which to make selections became available. Frequently, superintendents of older facilities recognize colonization of areas by superior grass segregates and take the time to notify people involved in making turf selections.

Fortunately, in recent years plant physiologists have considerably increased the basic knowledge about the reasons behind geographic plant distribution. Tropical grasses, such as bermudagrass and zoysia, differ physiologically and anatomically from temperate species, such as bluegrasses, fescues and bentgrasses. These physiological differences help explain why tropical species are more vigorous during the hot summer months than the temperate species.

PHYSIOLOGICAL DIFFERENCES

Plants must incorporate carbon into their systems for use in growth. The only way plants can do this is through photosynthesis. During photosynthesis, carbon dioxide is fixed from the atmosphere and incorporated into sugar molecules through a series of reactions taking a fraction of a second. During this process, radiant energy from the sun has been "trapped" in the sugar molecule in the form of chemical energy. This energy is available to drive reactions necessary for the normal metabolism of the plant.

Warm season grasses have a different method than cool season grasses for capturing carbon dioxide out of the air. The enzyme involved in this capture has a greater attraction for carbon dioxide at higher temperatures than the enzyme in cool season species (Figure 2). This greater attraction at high temperatures is part of the reason why warm season grasses are more vigorous than cool season grasses when temperatures are high.

Plants and animals must respire to provide their systems with the energy trapped and stored in sugar compounds. When animals breathe, they take in oxygen and liberate carbon dioxide. The oxygen taken in oxidizes stored sugar and releases energy for use by the body, and carbon dioxide, which is exhaled. Plant respiration is essentially the same, the main difference being the utilization of this respired energy. Animals use most of the energy to satisfy muscular demands in mechanical movement. This demand is absent in plants; however, there are energy requirements existing in plants that are missing in animals. Energy is required during photosynthesis and nutrient uptake, to name two critically essential areas.

One striking physiological difference between tropical and temperate turfgrasses is the phenomenon of photorespiration. As the name implies, this respiration takes place in the presence of light and occurs simultaneously with photosynthesis. Unfortunately for cool season grasses, they possess this inborn error in metabolism and warm season grasses do not. Why is this referred to as an error in metabolism? As explained earlier, the respiration common to both cool and warm season grasses liberates energy. During photorespiration, however, no utilizable energy is generated for the plant. Also carbon dioxide evolves from the plant into the atmosphere just as it does when animals exhale. Consequently, carbon is lost to the air, which would have been available for incorporation into growth materials. Warm season turfgrasses, which lack photorespiration, conserve the carbon they capture from the air, and this provides an advantage over cool season grasses.

What can be done about this wasteful metabolic "hang-up"? One approach is chemical inhibition.

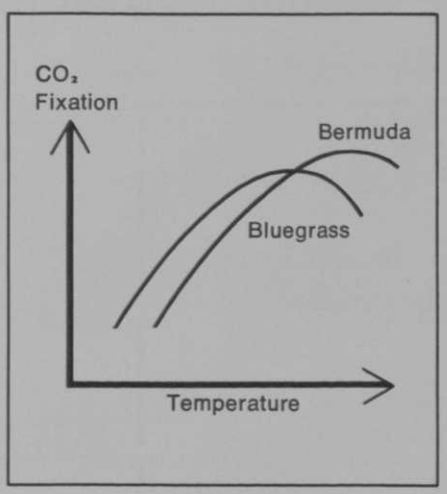

Figure 2. Effect of temperature on the photosynthesis of bluegrass and bermudagrass.

Research using disks cut from green leaves has shown that the photorespiration can be inhibited by blocking the activity of the enzyme involved. However, attempts to chemically inhibit photorespiration have failed (5). Another method used to inhibit photorespiration is the lowering of the atmospheric oxygen concentration to near zero. Because respiration is an oxidative process, a lowering of oxygen concentration will cause inhibition. Photosynthetic rates of cool season grasses exposed to normal oxygen concentrations and high temperatures have revealed that it is approximately one-half that of bermudagrass (4,5). When photosynthesis of cool and warm season grasses is measured in low oxygen air, the rate of the cool season grasses nearly doubles, while the rate of the warm season grasses remains essentially unchanged. Photorespiration can then be calculated by subtracting the photosynthetic rate in normal air from that of low oxygen air.

The total difference in photosynthesis between the warm and cool season species is not entirely accounted for by inhibiting photorespiration. As previously mentioned, the enzymes involved in the capturing process differ in their attraction for carbon dioxide. This phenomenon accounts for the remaining difference.

When Kentucky bluegrasses are ranked according to their photosynthetic rate in normal air at high temperatures, those selected from southern latitudes tend to rank higher than those from northern latitudes. The ranking for photosynthetic rate in reduced oxygen air revealed a considerable rearrangement of the order. Some from northern latitudes ranked higher than those from southern latitudes. This would indicate that Kentucky bluegrasses vary in their amount of photorespiration. Also, the implication that some Kentucky bluegrasses can regulate photorespiration, at least slightly, is significant. Germplasm undoubtedly exists that survives southern environs, and this is promising from the point of view of its inclusion in breeding programs to develop more widely adapted turfgrasses.

continued on page 43

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TRANSITION *from page 41*

Once this can be accomplished, turf managers in areas, such as the transition zone, will have better tools to use for the production of fine turf.

Research currently is being carried out at Penn State to determine if Kentucky bluegrasses with photorespiration inhibited can grow as well as bermudagrass at high temperatures. These experiments are being conducted in controlled environmental growth chambers, so temperature, humidity and gaseous components of the atmosphere can be controlled. Results from this research will help determine the practical advantages, if any, of having photorespiration inhibited on the golf course.

Hopefully, other biochemical indicators of high temperature tolerance can be developed to be used as screening tools to reduce the time required for varietal testing. The day will come eventually when predication equations for geographical performance by new grasses can be written based on results from a series of indicator tests for disease, heat, drought and cold tolerance and others.

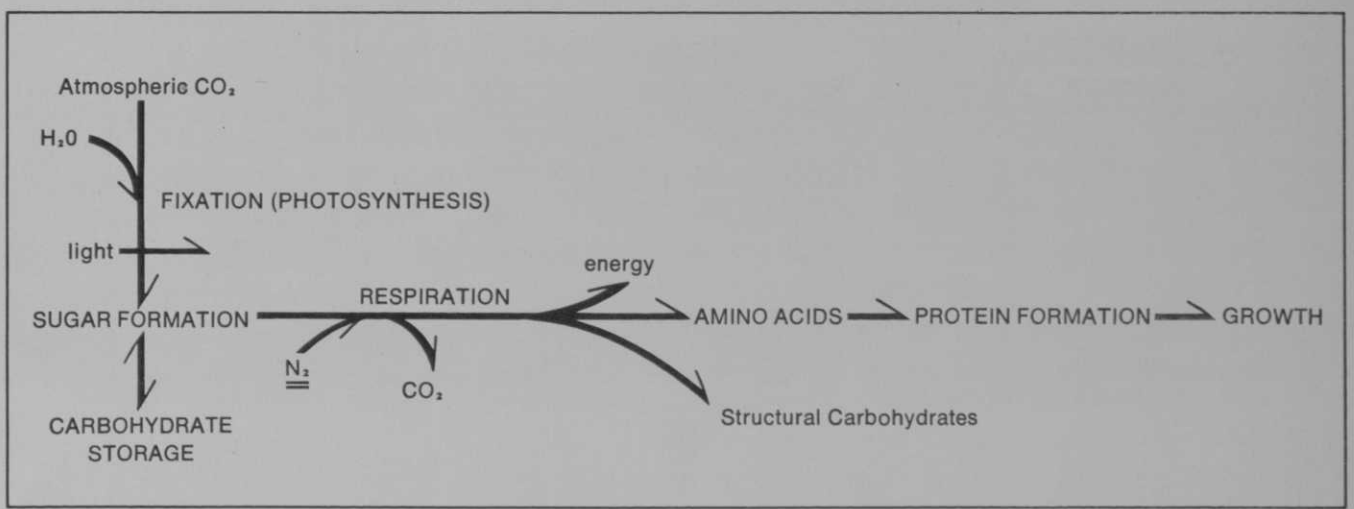

Figure 3. Schematic diagram linking various physiological processes to plant growth.

REDUCING STRESS

What can superintendents in stress areas do to increase turf quality of cool season grasses during periods of high temperatures? First, a basic understanding of how plants grow is necessary. Photosynthesis and respiration have already been discussed. Once carbon has been incorporated into sugars, the plant can utilize them immediately or store them for later use. The term carbohydrate is most often used in reference to sugar metabolism. Stored carbohydrates reflect how the plant has been growing. Carbohydrate depletion is most often a reflection of growth stimulation resulting from nitrogen fertilization, elevated temperatures, irrigation or usually a combination of all three. Increases in stored carbohydrates result when temperatures are cool and photosynthesis is rapid.

Tolerance of high temperature stresses is directly related to the amount of carbohydrates present in plant tissue. Those species that have high carbohydrates can better tolerate stresses than species with lower carbohydrates (3,4). It becomes obvious when examining the conditions that lead to carbohydrate depletion that proper timing of fertilization is necessary to maintain high carbohydrate levels. Examining a schematic drawing, one can see that nitrogen stimulates carbohydrate utilization for protein production which increases growth (Figure 3). Growth is necessary for injury recovery, however, nitrogen fertilization during hot weather is not necessary to stimulate growth. Chemical reactions involved in the growth processes are accelerated by temperature increases. As long as carbohydrates are available, growth will proceed unhindered unless nitrogen is deficient. It has been shown that Kentucky bluegrasses, grown at cool temperatures, which favor carbohydrate accumulation, increased in growth when subjected to high temperatures for at least a week (4). Once the carbohydrate level was depleted, growth subsided dramatically. During periods of normally accelerated growth, nitrogen applications complicate the problem. The resulting stimulation hastens growth cessation and initiates physical deterioration. Nitrogen should be used sparingly during stress periods. Green color can be maintained in these stress periods by very light applications (spoon feeding) of a soluble nitrogen source of one of several sources of available iron.

Cool season grasses normally have a flush of growth in the spring (mid-April to mid-May). Fertilization should be delayed until after this time to minimize carbohydrate depletion prior to entering the stress portion of the season. Usually late fall or winter applications of fertilizer will provide adequate nutrition for early spring green-up and growth until after the spring flush. The majority of the seasonal nitrogen supply ideally should be applied in fall, when photosynthesis is still high and while temperatures are cooler and growth subsiding. At this time, climatic conditions favor root growth and carbohydrate accumulation.

Another technique practiced by many is syringing. From previous discussion in this article, the advantages of a cooler microclimate can be appreciated. The resulting reduction in canopy temperature, even though temporary, occurs dur-

continued on page 54

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TURFGRASS RESEARCH IN JEOPARDY

Members of the turf industry are fearful over the proposed reduction in Federal funds for agricultural research, and with justification. The cutback can have far-reaching effects on the total turfgrass industry

by DR. JAMES B. BEARD

IF THE DIE IS CAST

The Nixon Administration's proposed budget for the 1974 fiscal year deals a heavy blow to funding for turfgrass research.

Federal agricultural officials are asking for a 20 per cent reduction in research funds primarily from the Hatch Act appropriations and two related bills that were established to support research through state agricultural experiment stations, which handle most turfgrass research.

If this proposed 20 per cent reduction is passed by Congress, it will mean a 5 per cent reduction in state agricultural experiment station research budgets, which are administered by state universities in 50 states.

A BRIEF HISTORY

University staff, responsible for doling out the funds contributed jointly (but not necessarily equally) by the state and Federal governments to support agricultural research, has historically relegated turfgrass research to a lower priority than commodity (food, feed and fiber) research. This has been partly due to a filtering down of Federal and state priorities on agricultural research to the universities.

The upshot has been that turfgrass research has had to rely heavily on extramural grants from state and regional turfgrass foundations, the USGA Green Section, O.J. Noer Research Foundation, the GCSAA, private industry and similar sources of sustenance. But these sources have not been sufficient to carry turfgrass research beyond the rudimentary stage, compared to other areas of applied plant science.

WHAT FUTURE?

The fact that many state agricultural administrators tend to concur with Federal leaders on the low priority of turfgrass research creates the possibility that state budget reductions in funds to support university agricultural experiment stations may vary, with some schools suffering more than 12 per cent cuts in available funds. (It should be noted here that most turf research in the form of new cultural practices, grass varieties and chemical materials has been done at state agricultural experiment stations rather than at the Federal level, and yet the Federal budget for agricultural research was not reduced. The Federal government employs two turf researchers compared to at least 50 at the state level.)

NEW PRIORITY—NO MONEY

The tragedy for proponents of greater emphasis on turf research is that university staffs responsible for setting priorities in agricultural research have become increasingly aware of society's con-

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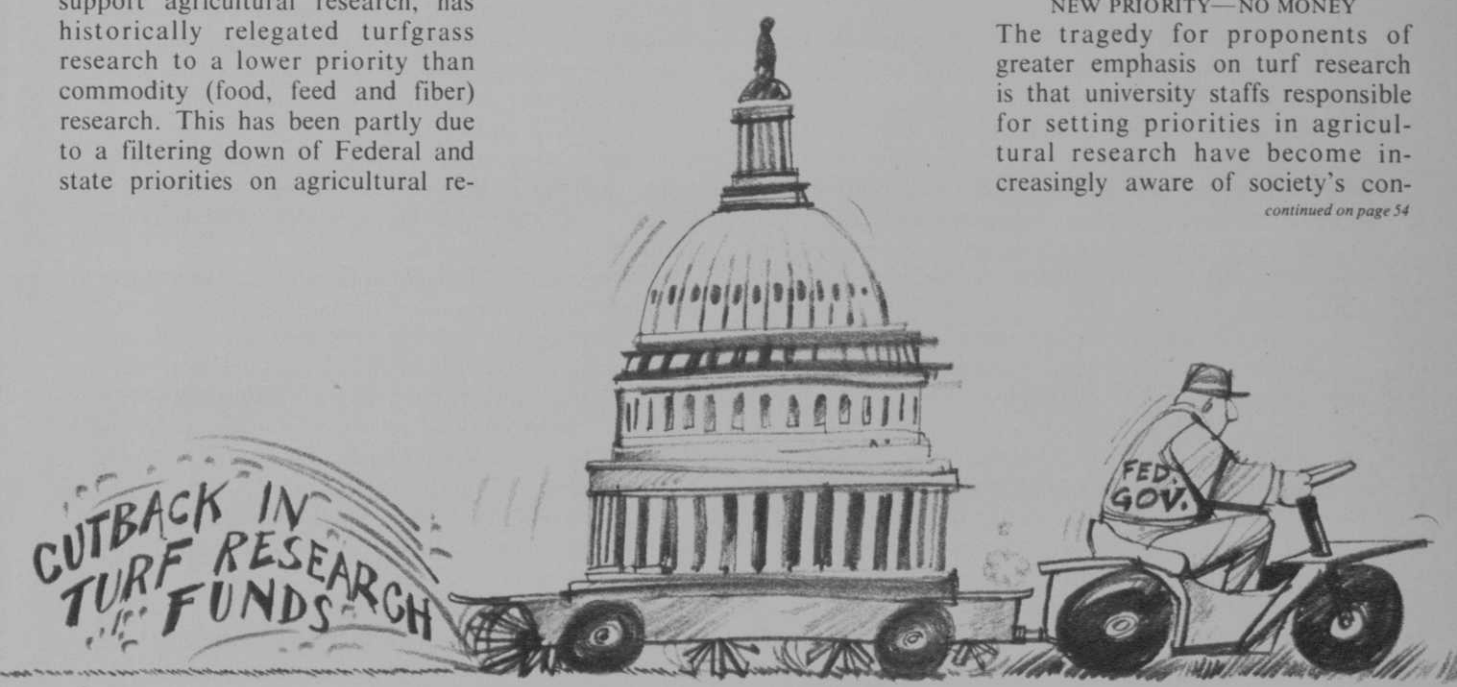


HOW ARE CLUBS FARING IN THE OSHA STORM?

by KEN EMERSON
EXECUTIVE DIRECTOR,
NATIONAL CLUB ASSN.,
WASHINGTON, D.C.

OSHA's initial anti-business attitude has disappeared. It now is trying to educate employers to help them create safe working conditions, rather than simply penalizing noncompliance

It has been two years since the Occupational Safety and Health Agency issued its first set of standards on May 29, 1971. Designed to provide "every working man and woman in the nation safe and healthful working conditions," their publication was accompanied by statements of pride from the sponsors and supporters and cries of outrage and prophecies of doom from many in the business and the industrial communities.

The intervening months have, as expected, seen many problems—and some unexpected and pleasant surprises.

After sifting out the initial rumors and allowing for the usual confusion and disorganization involved in launching any new understaffed and overburdened Federal agency, it is now apparent that the first "OSHA will get you" reaction was overstated. The experience of the club industry in this respect probably is fairly typical.

It was evident from the beginning that there would be problems. Hundreds of "consensus" standards were adopted en masse by OSHA from the American National Standards Institute (ANSI), the National Fire Protection Assn. (NFPA), the American Society of Mechanical Engineers, The United States Public Health Service, the Walsh-Healy Act and other legislation applying to Government contractors. Overpowering in their sheer numbers and often either too vague or too specific for general business, these standards were comprehensible in their entirety to few, if any, people in OSHA or business. Many standards had even been on the books so long that modern technology had passed them by. (A case in point was the adoption of a standard that forbade ice coming in direct contact with drinking water, a holdover from the days when ice was cut from lakes during winter and stored in sawdust insulated icehouses until the summer.)

Small businesses in particular lacked the time and understanding to deal with the complexities of the new law; a position shared by golf clubs. It was left to trade associations to assume this burden, and the National Club Assn. moved to fill the void for clubs.

In the past 24 months, NCA has published numerous reports and analyses of OSHA regulations, an inspection guide, a manual for clubs and offered several courses in compliance. In the process NCA has come in close contact with OSHA, both in Washington, D.C. and in its 10 regional offices, and has seen some dramatic changes occur within the two-year-old organization.

In the early days of its administration, June 1971 to February 1972, contacts with OSHA tended to bear out a general feeling that the agency was anti-business. Attempts to discuss industry-wide problems with those in OSHA available to the public in Washington were brushed off or rebuffed. Efforts to secure such basic items as an OSHA poster from staffers were met with blank stares or statements questioning their very existence.

In retrospect, it is now apparent that this early treatment was the result of overwork, the necessary setting of priorities and a totally inexperienced staff just starting to put together an organization. Certainly, during the last year Gerard Scannell has been helpful to many of us in the club industry, and new additions to the agency, particularly Dr. Earl D. Heath, director of the office of training and education, and Helen Farrington, chief of public liaison, have both gone out of their way to be helpful to the club industry.

The changes in OSHA's attitude are nowhere more evident than in their increased awareness of their image and their need for public support. OSHA's sincere concern for employee safety and the enforcement of the standards has never been in doubt. To this has now been added an equal effort to

educate employers and assist in creating safe working conditions rather than to simply penalize noncompliance.

OSHA regional offices have been especially helpful to clubs by supplying technical help and instructors for educational meetings. (Each of OSHA's 72 field offices must present at least one employer seminar a month.) Noteworthy has been the assistance offered by Craig Leedom, Philadelphia; Cois M. Brown, Atlanta; Robert Griffin, Tulsa; Dwane Parker, Carson City, Nev.; Gabriel Gillotti, San Francisco, and Paul F. Hagood, Honolulu. Clubs should feel free to call on these men and others in regional and area offices for technical advice. Such calls will not precipitate an inspection, but will go far toward establishing goodwill and an intent to comply with the standard, important points when you are inspected. Do not, however, expect a free, advisory inspection. Compliance officers, under the present law, are forbidden from making such services.

MOST FREQUENTLY VIOLATED STANDARDS

A survey of those sections of the standards most frequently cited for violations provides a good guide to what to watch for in your own club. Listed in descending order of frequency, the list is as follows;

General Industry (Part 1910)

Section

309 National Electrical Code. Failure to ground lines and equipment; overloading lines; frayed wires; improper insulation; unprotected switch and fuse boxes.

219 Mechanical power transmissions apparatus. Unguarded belts, fly wheels, drive chains and gears.

157 Portable fire extinguishers. Outdated inspections, improper mountings, inaccessible locations.

212 General requirements for all machines. Inadequate point-of-operation guards.

213 Woodworking machinery. Unguarded sawblades.

23 Guarding floor and wall openings and holes. Unprotected drops of four or more feet.

22 Walking and working surfaces. Unclean and wet working areas. Projecting nails and splinters.

252 Welding, cutting and brazing surfaces. Improper storage of compressed gases.

215 Abrasive wheel machinery. Improperly adjusted tool rests, missing guards.

178 Powered industrial trucks. Left running and unattended.

265 Saw mills.

37 Egress, general. Unmarked, locked or improperly lighted exits.

106 Flammable and combustible liquids. Improper storage.

147 Sanitation.

107 Spray finishing using flammable materials. Failure to post "No Smoking" signs.

242 Hand and portable power tools and equipment. Failure to ground, missing guards.

125 Portable ladders. Broken or wobbly legs, broken

continued

the law in brief

OSHA, more properly, the Occupational Safety and Health Act of 1970, applies to all businesses with one or more employees, though those with seven or fewer employees are excused from the law's record keeping requirements.

The law provides:

1. The establishment of an Occupational Safety and Health Administration within the Department of Labor, which is empowered to establish and enforce safety and health standards.

2. Most proposed standards were set between May 29 and December 1, 1971, although the secretary of labor had until April 28, 1973, to add to them. After August, 1973, the proposed standards become permanent. Additional permanent standards may be issued from time to time, and temporary standards can be issued in emergencies. Such standards will only be enforced for a period of six months.

3. Regular on-site inspections are made according to a fixed schedule of priorities. These are (a) on the occasion of an employee's death; (b) if five or more employees are injured from a single accident; (c) in response to employee complaints of unsafe conditions, (d) certain target industries, and (e) general inspections.

4. Record keeping. Employers with eight or more employees must keep detailed records of job related injuries and illnesses. Forms are supplied by OSHA and will be one of the first items checked during an inspection. Additionally, an OSHA poster must be displayed on the premises.

5. Enforcement. Penalties, some severe, are provided for violations of the standards. Violations are graded according to their seriousness:

(a) *De minimus.* A violation not directly related to safety or health, such as a failure to meet specifications for toilet stall partitions. No fines are likely; (b) Nonserious. The bulk of the citations are issued for this category. Minimum penalties are $100, though these can be discounted by up to 50 per cent for such reasons as evidence of good faith, safety programs and willingness to comply; (c) Serious. Penalties for this category can go up to $1,000. (d) Imminent danger. Issued only in cases where a compliance officer sees an imminent danger of death or serious injury, the law provides him with the authority and means to close down an operation when such conditions exist, and (e) Certain mandatory, non-reducible fines are also specified for failure to display an OSHA poster ($50) and keep the proper records. Additionally, failure to correct a cited violation can bring a penalty of up to $1,000 a day, and criminal penalties can be imposed for a willful violation of any standard or rule that results in death.

OSHA *continued*

or missing rungs.

151 Medical service and first aid. Inadequate or missing first-aid kits.

133 Eye and face protection. Failure to wear protective goggles.

INSPECTIONS: WHAT TO EXPECT

Although there has been a discernible effort on the part of OSHA compliance officers to encourage good safety practices rather than arbitrarily penalize a lack of knowledge of the standards, an inspection is not to be taken lightly. Compliance officers are tough, they are enforcing the standards and they are assessing penalties.

Some of the things to expect on every inspection are:

1. The inspection will be announced;
2. The compliance officer will talk to your employees, in private. He will ask for their opinions on your safety procedures;
3. When he finds a violation he will not cite you on the spot, nor will he fine you. He should discuss the alleged violations with you, but the decision to assess a fine is not his alone. His area director must also participate. (There have been rumors of persons claiming to be OSHA inspectors making on-the-spot collections of fines. Though these seem to be unsupported, insist that the compliance officer produce credentials.)
4. If you think the inspector is wrong, contest the citation. But be sure of your ground. Only about 5 per cent of those cited do contest, which would indicate that most feel the inspections are fair.
5. Do insist on a closing conference. You have a right to it and it will be your best opportunity to argue your case before a citation is issued.

One of the principal—and legitimate—concerns with the standards are that many of them are of a "judgement" nature. The compliance officer must make a decision based on his own experience and background about whether or not a particular condition is hazardous.

For a time it was feared that the general duty clause would be used on a club and cited by a compliance officer whenever he was unable to find a specific standard to apply to a given condition. Although this possibility has not materialized, the threat remains.

WHAT'S AHEAD?

Of current concern to OSHA are occupational health hazards. Presently under study are standards that would apply to the mixing and applications of pesticides and the toxicity of chemicals; two areas of obvious importance to golf courses. Additionally, the Office of Standards is reviewing standards for lawn mowers and tractors and roll-over protection for agricultural vehicles, including tractors. Of present concern to the industry are the OSHA standards on mixing and application of pesticides. It now appears that OSHA will not adopt the Environmental Protection Agency's consensus standards, and initial reports on the first draft of OSHA's own standards are disturbing. If the reports are true (that they include blood tests and annual physicals, among other requirements), they could be unusually limiting and expensive.

During the next year, OSHA will get underway an extensive educational program. Already in progress is a 40-hour course in health and safety procedures for the construction industry. Available shortly is a series of 29 voluntary compliance training courses at the OSHA Training Institute near Chicago. This series will teach self-inspection procedures and will be open to employer representatives. For more information, write OSHA Training Institute, 10600 West Higgins Road, Rosemont, Ill. 60018.

WHAT YOU CAN DO—NOW

You should already be keeping the proper OSHA records. These include Forms 100 and 101 and Summary Form 103. You should also inspect and label all hazardous equipment, tag faulty ladders and label all machines and equipment under repair.

Institute a bona fide safety program. Designate one person as your safety inspector. See that he holds regular meetings.

The real cost of OSHA is not fines and citations; it is correcting violations. Repairs, replacements and alterations can be very expensive, especially when they come as unexpected expenses. Survey your clubhouse, maintenance buildings and grounds after you have familiarized yourself with the OSHA standards. Budget now for future replacement and establish priorities based on the need to correct hazards.

WHAT WILL CONGRESS DO?

There are some 15 bills presently before Congress that would amend OSHA requirements. Of these, perhaps six are being seriously considered. These seek to provide some relief for small businesses.

Organized labor, however, maintains that most accidents occur in small businesses and is applying tremendous pressure to maintain the requirements of the present law. The new secretary of labor is known to favor this position.

It is too early to predict what Congress will do, but at this point it is unlikely that major changes will take place.

OSHA is, however, limited from another direction—financially. The current OSHA budget has severely limited proposed inspections in the current fiscal year.

CONCLUSIONS

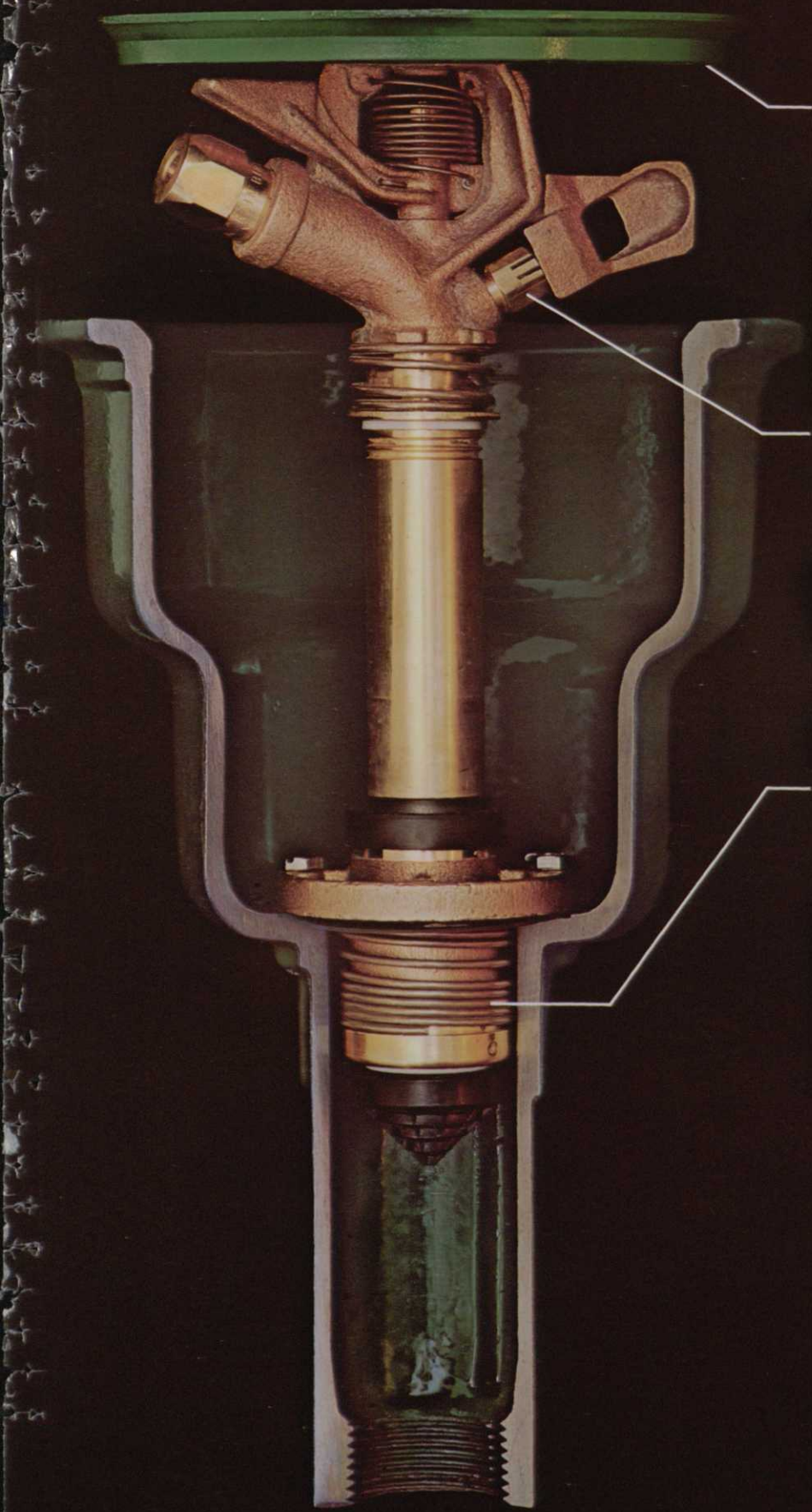
The Occupational Safety and Health Act is here to stay. It will continue to exert considerable influence on the day-to-day operations of the golf club.

However, a common sense approach to safety, a knowledge of the standards set forth by the act and a genuine concern on the part of the employer for the safety of his employees should do much to eliminate both hazards and the need for penalties.

On the negative side is the fact that the Federal government has inserted one more wedge into the operations of business. Whether or not this wedge is the result of business' failure to meet its obligations in the area of safety will probably never be answered satisfactorily. Suffice to say that OSHA is now a fact of business life.

Happily, the administration has become increasingly aware that it has been unnecessarily harsh in some of its requirements. The future looks brighter. □

And the green grass grows all around



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MAINTENANCE AFFECTS PLAY

by JERRY CLAUSSEN

Sometimes a superintendent and his crew can get so wrapped up in the process of growing fine turf that they forget the real purpose of their work, which is the larger goal of creating and preparing a total golf playing area.

Maintenance affects fair play in a variety of ways. Good judgment and an eye for detail are important qualities in a superintendent. The green chairman and committee, or course owner, also have a responsibility in creating the golf environment; they must represent the golfer's viewpoint and suggest, then support, procedures to improve the course.

How does the maintenance program affect fair play? Here's how and what should be done:

MARKING THE COURSE

☐ Set tee markers frequently, so there is good turf between and two club lengths behind, on level ground;

☐ Rotate every day tee markers and pin placements, so six holes play long, medium and short. This offers shot variety, but retains about the same total course length each day;

☐ Set tee markers so that they are at precise right angles to shot line up the fairway or on par threes, to the green;

☐ Set cups at least five paces from the edge of green in a fairly flat area that has the same contour within a three-foot radius;

☐ Mark ground under repair so there is no question about where a ball may be dropped out;

☐ Mark man-made obstructions that may interfere with play and thus permit a free drop;

☐ Clean around water hazards so a player knows exactly whether a ball is in or out;

☐ Mark hazard boundaries clearly and define the point where a water hazard becomes a lateral hazard if a lake or creek parallels then crosses a hole, so a player may drop correctly;

☐ Measure each hole correctly, from center of tee through the middle of the fairway in the air to center of green, and correctly list these distances on tee markers and scorecards;

☐ Make yardage distance markers, if used, as natural as possible, preferably using a native tree not a sign;

☐ Put up directional signs from green to next tee in cases where routing may be confusing, the next tee cannot be seen or where guest play is heavy;

☐ Place benches, ball washers, standing markers and fountains even with, or in back of, tee markers so that they do not interfere with sight lines or wild shots.

One example of a poorly placed car path. Note criss-crossing tire marks.

MAINTENANCE PRACTICES

☐ Mow all surfaces so the height of cut is consistent and fair, as dictated by the grasses, climate and season;

☐ Mow fairway widths to 50 yards or more except where hazards compress the target area;

☐ Manage irrigation programs so that greens aren't hard while front aprons are soft, and tees are firm under foot;

☐ Cut bunker edges and fill with sand so there is no sharp line on the back edge, no overhang over the front edge;

☐ Keep rakes available at all bunkers, and rake and clean sand as often as crew man hours allow;

☐ Repair depressions from natural settling, broken drain tiles or irrigation lakes to minimize possible bad lies through the green;

☐ Keep equipment parked out of the line of play when crewmen are on the course and any irrigation hoses coiled up and away from tees and greens when not in use;

☐ Trim trees, if possible, to allow golfers to walk under if not swing full underneath.

CONSTRUCTION

☐ Build or rebuild greens to allow adequate size—5,500 square feet is average now—gentle contours for fair putting and maximum area for pin settings;

☐ Build or rebuild tees to allow adequate size for frequent resettings of markers and flexibility in hole length;

☐ Place hazards, both sand and water, so they can be seen and do not demand a perfect shot by the average golfer;

☐ Plant new trees so they help frame or background a hole, but do not severely pinch the target area or block good shots;

☐ Cut in golf paths to agree with preferred golfer traffic patterns, but not in line with the hole, nor within 20 yards of a green.

These are just a few of the major considerations in caring for a golf course. The game is more than growing grass. ☐

BEARD *from page 12*

high nitrogen nutritional level also results in reduced heat stress tolerance and proneness to loss of turf. Thus, nitrogen fertilization, which stimulates shoot growth, should not be applied during heat stress periods.

It should be noted that these three temperature treatment differentials were based on soil temperatures. Soil temperature has much more influence on turfgrass growth and development than air temperature. It is possible to maintain turfs at extremely high air temperatures as long as the soil temperature is maintained at a more moderate temperature. This is also the reason why night temperatures are so important in controlling turfgrass responses. As long as the night temperature drops to lower levels that will maintain a cooler soil temperature, the turf can be maintained rather easily at normal growth rates. However, when the night temperatures rise to higher levels comparable to daytime temperatures, the soil is warmed considerably, resulting in restricted root and shoot growth and a decrease in turfgrass quality, health and vigor.

Because of the significant effects of soil temperature on heat stress, it is important for the golf course superintendent to periodically monitor soil temperatures under selected turfgrass areas on the golf course. In this way, he can more adequately interpret the turfgrass responses being observed and also make appropriate adjustments in his turfgrass cultural program. While these adjustments may appear to be relatively minor, they can be very important in determining whether an adequate or inferior quality surface is maintained for golf play.

So far as specific temperature responses are concerned, optimum root growth of Penncross creeping bentgrass occurs at lower soil temperatures than shoot growth. Specifically, the bentgrasses as well as Kentucky bluegrass, tend to maintain maximum root growth in the soil temperature range of 50 to 60° F. In contrast, optimum shoot growth and recuperative rates occur at somewhat higher temperatures in the range of 65 to 75° F. The over-all turfgrass appearance and color are also very good in this temperature range. Specific temperature stresses become evident as soil temperatures are raised into the 90° F range. Bermudagrass responds to temperature comparable to that for bentgrass and Kentucky bluegrass except in a higher temperature range. For example, optimum shoot growth for bermudagrass occurs in the range of 85 to 95° F.

Above the optimum temperature range there is a decline in most turfgrass growth response characteristics. Initially, this is expressed in reduced root growth. Not only is senescence of the existing roots progressing more rapidly to a brown, spindly, weak appearance, but initiation of new roots from meristematic areas on the crown is also blocked. This results in a very restricted root system for cool season turfgrasses at soil temperatures above 80° F. Other responses observed under temperature stress conditions included a decline in shoot growth as well as a reduction in (a) leaf length, width, and area, (b) rate of new leaf appearance and (c) succulence of the above ground tissues. The turfgrass appearance becomes dark green to blue green in color under heat stress. A decline in shoot density will also appear if the heat stress persists.

This brief article is a simplified introduction to the many effects of temperature on turfgrass growth and culture. It is a very complex aspect of turfgrass management, which is interrelated with many other cultural practices including mowing, fertilization and most important, irrigation. □

CORRECTION

GOLFDOM inadvertently misquoted Vaughn E. Border, director of marketing, Outboard Marine Corp., in the article entitled "The Japanese in the U.S. Golf Market: Where are They Now and Where are They Going?" published in the May issue, page 21. The correct quote should read: "The fact is that there are still only about *51,000* or *52,000*, I would guess, new golf cars being sold every year."

NON-PROFIT STATUS:

DOES IT MEAN MORE THAN MONEY?

This second article on the problems a club might face if it relinquishes its non-profit status answers the questions of how this change would affect the club's liquor license and its position under state and local tax laws

by JACK JANETATOS

Private clubs have been exempted from the Federal income tax since it began early in this century. Until recently that tax exemption had a large economic value to clubs because it enabled them to earn profits from non-member business without the necessity of dividing those profits with the Government. In 1969 the now famous Tax Reform Act imposed a tax on the unrelated business of clubs, and this economic benefit was effectively eliminated.

There still is an economic benefit in tax exempt status, particularly in the exemption from tax on the gains from the sale of club property. The principal benefit, nevertheless, disappeared with the Tax Reform Act, and many clubs began considering whether or not they should give up their tax exempt status.

It is hard to imagine any set of laws and regulations that have had as much effect on clubs as have the tax exemption provisions. These rules goven the contents of articles of incorporation, by-laws, house rules and even the forms and procedures used in day-to-day business. Even beyond these organizational controls, the rules govern the manner of operating the club. The tax law governs the amount of outside business a club can have and how it sells its property.

Nearly all member-owned clubs were organized along the lines required by the tax rules. Even today the majority of clubs maintain their operations in complete conformity with the strictures imposed by the complicated regulations of the Internal Revenue Service. A number of clubs, however, do not maintain tax exempt status either because the IRS took it away or the clubs' managements decided they didn't want to keep it.

Today, one rarely sees a new member-owned club formed. The current trend is toward investor-owned clubs connected with real estate developments; these rarely seek tax exempt status. The growing number of these profit-making clubs and the successful operation of most of them raises the question of whether tax exempt status is essential to a club. There is no recorded case in which a club has terminated operations solely because it lost its tax exemption, and anyone looking at such a club would feel that it continues to operate the same after losing its exemption as it did before.

All of these factors come regularly into the view of members of club boards. Their natural reaction is to question whether they couldn't operate without a tax exemption and rid their clubs of all of the restrictions and obligations of the Internal Revenue rules. Unfortunately, there have been some instances where the propounding of the question has produced a visceral response, and clubs have given up tax exemptions without fully considering all facets of the question.

A preliminary, but most important consideration