turf damage declines since about 75 percent of the root system is in the upper four inches of soil. Frequent soil probing is the only positive way to effectively monitor the freezing level. Traffic should be adjusted accordingly.

Understanding the effects of traffic must be carried one step further. Cart and foot traffic can be devastating to dormant bermudagrass, and golfers don't realize the damage traffic funneling can cause. They must use golf cart roads. The illustrations that show damage from winter traffic are all from courses that have light play, less than 22,000 rounds of golf per year. Imagine the potential for damage on more intensely played courses.

PREPARING the turfgrass for winter dormancy or semi-dormancy is a continuous, year-round process, but, unfortunately, winter preparation is often forgotten until fall. If summer and winter extremes were never experienced, there would be no need for careful and judicious programs involving the proper balances of pesticides, fertilizers, and cultural practices. But these two extremes are realities, and proper management is essential to maintain good turf covers throughout the stress periods.

Fertilization in the late summer to early fall, using a high-potassium and low-nitrogen material, will not only insure a good foliage growth rate, but it will also maintain vigorous rhizome and root development to begin the hardening off process for winter. Adequate potassium in the late summer encourages hardening off of the grass in the fall, a condition that increases storage and

(Above) Early morning frost remains in shady areas.

(Left) Last winter, cart traffic killed a lot of dormant bermudagrass.

assimilation of carbohydrate reserves. Nitrogen overfertilization in the fall prevents adequate carbohydrate reserves from being stored and stimulates excessive foliage growth. This adds to thatch buildup and produces a lush turf that is very susceptible to cold weather damage.

Phosphorus and potassium, a blend of minor and micronutrients, along with the lower rates of nitrogen, balances the nutrient requirements of the grass and provides maximum winter hardiness. Remember, one of the functions of potassium is to improve winter hardiness of the grass, because potassium tends to reduce the amount of water in the plant cells and acts as an antifreeze to lower the freezing point of the plant. This is very beneficial in reducing low-temperature stress or damage that can quickly occur on turf. The use of heavier potassium applications in the fall is based on already proper soil nutrition levels, which should be tested annually. Regardless of the nutritional condition of the grass, no fertilizer application can offset winter damage imposed by traffic.

Several factors influence a particular grass strain's tendencies for winter injury or death. These include (a) hardiness of the plant, (b) freezing rate, and (c) length of time frozen. Usually the more rapidly the freezing occurs, the higher the temperature at which kill is observed. If a sudden severe cold front develops, the turf will be damaged to a much greater extent if this hardening off process is not fully encouraged. A perfect example of this is the winter of 1983-1984.

ANOTHER important winter preparation is late summer or early fall aerification of cool-season grasses to establish a proper soil-to-air-to-water ratio in the soil and to remove compaction so that growth rates of rhizomes and roots are at their highest level. Growing conditions for the root system should be as favorable as possible in the spring and fall so that maximum root elongation and branching allow the grass to build up the necessary root system for surviving stress periods. Coring in the late summer or early fall, along with vertical mowing and topdressing of cool-season grasses, will check thatch and reestablish the best growing conditions. Initiation of new plants through rhizome and stolon activity occurs, therefore, at one of the optimal times of the year.

The importance of developing a strong and adequate root system for the winter months has already been mentioned, but its importance should be re-emphasized through the function of the root system during the low-temperature stresses of winter. When adequate carbohydrate reserves are developed in the root system, the turfgrass plant has a reserve food supply that can be used when the grass plant is not able to conduct photosynthesis. If a root system is not developed in the fall, or if the grass plants are sheared off from the root system by play on partially thawed greens in the winter, it is unable to use the stored carbohydrates, and the plants starve to death. As better growing conditions develop again in the spring, whatever carbohydrate reserve is left in the healthy grass plant will be used to initiate new growth. Many turfgrasses now die if the root system has been removed from the crown portion of the plant or if an inadequate supply of carbohydrates was stored in the fall.

Another problem with playing partially thawed greens is the tremendous tracking or footprinting created by heaving action at the frost line in the soil. Since soils do not thaw or freeze uniformly throughout the putting surface, some areas on the greens may be softer than others, thus accentuating the effects of tracking

Concentrated foot and cart traffic can be devastating.

News Notes for Autumn 1984

Oppps - upped $50

In spite of air fare price wars on coast-to-coast and some north-south routes, travel costs have continued to increase in 1984 and are responsible for a small but necessary increase ($50) in Turf Advisory Service (TAS) fees for 1985. Even so, the Green Section's Turf Advisory Service is still the best buy in the management of golfing turf today, less than one-quarter of one percent of most golf course maintenance budgets in the U.S.A.!

The Green Section Staff, recognized worldwide as an authority in scientific and practical turfgrass management, serves and directly assists golf course superintendents and green committees of USGA Member Clubs subscribing to TAS. Direct visits to your course, written reports, unbiased recommendations and consultation by the experienced staff throughout each year continue to be the Green Section's pledge to you and your club. And the USGA Green Section has been at it and the leader in this field since 1923!

The following TAS fee schedule will be in effect as of January 1, 1985.

One-half day visit: $500 if paid on or before April 15; $550 if paid after April 15.

Full day visit: $800 if paid on or before April 15; $850 if paid after April 15.

Over 1,000 USGA Member Clubs, large and small, subscribed to TAS this year. We need your continued support! To the other clubs and their superintendents who have not been subscribers, join us in 1985 and let us assist you in providing the best golfing turf your club has ever known.

Billy Buchanan, Mid-Atlantic Director and Green Section Agronomist for Championships Resigns

Billy Buchanan, a member of the Green Section staff since 1970, announced his resignation on July 15, 1984, to become Tour Agronomist for the PGA. During the past few years, Buchanan served as the Green Section Agronomist for USGA Championships, including the United States Open, United States Amateur and other major USGA events. He also served as the Mid-Atlantic Regional Director and, earlier in his career, visited TAS clubs throughout the East. His real interests developed in tournament golf. All of us thank him for his contributions and service and wish him well in his new adventure.

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or footprinting. Footprinting is further enhanced when a frozen subsurface disrupts water percolation, leaving a wet layer on top.

Now the superintendent is faced with a real dilemma and a difficult decision. Should such greens be removed from play (using alternate winter greens if they're available) until complete thawing occurs, or should the regular greens be aerified in the early spring to check upper profile compaction and improve the soil-to-water-to-air ratio in the root zone? If they are aerified in the early spring, the superintendent and members can anticipate an increased crop of *Poa annua* on the greens later in the spring and summer (with all of its attending problems)! It's not an easy choice. Many other circumstances must and will influence the final decision. For example, what percentage of the members play in the late winter and early spring and how important is that play compared to quality putting surfaces later in the year? It's a decision to be shared by the green committee, the superintendent and perhaps even the Board of Directors.

ASSESSING winter injury on warm-season grasses can easily be initiated in late winter just before spring green-up. The easiest method is to collect five to ten plugs from suspect winter kill areas and pot them in a greenhouse or similar light and temperature conditions. This provides an excellent representative evaluation of winter damage. Renovation plans, etc., if needed, may be made early. Healthy areas should green-up nicely in two to three weeks, and weaker areas will green-up accordingly, if at all.

Many letters and articles are published every year in an attempt to educate golfers to the potential problems of playing on frozen or partially frozen turfgrass areas. Golf course superintendents or club officials should educate golfers in the fall regarding the problems with playing frozen greens so the golfers themselves have a better understanding of the damage that occurs when traffic is imposed on frozen or partially frozen turf. In most cases, informing golfers of suspended play due to frozen greens is inadequate and sounds more like an excuse than a reason. However, if care is taken to educate members through a seminar, newsletter in the golf shop, or a handout distributed directly, it will help members understand exactly what happens when foot traffic is placed on frozen and partially frozen putting surfaces, and it also informs them of winter traffic damage to the turf in general. Perhaps most important of all, it gives the membership, through the green committee, the opportunity to decide if alternative winter greens should be provided and are economically justified under their conditions.

If the golf course superintendents and other club officials make a concentrated effort to educate their memberships as to why traffic is not allowed on the golf course on particular winter days, they will gain support and will eliminate the current Saturday morning standoffs at the pro shop and the descriptive name-calling sessions which inevitably arise.

The Stimpmeter — A Perspective

by ALEXANDER M. RADKO
USGA Green Section Committee

THE STIMPMETER is a device for measuring the speed of putting greens. It was made available for club use by the USGA in 1977. Its purpose is two-fold: first, to establish a guide to green speeds for tournament play, and secondly, to establish a guide to green speeds for regular membership play. The following comparison tables were published in 1977, also, and the fact that they have held up without change to date is a credit to their accuracy.

USGA Green Speed Test Comparison Table (Regular Membership Play)	
Fast	8'6"
Medium-Fast	7'6"
Medium	6'6"
Medium-Slow	5'6"
Slow	4'6"

USGA Green Speed Test Comparison Table (Tournament Conditions)	
Fast	10'6"
Medium-Fast	9'6"
Medium	8'6"
Medium-Slow	7'6"
Slow	6'6"

Before the Stimpmeter, there was no positive way for a club selected as a site for a national championship to determine accurately the speed or uniformity of its greens. It seemed incongruous for the best players in the nation to compete for a championship and not always be provided every opportunity to use their true putting skills to the fullest. The Stimpmeter proved there was significant variation among greens on many golf courses used for USGA events, and this prompted Green Section agronomists to establish a management program that now serves as a guide to attain speed and uniformity for all USGA competitions. These speeds are shown in the table for Tournament Conditions. However, the term Tournament Conditions was never clarified, and herein lies the rub! Did the USGA suggest by these tables that clubs were supposed to oscillate from regular membership speeds to tournament speeds for every club tournament? No, this obviously would be an impossible task to impose upon any golf course superintendent. Was the tournament speed table established to suggest that standards for players of national and international caliber should be different from the speed standards for the average golfer? The answer here is a resounding yes! Their game is totally foreign to the game played by the average golfer, and it follows that the course should be set up specifically for that exceptional caliber of golf. Only a few clubs are willing to take on the challenge to shift management gears for the intensive maintenance required to handle national and international competitions and to make the sacrifices.

WHAT GOES INTO the special tournament preparations necessary for a USGA championship? Let's give you an insight! Two years before the target date, the Green Section agronomist responsible for championships schedules his first visit to discuss on-site conditions and USGA turfgrass specifications for their competitions. A two-year conditioning program is discussed and agreed upon with the host golf course superintendent and club officials involved on committees appointed to work with the USGA to assure that turf conditions will be as nearly perfect as possible. Periodic visits by the Green Section agronomist during these two years help ensure that USGA turf projections are progressing on schedule.

As for greens during this time, a few major changes are recommended. These include a sparse nitrogen fertilizer program, an accelerated topdressing program, and a judicious vertical mowing program. All other programs remain the same for most of the two preparatory years. The decisive change on greens occurs four days in advance of the formal practice round. From that day on through the competition, all greens are double-mowed daily at a height that will assure that green speeds will be at the prescribed pace beginning on the day of the formal practice round. This speed ranges between 8'6" and 10'6", depending upon the specific championship. Having been prepared over two years, there is no problem in reducing the height of cut on greens slightly to attain the necessary speed.

Green speeds for the Junior Championship would not be as quick as for the Open Championship. For example, if the designated speed agreed upon for a specific championship is nine feet, all greens, including the practice green, are conditioned to average nine feet beginning on the day of the formal practice round. Since the formal practice round is traditionally played on Wednesday and the tournament is played from Thursday through Sunday, this means that all greens are kept at the designated tournament speed *for five days only* . . . six days if there is a playoff! In the specific example cited, all greens rolling in the range of 8'6" to 9'6", or plus or minus six inches from the designated target speed of nine feet are considered uniform.

IMMEDIATELY after the competition, green speeds are returned to their normal regular membership speed! Unfortunately, golfers who attend the tournament or watch on television conclude that the speed they see during the competition is the speed the club maintains all year around. This is not so! It is costly and indeed risky to attempt to keep greens at an average above 8'6" all season long. Now, having said that, there are always exceptions! The few clubs that prided themselves on their

fast greens long before the Stimpmeter came into use still do everything they can to uphold that tradition. It is important to them to do so, and they are willing to budget and to take the risks in the interest of tradition.

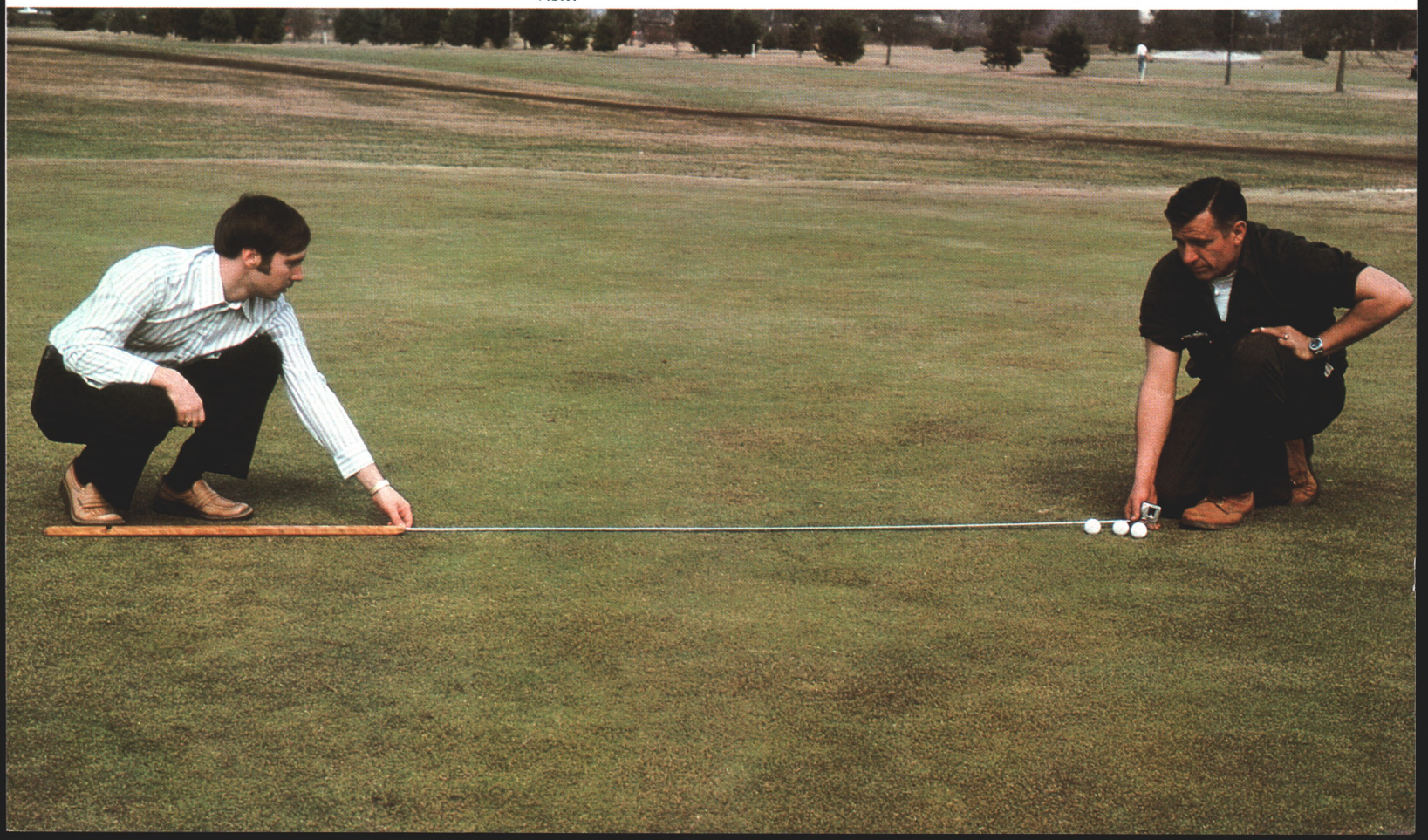
So much for the national championships. Now let's turn our attention to special club tournaments, such as their men's and women's club championships and state championships. How should clubs prepare greens for these events? Should they use the tournament speed table or the regular membership speed table? Without question their choice should be the regular membership speed table. They should work towards increasing green speeds a comfortable few inches above speeds normally maintained the year-round. This can be done within budget and without danger of turf loss simply by double-mowing (without changing the mower setting) beginning four days before and every morning during the competition. This practice should increase speed from three to six inches over the everyday speeds normally encountered. For example, if the club's regular everyday green speed averages 7′9″, double-mowing in the manner described should increase the green speed average to somewhere between 8′0″ to 8′3″ for the competition.

WHAT SHOULD the pace of greens be for the average club? The USGA does not dictate a pace but suggests that clubs select a speed from the regular membership speed table comfortable for the membership, and then take the necessary measures to insure that all greens, including the practice green, putt uniformly. From my personal findings, during several years of testing greens while in the employ of the USGA Green Section, I was surprised and disappointed that too many greens measured less than seven feet. In my opinion, all northern clubs with bentgrass greens should average between 7′6″ and 8′ for most of the playing season. This, I feel, is where good putting quality begins. After all, greens are the most intensively maintained turf of all the playing area; therefore, it follows that they should be flawless in roll and pace for most of the golfing season.

One of the major problems has been that putting green grasses were fertilized too heavily. It took years to convert to programs of sparing fertilizer use, not only in total, but also sparingly per application! This is most important, for even one heavy nitrogen application per year could spoil the grass texture for that entire year. It is the way to better greens! Some call it a low fertilizer program. I disagree with that statement entirely; it is the only way, the right way to fertilize greens!

The Stimpmeter is not only a remarkable management tool, it can also serve as a barometer to gauge your total greens program. It is extremely accurate and provides a very high degree of repeatability. The Stimpmeter can serve as a positive influence on greens management. If used in a positive way for improving uniformity and quality of putting surfaces, more golfers will enjoy increased pleasure from the game . . . because of the chance to improve in what many consider the most important part of the game, their putting skills! Isn't that what golf turf management is all about?

USGA Northeastern Director Jim Snow checks the ball speed during a Turf Advisory Service visit.



TURF TWISTERS

FALL IS FOR SULFUR

Question: Can sulfur cause a burn on my greens? (Illinois)

Answer: Indeed it can! As with any chemical, exercise care in the rate, formulation, and timing of sulfur applications. (See Dr. Roy Goss's article in this issue.) We have seen instances where coarse, granular sulfur applied in the fall did not break down and was still visible the next spring and even caused small Dollar-Spot-sized burn marks the following summer! Therefore, choose a sulfur that readily dissolves and use at common-sense rates: one-half pound per 1,000 square feet per month in cool weather until three-and-a-half pounds are applied per year. Avoid summer applications.

SHATTERING IS FOR SOILS

Question: What is "shattercore" aerification, and is it useful? (Florida)

Answer: Shattercore aerification is solid-tine aerification with a walking green aerifier. The name shattercore is derived from the shattering of the soil around the tine due to the force of the machine. Studies at Michigan State University have shown short-range improvement, but long-range results are not known at this time. Since some surface disturbance is possible, it is best to experiment with the technique on your soils before making big plans.

EDB IS FOREGONE

Question: Now that EDB is gone, what do I use for nematode control? (Florida)

Answer: Unfortunately, there is not a good substitute for EDB at this time. Of course Nemacur is still available, but this material, unlike EDB, is too expensive to be used on fairways, roughs, or other large acreage areas. Hopefully, there will soon be a new product available to turf managers to replace EDB and DBCP.