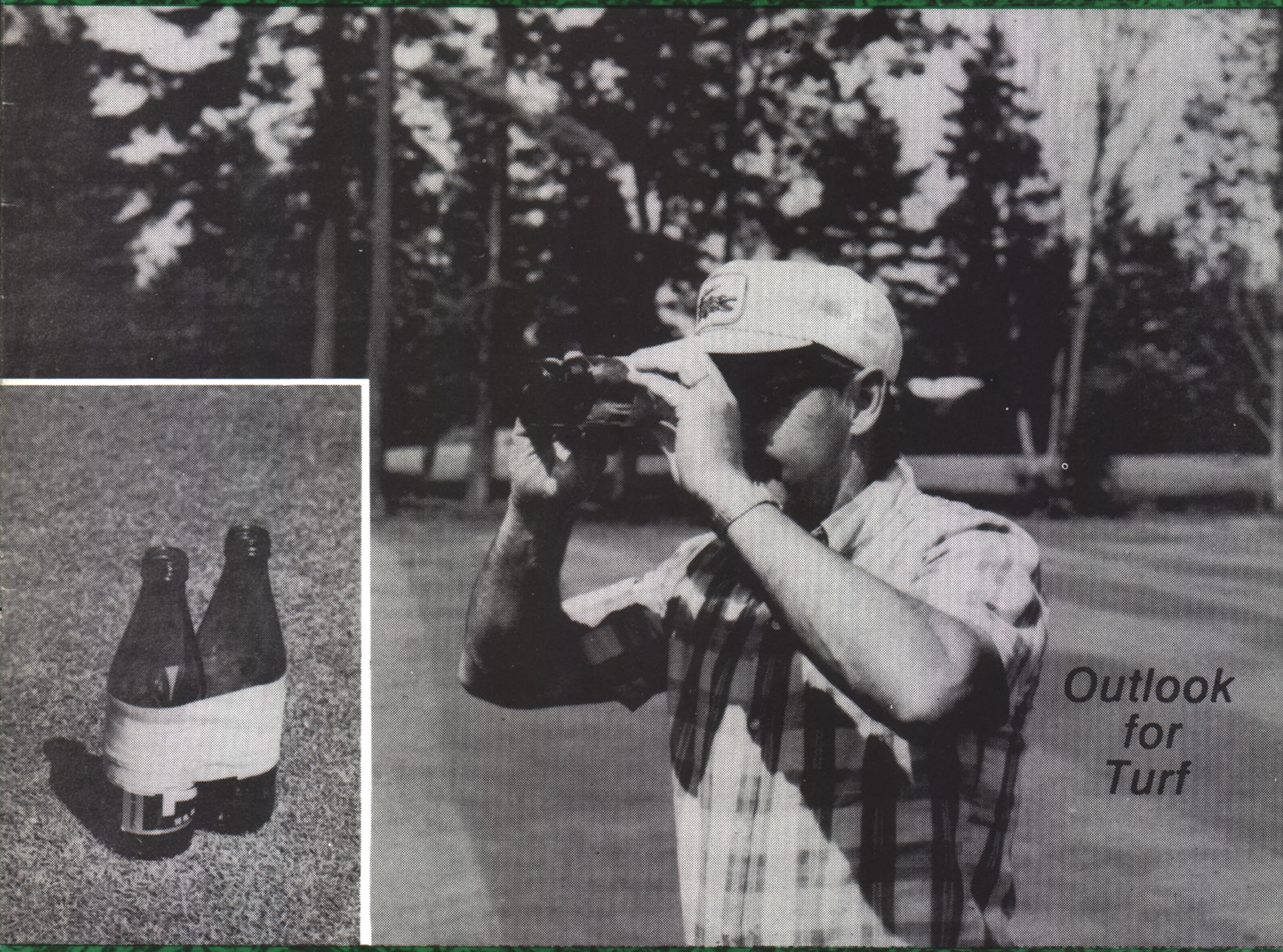
JANUARY 1977

USGA GREEN SECTION RECORD

A Publication on Turf Management
by the United States Golf Association



Outlook for Turf

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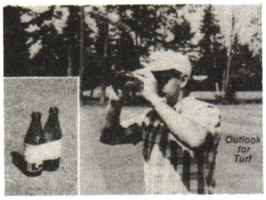
VOL. 15, No. 1 **JANUARY 1977**



Seattle Golf Club Superintendent Milt Bauman has found the sure way to find grass always green.

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Most new golf courses are being built away from cities and are surrounded by real estate development. Water is a necessity.

The Outlook for Turf

by JAMES B. MONCRIEF, Director
Southern Region, USGA Green Section, Athens, Georgia

Few superintendents and even fewer golfers today realize that the earliest scientific observations of grasses in the United States were made by George Washington and Thomas Jefferson. No, they were not the first golfing Presidents of the country. They were, however, interested in cattle production and they worked with fescues, bluegrasses, and bentgrasses as well as other pasture-type grasses imported from Europe.

The first actual turfgrass research done before 1900 was in Rhode Island and Connecticut. Then in 1917, Piper and Oakley, two scientists with the Department of Agriculture, with support from the USGA wrote the first book on turfgrasses and golf course management. Not until the 1920s however, did the science of turfgrass culture become a separate field of study, apart from pasture grass interests.

The USGA Green Section began its support of turfgrass research in 1921 in cooperation with the U.S. Department of Agriculture. Experimental plots were established at the Arlington Turf Gardens, Arlington, Va., on the very site of today's Pentagon Building. The plots were moved in the early part of World War II to the Plant Industry Station, Beltsville, Md. USDA turfgrass research continues there today. The Green Section also supported turfgrass research at Gainesville, Fla., in 1928 under the direction of Dr. Enloe. Over the years, the goal of the Green Section has been the betterment of turfgrasses for golf; not only for USGA Member Clubs, but also for golf throughout the world.

After World War II there was a tremendous expansion of interest in golf and turf. Many schools offered study opportunities from one- to two-day short courses, one- to 10-week crash programs, and two- to four-year college curriculums. But as golf course construction slowed in the mid '70s, the turfgrass industry also slowed. It is no longer accelerating in all categories.

In 1975 the National Golf Foundation reported a drop of 15 percent in new golf course construction. Most of the new courses are profit oriented. They have not been built for memberships, and neither are they member owned. Of the nation's golfers, 45 percent use municipal or public fee facilities, and yet these facilities only comprise about 14 percent of all the nation's golf courses!

As a whole, the well established private clubs have weathered the recession quite well while other industries have suffered serious setbacks. Many club members have stayed home and used their own golf facilities more than in the previous five to seven years. Country clubs are also trying to lower the average age of their memberships. This will be a major accomplishment and will help perpetuate private club operations. New members under 35 are being recruited with reduced initiation fees and under different classifications. Expansion of tennis facilities has not created the extra income as some clubs assumed.

Energy and Turfgrass Management

Turfgrass management has been affected by the energy shortage as well as other industries. A recent agricultural engineering society meeting in Davis, Calif., pointed out that the energy sources presently used in this country are: oil 46 percent, gas 31 percent, coal 17 percent, hydro-electric 4 percent, atomic 1.8 percent, and other energy such as geothermal, tides, etc. .2 percent. One kilowatt hour of energy out of five goes for food production. People as a whole do not realize the seriousness of our energy shortage.

It is important that we become aware of these energy sources. They directly affect our operations and our future. The present rate of oil consumption in the United States is 18 million barrels per day of our domestic oil. This will last about 12 more years if we assume no new findings. With new discoveries we should be able to go to the year 2000. Imported oil is costing us about $3 million per hour! The known domestic natural gas will last about until 1982 but, with new discoveries, we can probably stretch it to 1990. At the present rate of use and with no new discoveries, coal will last about 500 years. Half of our coal production comes from strip mining.

You have heard much about exotic sources of energy such as oil from shale. The shale must first be heated to 600°F. and then processed for it to be in a form we can use. Mining costs are tremendous. The rock remaining after extraction of the oil is of tremendous volume. The present outlook is not bright. Because of high costs, some oil companies have already stopped research in oil shale extraction.

The Idaho Raft River Electrical Co-Op has just brought in its second successful geothermal well and this is a new source of energy. The temperature at 4,800 feet into the earth is about 300°F. and the hope is that by drilling another 600 feet, 300° steam may be brought to the surface. The first well, at 5,000 feet, produced over 1,000 gallons of water per minute. The Co-Op is funded by the Federal and Northwest Power Council.

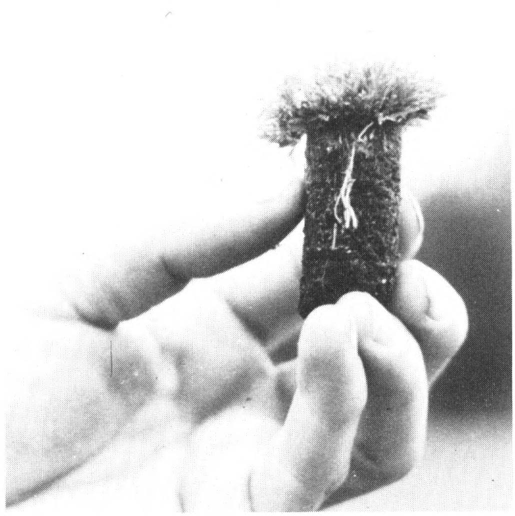
A recent Federal Institute Marketing Conference was told that natural gas is best for ammonia production. Another source of ammonia is now naptha, more costly as petroleum prices rise. A study released by the USDA showed that a 10 percent increase in agriculture would result in an additional one million tons of nitrogen per year. Additional ammonia plants are being constructed now and nitrogen will become more available.

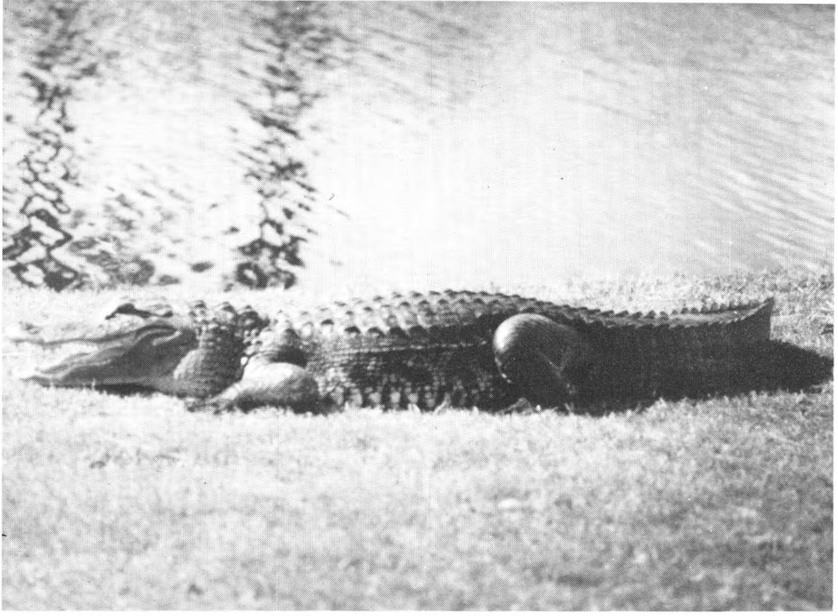
Most of us think atomic energy can be used immediately as a substitute for oil and gas, but the facts do not bear this out. It cannot be considered as a substantial and immediate source of energy for many, many, years. We must live with present energy sources for at least the next 15 to 25 years while developing new ones. To preserve the energy we have, we must initiate a real program of conservation. We must change our complete attitude toward energy. It is not inexhaustable. Automobile consumption is still great, our homes are insulated poorly and we can no longer afford to be a throw-away societv.

Research and Education

I would say the turfgrass manager faces a tremendous challenge, although American ingenuity will surely cope with the energy situation. Colleges with turfgrass curriculums continue to graduate students in the same numbers as before the energy crunch. Many turfgrass school professors

We still have Poa annua *in spite of research from 1934 to 1976.*





Some golf course pests are still difficult to control.

find that about 40 percent of their graduates become assistant superintendents, 10 percent or less superintendents, and 50 percent go into turf-allied interests, such as sales of chemicals, nursery stock, sod farms, large greenhouse operations, and others.

Researchers will always have turfgrass problems to solve. It seems as if as soon as the solution to one is found, two or three new and unrelated problems develop.

Researchers are now working on techniques for better timing of chemical applications, fertilizers and pesticides. The Pesticide Control Act has caused the turf manager to plan his chemical program, keep better records, and have a tighter grip on timing for maximum results with a minimum amount of chemical. The synergistic effect of two chemicals has proven a real advance. Within the next five years there will be newer chemicals for our use, including weed problems such as goosegrass, *Elusine indica*.

New seed selections are being developed for all of golf. The problem of overseeding bermudagrass greens each fall is constantly under review and rechecking. The introduction of improved grasses into existing fairways should become a common practice as new techniques are developed to minimize disturbance to play. We can look for more new grass selections to be released and probably more seed imported from Europe.

We may lose a number of turfgrass researchers over the next few years, but the quality of research should stay about the same. If a smaller number can work on the most pressing problems and solve them faster, it will be to our advantage.

No Substitute for Good Planning

Budgeting will be even more important, and close attention should be paid to the amount of each product you order. Comparison shopping is necessary because several thousand dollars may be saved with this technique. As in the past, all increases in cost will be passed on to the golfer and, therefore, you, as the golf course superintendent, can directly affect the cost as well as the quality of the game.

You may be using less personnel in the future and paying them more, including fringe benefits.

The number of golfers and golf cars continue to increase. Sea Island Golf Club, St. Simons Island, Georgia.

Summer training is an important requirement of turfgrass school curriculums.

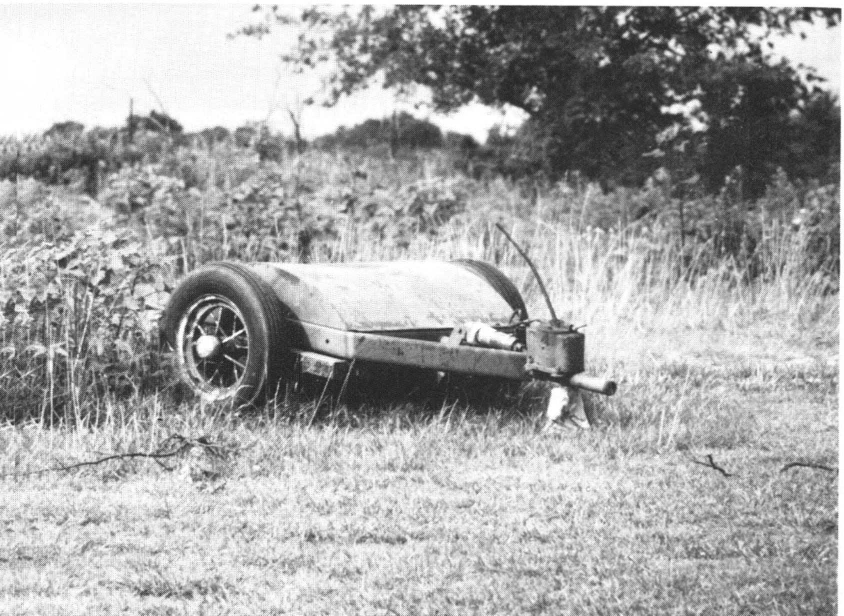
But there is an advantage to a smaller crew if the crew is productive and dependable. Your ability to train them and develop maximum efficiency will be essential. Training should be a continuous procedure with each employee checked out at least twice a year to assure high operational standards. Time and motion studies are now being used on some golf courses in Florida in a thorough study of the total operations.

More emphasis will be placed on water availability, cost and use. You will probably compete more for water than in the past. Food production and human consumption come first. As the population increases, municipalities will need one and a half times as much water by the end of the century. Many superintendents are aware of the increasing demands for water, and they have developed certain commitments as to how much water they need and use on their golf course.

I can foresee an increasing use of effluent water for golf course irrigation. Golf course land is an excellent area for filtering and purifying water and returning it to the water table and aquifers below. There will also be an increasing concern over sources of chemicals entering the water tables under our land. Fortunately, chemicals placed on turfgrass areas have a minimum effect and minimum movement. The overall contribution of a golf course to a balanced environment weighs heavily in our favor.

It will be essential to become familiar with the metric system as this country gradually moves toward it. We will soon have the first domestic steel company offering products in metric sizes. U.S. Steel will offer the bar and rod in metric, then wire, plate and sheet products. With numerous foreign cars already on the scene, metric hand tools are readily available. Our money is based on the metric system and there are many other areas where we will use the metric system without a major adaptation. For a while however, you may be confronted with both metric and standard tool sets on inventory.

Our society is a multifaceted technical, political, and economic one with interactions too complex and too subtle to be mastered by any regulatory



We can no longer afford a "throw-away society."

bureaucracy. We are self-sufficient in only four strategic mineral commodities; molybdenum, phosphate, borate and bituminous coal. We will have to compete with other countries for scarce raw materials. We will be self-sufficient in phosphate and nitrogen and, with the help of Canada, can have an adequate supply of potash and sulfur. But western Europe and Russia are also in need of potash and sulfur. To be an efficient turfgrass manager, you will need to know more about the utilization of fertilizers by the grass plant and the type of sand or soil series you have under your supervision. You will need to get maximum utilization from the fertilizer to keep your golf course in first class condition at the lowest possible cost at all times.

Turf management for golf, along with the entire turfgrass industry, will have its ups and downs in the years ahead. Indeed, the U.S. Department of Agriculture has a Committee on Land Use Policies. Its mission is to preserve prime lands. Land use planning by local and state authorities will become more pronounced and could influence future sites for golf courses. But the golf course plays an important role in green belt area development, and even if, as some predict, the coast lines of the United States become one line of continuous lights by 2000 golf will still be there and enjoyed. The golf course superintendent will contribute much to the growth, health and happiness of our future generations.

A GREEN SECTION SUPPORTED RESEARCH PROJECT

Nitrogen Losses From Golf Greens

by
K.W. BROWN[1], R.L. DUBLE[2] and J.C. THOMAS[3]

Although only a small portion of a golf course is devoted to putting greens, they are given first priority for fertilizers and irrigation. Poorly constructed greens often have low infiltration rates and excess water may run off the surface. Greens constructed to USGA Green Section specifications have higher infiltration rates and excess water moves through these greens quickly. Water lost from golf greens through runoff or leaching carries with it nitrogen from the fertilizer as either nitrate or ammonia.

Nitrate is known to cause eutrification of lakes and can be harmful to humans and livestock if consumed in drinking water. The Federal Water Pollution Control Administration (now the EPA) has established limits for the concentrations of nitrate in drinking water. These regulations call for not more than 45 ppm (parts per million) nitrate in water.

The amount of nitrate that may be lost from golf greens will depend on many factors. Among them are the following: the nitrogen source in the fertilizer applied, the time between fertilizer applications, the amount of irrigation or rainfall, the infiltration rate of the greens mixture, and the season of the year (soil temperature).

Research was therefore undertaken at Texas A&M University, under the sponsorship of the USGA Green Section, to obtain data on the amount of nitrate lost. If pollution hazards do not exist, the data would serve to protect the golf superintendent from undue scrutiny; and on the other hand, if hazards do exist, recommendations can be developed to reduce or eliminate the hazards.

Individual isolated golf greens 10 feet on a side, with gravel underdrains, were constructed on a raised subgrade. The drains and, in the case of the greens with low infiltration rates, the runoff collection troughs were fed into collection barrels. Top mixtures included pure sand, sand-soil-peat mixtures which met USGA specifications, and a fine sandy loam soil typical of many older greens. Treatments were designed to provide information on all the factors mentioned above.

When soluble forms of fertilizer, including ammonium nitrate and ammonium sulfate, were applied, high concentrations of nitrate were found in the leachate from all greens. The concentrations were highest and occurred earliest in the greens constructed of sand alone. As much as 22 percent of the applied nitrogen was lost during the first three weeks after application and concentrations in the leachate reached over 300 ppm for periods of two weeks. Such concentrations are six to

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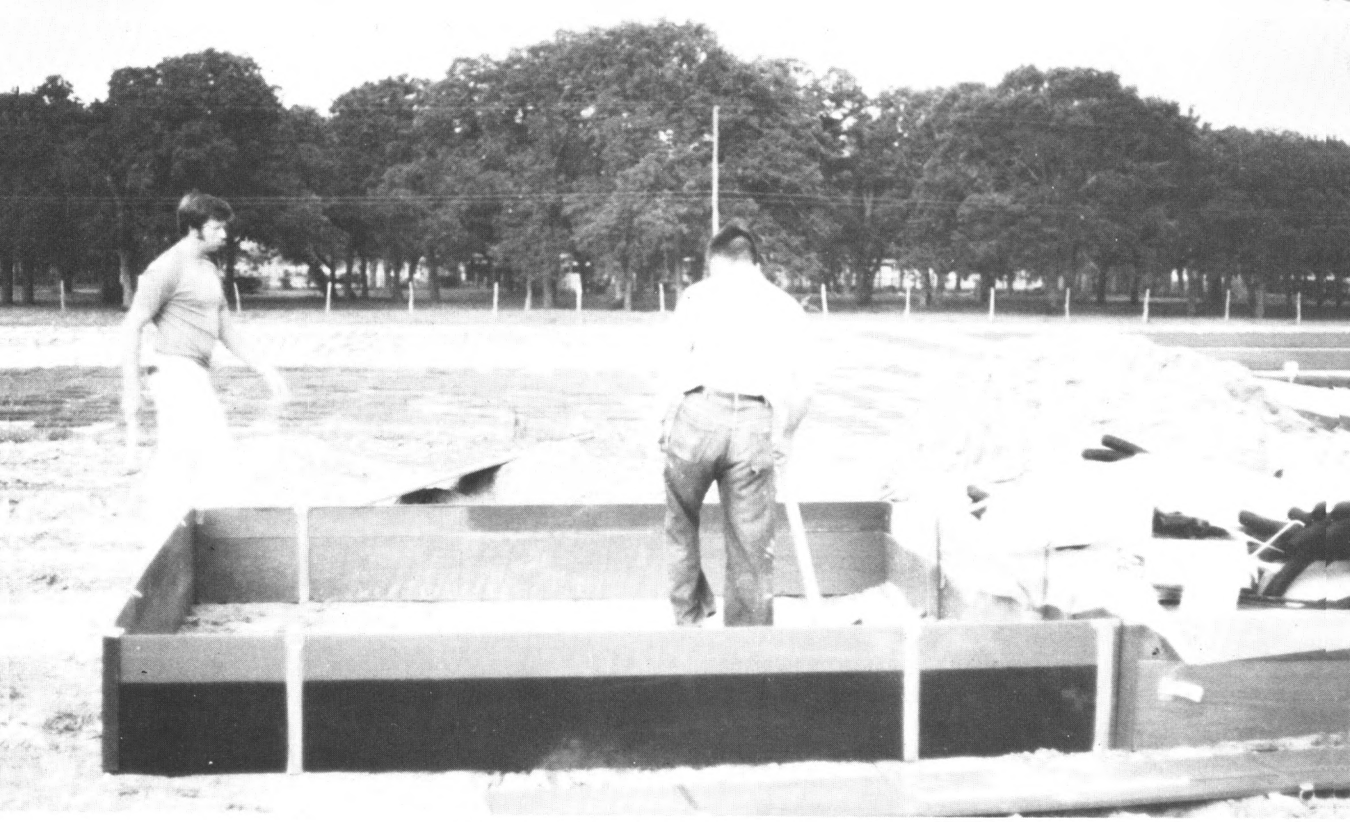


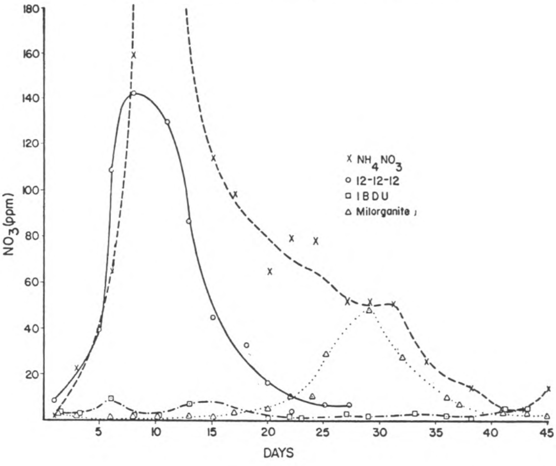
Construction of individual golf greens.

seven times the permissible limit for drinking water and constitute a pollution hazard as well as a significant fertilizer loss.

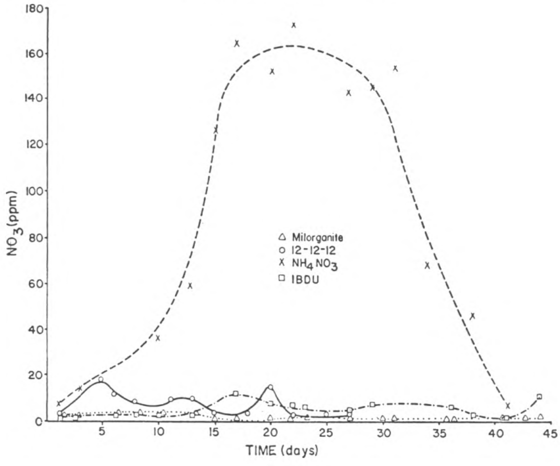
When organic or slow release forms of fertilizers, including IBDU, urea formaldehyde and sewage sludge (Milorganite), were applied, the concentrations of nitrate found in the leachate were always low and the water met EPA standards for drinking water. Less than 2 percent of the nitrogen applied as IBDU and urea formaldehyde was lost, mostly in the form of nitrate, while 10-14 percent of the nitrogen applied as sewage sludge was lost. It was evident from these results that the use of inorganic fertilizer sources results in economic loss and environmental hazards that can be avoided by the use of slow release organic forms.

More careful management schemes must be developed to maintain greens in top shape and minimize nitrogen losses. Small applications should be scheduled on a routine basis so that a continual supply of nitrogen is available at all times to maintain a healthy green playing surface. With proper planning, it should be possible to reduce the need for applications of soluble nitrogen sources to stimulate a weak turf. Applica-

Concentrations of nitrate in the leachate from sand plots treated with different sources of nitrogen fertilizer.



Concentrations of nitrate in the leachate from soil plots treated with different sources of nitrogen fertilizer.



Experimental test site at Texas A & M University.

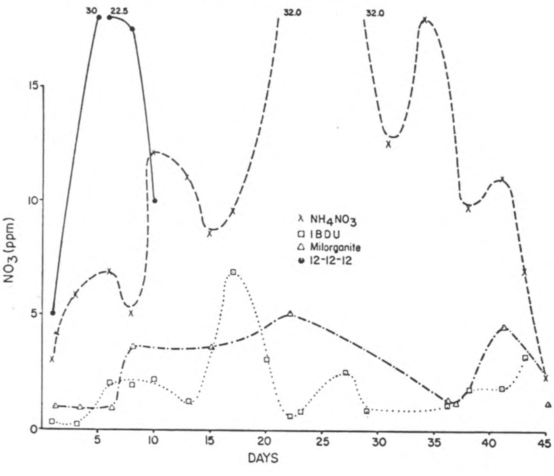
tion of rates of soluble nitrogen fertilizers should not exceed ½ pound per 1,000 square feet per application.

Although other factors studied do not have a major influence on the conclusions, it is interesting to note that greater irrigation rates resulted in the greater concentrations and more rapid loss from the quick release sources of nitrogen. Irrespective of the source applied, the losses could be minimized by controlling irrigations to cut down runoff and leaching. This will not, however, completely eliminate the problem because of occasional heavy storms.

More nitrate was lost from ammonium nitrate during the winter when the grass was nearly dormant than during the summer. Seasonal trends for the other sources were less evident. The amounts lost always increased as the application rate increased.

Thus, the use of organic and slow release nitrogen sources, light applications of soluble nitrogen sources and controlled irrigation will help reduce nitrate losses in golf greens constructed to USGA specifications.

Concentrations of nitrate in the runoff from soil plots treated with different sources of nitrogen fertilizer.



Concentrations of nitrate in the leachate from mixed plots treated with different sources of nitrogen fertilizer.

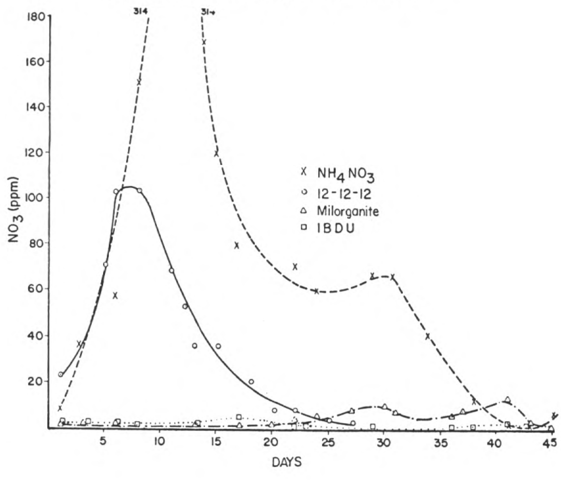


Figure 1.

Sump Pumps for Unusual

At the Picatinny Arsenal Golf Course, Dover, New Jersey, a severe drainage problem existed on two holes and desperately needed correction. Surface runoff water collected on two fairways and would not percolate through the heavy humus soil. In fact, the area became so wet it was impossible to carry out fairway mowing with the seven-gang units at certain times. Green Chairman Frank Ferry, Superintendent Michael George and Engineer John Klusick went to work on a solution.

On the 13th fairway, a hole was dug large enough for a 50-gallon drum. Holes were made in the side of the drum and crushed stone placed around the outside of it. Direct burial cable was snaked through existing drain pipe from a 110 volt electric meter cover duplex outlet. An electric sump pump was installed into the drum casing with the two-inch discharge plastic pipe connected to the existing six-inch drain pipe which emptied into a brook. The water table is maintained approximately two feet below the fairway from January through December. The fairway became firm providing mowing with the seven-gang equipment and gave a playable fairway.

A green plastic packing material was secured to the lid of the 50-gallon drum with adhesive to provide a normal bounce should a golf shot land here. The estimated cost of the project is less than

Figure 2.

Figure 3.

Drainage Problems

by RALPH E. ENGEL, Rutgers University, New Jersey

Figure 4.

$500. (See Figures 1 and 2).

On the 14th fairway, a similar hole was dug for another 50-gallon perforated drum. Crushed stone was again placed around the outside of the drum casing. The area was regraded to the sump hole. Electricity was not readily available. A four-inch irrigation line with a 1½-inch riser to a self-closing sprinkler valve ran adjacent to the sump hole. A water pump was purchased (hydraulic cellar drainer) and connected to the irrigation riser, an 1½-inch plastic rain pipe was extended from the water pump to an existing drain pipe adjacent to the fairway and piped to the brook. The system is used during the golfing season, during rainy weather or if irrigation water runoff enters the sump hole, the float is lifted by the water pressure activating the irrigation water through the ejection valve providing suction to the drain pipe. As the surface water in the sump is lowered, the float descends to the normal position shutting off the irrigation water and the water level is approximately two feet below the rough grass area.

This installation also cost less than $500. (See Figures 3 and 4).

The Green Committee has received favorable comments from the Membership on the improved appearance and playability of these fairway areas.

TAKE CARE OF YOUR POWER SPRAYER

The power sprayer—it should be a long term investment.

by CARL SCHWARTZKOPF, Director, Mid-Continent USGA Green Section

A sprayer is—or at least should be—a long term investment! If given proper care, it will provide many years of satisfactory golf course service and play a vital role in good turfgrass management operations.

Perhaps the most important happening of all occurs on the very day you take delivery of the new spray rig. Read and heed the manufacturer's maintenance and operating manual! It will save you hours of frustration, bring high efficiency to every spray application and give you years of great and reliable service. Proper operation, lubrication, cleaning and storage is all that is asked.

At one time or another everyone has had problems with clogged spray nozzles. However, the clogging problem is hardly ever due to the use of concentrated liquid pesticides themselves, nor should it ever occur if wettable powders are prepared properly and then diluted in the tank. Clogging by wettable powders can be prevented by mixing the material first in an adequate amount of water to form a thin, smooth batter of water and powder. Then, wash this mixture through a fine screen into the spray tank. Occasionally when two or more pesticides are mixed together in a tank, a slurry or precipitate may result and cause nozzle clogging. This seems more a problem of chemical compatibility, and the answer lies in not trying to accomplish too much in one spray operation.

The clogging of nozzles is rarely caused by the chemicals being used. Instead, it is caused by rust, scale, soil, sand, grass clippings and other foreign matter in the tank. Of course the answer lies in insuring a clean spray tank at all times. Nozzle tips and pumps become damaged quickly from sand-soil particles and rust. Again, careful operation pays dividends.

The typical sprayer is made up of several individual items which, when properly adjusted and coordinated, become an efficient and effective piece of turfgrass management equipment. Most spray units have some type of nozzle, a container or tank to hold the spray solution, and a pump to force the solution through the nozzles. Sprayers also contain filters or strainers, a pressure gauge, pressure regulator, shut off valve and connecting hoses.

The nozzle is probably the most important part of the sprayer. When all other parts are functioning properly, the nozzle produces the final pattern and determines the effectiveness of the entire operation. Nozzles are made of brass, aluminum, stainless steel, nylon, rubber and plastic. The choice depends on the spray pattern desired and the corrosive effect of the chemicals to be used. Some liquid herbicide solutions, especially those with an acid base, may be chemically corrosive on brass while wettable powders may be abrasive. Nozzles having finely machined edges are easily damaged by corrosion. This type of damage distorts the spray pattern.

Nozzles are also easily damaged by cleaning with a wire, knife or other hard object. A bristle brush or small wooden peg will usually dislodge materials without damaging the nozzle itself. Frequently, rinsing the clogged nozzle parts in water will loosen and remove obstructions.

The nozzle converts the spray-liquid into spray-droplets. Uniformity of application, rate of application and spray height and drift are influenced by droplet size. Therefore, the construction of the nozzle and pressure at which it operates determines the size and uniformity of the droplet being applied. The construction of the nozzle is also important in determining the uniformity of the spray pattern. At low pressures, the size of the particle or droplet will be considerably larger than at higher pressures. If pressures are exceedingly high, droplets may become a fog or mist and thereby create a drift problem.

Another integral part of the power sprayer is the pump. Pumps are of two types; providing either air pressure or liquid pressure to the system. The small five-gallon knapsack pump-type sprayer frequently used by home owners represents one that operates under air pressure. The entire system is under pressure and a smooth, uniform discharge results.

In liquid pressure systems, the pressure normally exists only from the pump through the lines and boom to the nozzles. The spray tank itself is not pressurized. Part of the liquid solution may be bypassed back to the tank for agitation as well as pressure control. There are many designs of liquid pumps, each with certain advantages and disadvantages. The pump should resist corrosion by the chemicals used and provide relatively long, trouble free service. The power to drive the pump may be obtained from the power take-off unit of the tractor or a separate engine mounted on the spray rig.

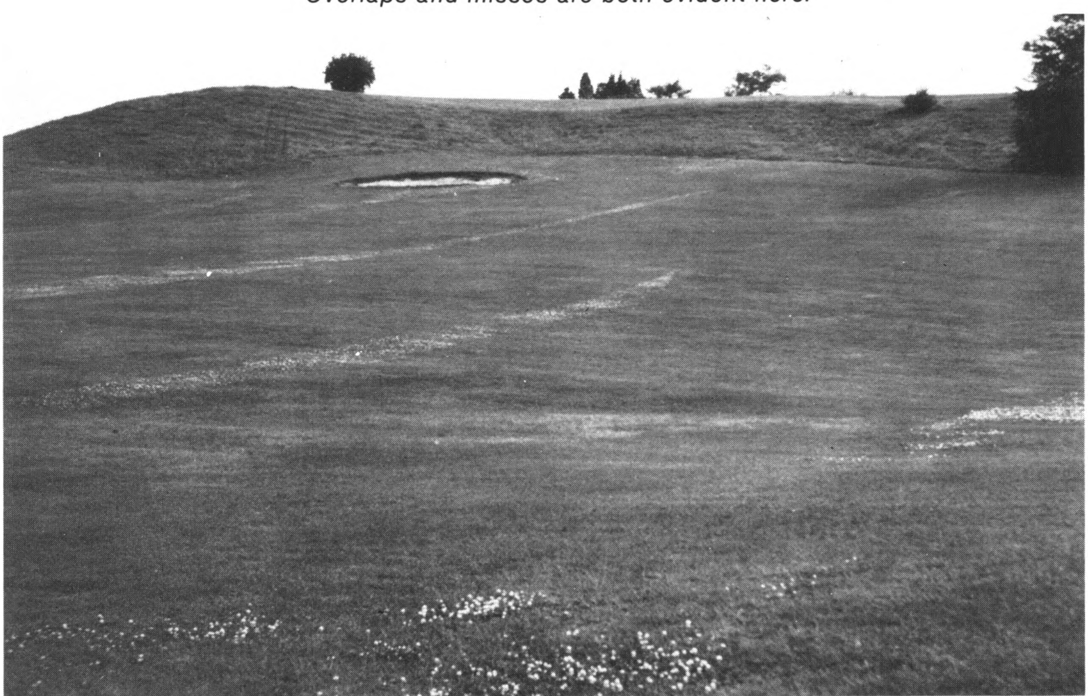
The filters or strainers are an important part of the power sprayer especially for low volume applications. Small filters or strainers are frequently found at each nozzle as well as others installed at the intake of the tank or in the line from the tank to the boom. A coarse strainer is also desirable for filtering the water as the spray tank is being filled.

The size of the strainer openings is determined by the size of nozzles being used. Usually, little difficulty with clogged nozzles results if the strainer openings are one-half as large as the nozzle opening. Unfortunately, wettable powders are seldom ground fine enough to pass through extremely fine filters. Thus, coarse filters plus large nozzle openings are usually needed for wettable powders.

The pressure regulator plays an important role in determining the effectiveness of each spray pattern. Certain nozzles are designed to operate at certain pressures and the regulator must be adjusted to this requirement. Pressure regulators may be of two types; the disk-type or spring loaded-type. Disk pressure regulators are usually more sensitive and provide a more accurate reading than the spring loaded-type. However, the spring loaded regulators usually cost less and provide trouble-free service because of their simple construction.

Finally, various parts of the power sprayer are connected by the hoses, and they also play an important role. Hoses should be selected to withstand expected pressures within the spray rig system. They should be made of materials that will not absorb chemicals from the pesticide solutions

Overlaps and misses are both evident here.



and they should also be relatively easy to clean and flush with clear water.

Calibration of the Sprayer

Along with insuring the proper mechanical operation of the power sprayer, it is of great importance that it be calibrated properly. The importance of calibration and insuring the proper amount of material applied to a given area cannot be overemphasized. Several methods have been developed in determining the number of gallons of spray applied per acre.

One frequently used method is that of referring to prepared tables made available by nozzle and pump manufacturers. The tables provide the pressures, speed, various nozzle sizes needed, height of spray boom, etc. to obtain various gallons of spray per acre. The chief disadvantage of using prepared tables or charts is that of coordinating the required tractor speeds, spray rig pressures, height of boom, nozzle sizes, etc.

Another method of calibration requires special measuring devices plus certain charts or graphs to make the final determination. The spray solution is collected for a prescribed period of time or distance and the amount of solution is then measured. Prepared tables or charts are then entered in order to determine the gallons applied per acre. Occasionally, glass jars or containers with the tables printed directly on them are available for this purpose. The disadvantage of using this procedure is the same as outlined above.

Perhaps the most accurate method for calibrating a sprayer is to actually treat an area of known size. For example, by starting with a full tank and measuring the gallons required to refill the tank after spraying a known acre, the gallons per acre can be quickly calculated. Care must be taken that speed and pressure do not vary significantly from the test area to the actual spraying operation on the golf course. An ideal location for establishing a test area and calibrating the power sprayer may be the landing area of the driving range, a practice field or even a vacant parking lot.

The care and calibration of a power sprayer may not be the first or foremost thought on the mind of most superintendents during the month of January. But one thing is for sure; your success in spray applications next spring, summer and fall will depend on the active use of these principles.

A GREEN SECTION SUPPORTED RESEARCH PROJECT

Creeping Bentgrass and Sod Webworm Larvae

by **WILLIAM R. KNEEBONE,** Professor,
Department Plant Sciences, University of Arizona

Many members of the sod webworm complex *(Crambinae)* infest creeping bentgrass *(Agrostis palustris Huds.)* putting greens. Matheny (1971), for example, identified 32 species in Tennessee turfgrass. Although control of these is not difficult and has become a regular routine for golf course superintendents, a reduction in degree of infestation or frequency of necessary control procedures would be worthwhile.

Many selections of bentgrass have been made and are under test with the aim of combining turfgrass quality with resistance to hazards such as environmental stresses, wear, and diseases. Next in importance to these problems are insect pests. A high level of resistance or a low level of attractiveness to these would additionally simplify management and improve turfgrass quality.

As part of a selection program for resistance to heat stress (supported in part by USGA Green Section Research Funds), 26 bentgrass clones, along with the cultivars 'Penncross' and 'Seaside', were established vegetatively at Tucson, Ariz., in replicated 4-foot by 8-foot plots in 1973. All plots were maintained as a putting green with mowing at ¼-inch and nitrogen applied weekly in ammonium sulphate at ¼ pound per 1,000 square feet. The green was used by University of Arizona golf classes. No pesticides were applied in 1975. Cutworms and sod webworm larvae, primarily sod webworms *(Crambus spp.),* began appearing in the sod in early June with gradual buildup partially held in check by predator wasps and birds. Counts were made in July and in August by the pyrethrum technique. A water solution of pyrethrum was poured slowly onto the center of each plot, spreading to form an approximate one-foot circle. Larvae appearing on the surface were counted and recorded. Three to four plots were treated at one time and counts were made sequentially at 5, 10, and 15 minutes after each application. Totals were summarized and the data from two sampling dates analyzed statistically.

RESULTS AND DISCUSSION

Recovered larvae averaged ½ inch to ¾ inch in length with few as large as one inch, evidence of biological controls by predators. Apparent damage was minimal in all but the most heavily infested plots. Plots with high counts were severely thinned by larval feeding.

Counts varied from plot to plot of the same selection, but certain clones were consistently infested and others virtually free of larvae. Five clones averaged less than four larvae per count (Table 1). Of these, (A6) is Old Orchard. The others are selections from seaside bentgrass greens. Seaside was in the low third while Penncross was in the high third, but because of plot to plot variability they could not be statistically separated. Of the low five, two were rated as lightly damaged, three had medium webworm damage in 1974. Of the four heaviest infested clones, significantly worse than the preceding, two were highly damaged and two had medium damage in 1974. All of these were selections from seaside. The mechanism behind differentials observed, whether attractiveness to adult moths or nutritive value to the larvae was not associated with degree of thatch buildup as shown by the scalping percentages (Table 1). Textural differences among clones were also unrelated to degree of infestation.

Although quality, vigor, and resistance to diseases and other stresses are primary criteria for selection among bentgrass clones and/or cultivars, these data add an additional selection potential to our arsenal. As new clones or cultivars become available this criterion may help our choices.

Literature cited: Matheny, E.L., Jr., 1971. Diss. Abstr. Int'l. B 32 (5):2777.

Table 1. Bentgrass selections, their origins, and data relative to differential worm infestation.

Selection	Origin(1)	Worms/ft.^{2}(2)	Worm Damage 1974(3)	% Scalping 1974(4)
A18	California (S)	13.3	M	20
A58	Arrowood	12.7	H	6
A37	Phoenix, Arizona (S)	12.0	H	67
A54	Mesa, Arizona (S)	12.0	M	47
A21	California (S)	9.5	L	15
A50	'Nimisilla'	8.3	H	20
A 7	'Toronto'	7.5	M	5
'Penncross'	—	6.5	M	25
A44	Phoenix, Arizona (S)	6.5	H	37
A13	USDA	6.3	M	8
A52	Fort Lauderdale, Florida	6.0	M	3
A61	Palm Springs, California (S)	6.0	L	8
A63	Palm Springs, California (S)	5.8	M	0
A 4	'Cohansey'	5.8	L	0
A24	Phoenix, Arizona (S)	5.7	M	12
A33	Tucson, Arizona (S)	5.3	H	30
A25	Mesa, Arizona (S)	5.2	L	90
A53	'Evansville'	5.2	H	20
A36	Tucson, Arizona (S)	4.8	M	63
A17	California (S)	4.7	H	25
'Seaside'	—	4.3	M	10
A12	'Springfield'	4.3	M	78
A39	Phoenix, Arizona (S)	4.0	H	53
A 6	'Old Orchard'	3.8	M	2
A16	USDA	3.7	M	6
A42	Phoenix, Arizona (S)	3.3	L	65
A48	New Zealand Browntop	3.0	M	17
A20	California (S)	2.8	L	15

(1) (S) indicates selection from bentgrass.

(2) Numbers which do not have a line in common differ statistically (19-1 odds).

(3) L = light M = medium H = heavy

(4) Greens mowed at 5/16", height dropped to 3/16". Generally heaviest mat, worst scalping. A25 upright grower and atypical.

TURF TWISTERS

AFTER BURNING:

Question: Seed prices seem to be going up each year. Why is this happening? (N.J.)

Answer: For several reasons, but these two primarily. First, because of the non-burning edicts issued by EPA. This limits the number of acres that can be burned annually. Burning helps produce a better crop, one that has less contamination of harmful diseases, insects and weeds—and this all adds up to a better seed yield. If you plan to attend the GCSAA International Turfgrass Conference and Show in Portland, Oregon, (February 6-11, 1977) you will hear more about this problem.

Secondly, because farmers can grow food crops easier, quicker and at a good profit, they are turning away from growing grass seed. Fields used for growing food crops also are much easier to keep free of production problems because these fields can be plowed under annually while grass seed fields are not.

FOR GOOSEGRASS CONTROL:

Question: Is there anything new for control of goosegrass *(Elusine indica)* in bermuda fairways and roughs? (Texas)

Answer: Yes, the researchers are trying many combinations of chemicals and should be publishing results in 1977.

EVERYTHING IS COMING UP MEADOWGRASS.

Question: In some turfgrass articles there is often reference to Meadowgrass. What is Meadowgrass? (Conn.)

Answer: Meadowgrass is an early European term for members of the bluegrass family. For example, Kentucky bluegrass has been referred to by the following names: Greengrass, Bluegrass, Junegrass, Smooth Meadowgrass, Smooth Stalked Meadowgrass, Brow-topgrass, Speargrass, Common Speargrass and Englishgrass.

Poa annua has been referred to as Annual Meadowgrass, Dwarf Meadowgrass, Early Meadowgrass, Maygrass, Suffolkgrass, Speargrass, Low Speargrass, annual bluegrass and would you believe it Goosegrass.