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USGA GREEN SECTION RECORD

A Publication on Turf Management by the United States Golf Association

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COVER PHOTO: The terrace was flooded to check for leaks in one step of building a Purr-Wick putting green.

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

Art Editor: Miss Janet Seagle

Building a Purr-Wick Green at Belle Meade

by **JACK MAURER**, Superintendent, Belle Meade Country Club, Nashville, Tenn., and **HOLMAN GRIFFIN**, Agronomist, USGA Green Section

"What's new in green construction?"

A whole decade has passed since the subject was first opened with *Specifications For A Method of Putting Green Construction* by the Green Section. Like a man going through an insurance physical, the Specifications have been inspected, poked, prodded, and re-examined from every possible angle. Individuals and private laboratories have attempted "improvements" of their own. Research stations have laborously explored the techniques and some have published additional suggestions.

After 10 years the Specifications have indeed undergone some small changes. Nevertheless, they are still sound and successful. They remain the only method of putting green construction recommended by the Green Section of the USGA.

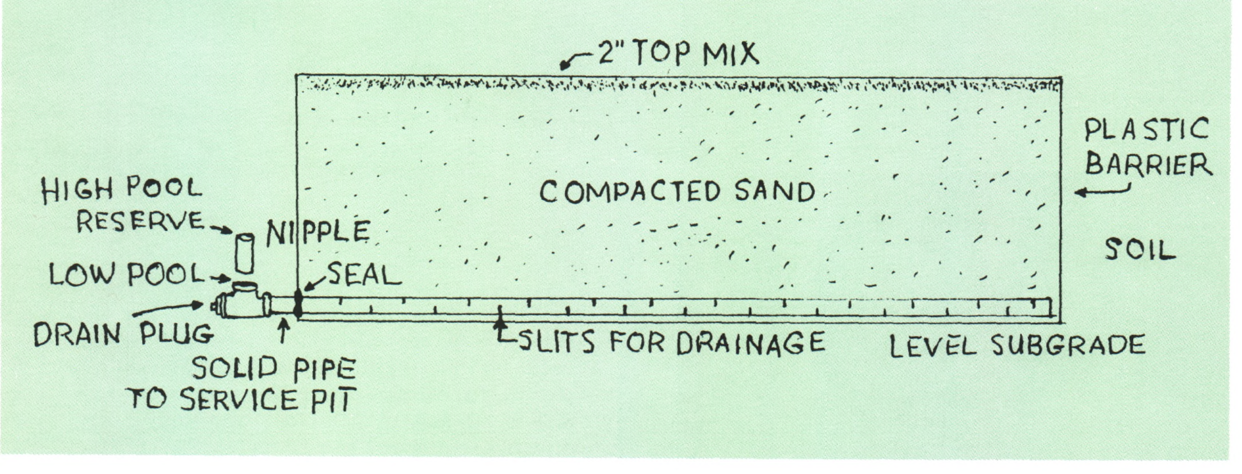
But the question, "What's new in green construction?" is interesting and worthwhile. New ideas are always evolving. One must keep pace. We must be aware and understand them if progress is ever to be made.

The most inventive new technique has been developed by Dr. W. H. Daniels, of Purdue University. Dr. Daniels calls his system the PURR-WICK method with the letters PURR standing for *P*lastic *U*nder *R*eservoir *R*ootzone and WICK denoting the wick or capillary action of the water moving through the sand above the plastic in the rootzone.

Belle Meade Country Club in Nashville, Tennessee decided to try the PURR-WICK method in constructing a new practice green. The following pictures tell the story.

A — This is a cross section diagram of one tier of PURR-WICK from a paper published by the Department of Agronomy at Purdue University. The diagram illustrates the basic PURR-WICK construction idea followed at Belle Meade.

Diagram A



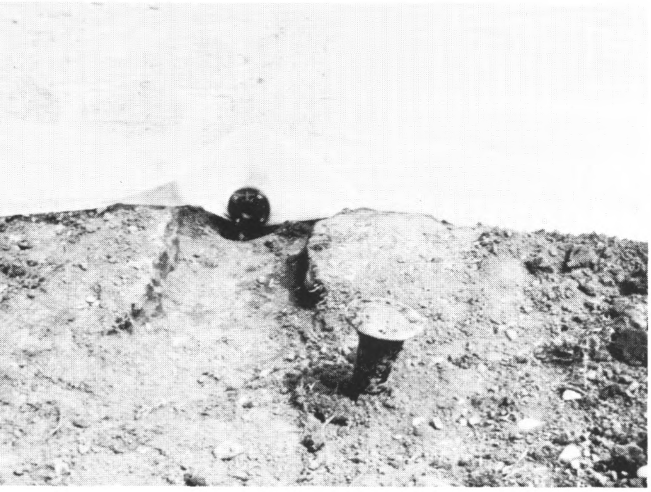
To begin, the old putting green surface was removed, the sod sold and the soil stockpiled. With old sod, soil and gravel removed, the rough grading begins. The allowable tolerance of the subgrade is plus or minus one inch. Water must be installed at the green site before construction begins because it is an essential element for construction as well as for future maintenance.

A bi-level base was produced in the subgrade and all rocks were raked up and removed so they would not puncture the plastic. In this case the subgrade for each section was 16 inches below the proposed finished grade and each level contained approximately 2,750 square feet, or a total green surface of 5,500 square feet.

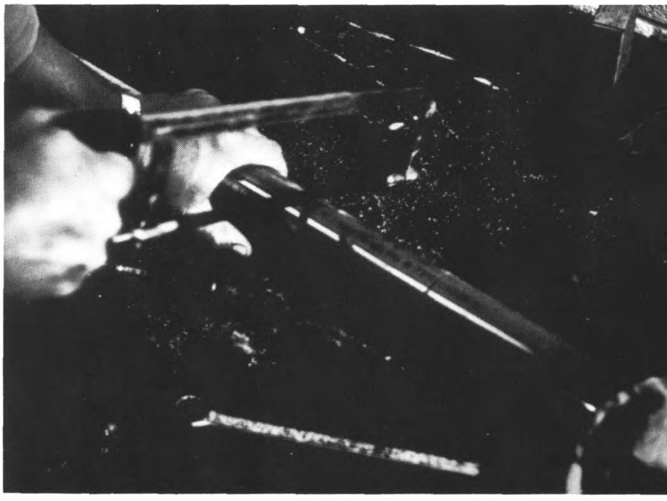
Four inch pipe was laid along the edge of the terrace and staked down. This formed a barrier between tiers which forms the reservoir on the upper tier. The difference in elevation of the tiers should not be more than half the depth of the sand layer. Example: If the sand is 16 inches deep, there should be no more than an 8 inch change in the elevation of the surface grade of the tiers.

Plastic was laid on the upper tier and seamed together with plastic tape. Belle Meade used 10 mil plastic sheets and allowed the plastic to overlap from three to four feet. Sheets 20 feet by 100 feet were used for an effective width of 17 to 18 feet.

The plastic was looped over the pipe on the edge of the tier with enough overlap to make the edge vertical without putting stress on the plastic. Lateral drains (slit plastic pipe) were installed and taped in place then covered with sand to further secure them. Then the terrace was flooded to check for leaks.



To run the drain pipes through the polyethylene at the side of the green, a cross (smaller than the pipe) is cut in the plastic at the desired spot and the pipe pushed through. The plastic is then taped to the pipe to make it as water tight as possible and a flange of collar is secured on both sides of the polyethylene and bolted securely around the pipe with additional tape covering this.



Drain pipe for each tier is produced by sawing slits on alternate sides of plastic pipe with a coping saw so that slits are wide enough to permit water but not sand. The pipe is sawed about a third of the way through on 4— to 6—inch centers. These drains may be laid in any desired pattern necessary to fit the green contours.

Dumping the first load of sand at the edge of the green is shown in picture 8. The sand is worked out from the edge and should be kept moist. When moving out on sand, make a bridge across the reservoir dividers and drain pipes first. By going slow and easy the sand will form a base which will support 25 tons of sand plus the weight of the truck rolling over it without damage to the pipes or polyethylene.

To push the sand out and rough grade the surface, a bulldozer may be used, but be careful not to push drain pipes out of line when working between tiers. The upper terrace was filled with sand first, but this was chalked up to experience and it is recommended that the lower level always be filled first to make the sand easier to push over the terraces without displacing the terrace dividers.

Once the sand has been placed over the entire green as uniformly as possible with a bulldozer, a scraper may be used to further level and true the surface. This equipment is easily supported by the sand base without fear of disturbing the drains and tier dividers underneath. Again, you should work slow and easy and keep the sand moist. Putting the sprinkler on for several hours before this operation will help settle the green and make working easier.

With the green surface leveled as much as possible by the scraper, the peat moss is applied by going over the surface once with the topdressing machine wide open.

The next operation is to put down a layer of calcined clay with a drop type spreader. On the 5,500 square foot green, about 40 bags of calcined clay were used, and this may be topped off with another layer of peat if desired. The calcined clay and peat in the surface help hold moisture for seed germination and also give the green surface enough body to hold a good lip on the cup.

The peat and calcined clay are incorporated into the top one to three inches of the green. In this operation, a Mat-a-Way machine worked well, but it needed some assistance when it bogged down now and then in the soft mix.

Following the incorporation of the calcined clay and organic matter into the green surface, the final leveling and smoothing was done with a rake in the same way all topdressing is smoothed when applied to established greens.

The green was then watered again and rolled to firm up the surface in preparation for seeding. When watering after the sand had been applied, leaks were easily detected by holes washing out in the sand. These should be corrected as soon as noticed.

Two or three strips of sod should be placed around the outside of the green to prevent washing and a snow fence is helpful to keep people and animals off the green until the seed is established. This picture shows the green being seeded.

With the seeding accomplished, the surface was mulched with a clean straw which helped hold the seed in place and speeded germination. The germinating seed should be inspected frequently and watered often enough to keep good moisture in the surface of the green. In this case, the green was first mowed three weeks after seeding.

This green cost a little over $3,500 to build, or roughly 64c per square foot with the sand being by far the most expensive item. Less than 400 man hours were used in construction. This would probably have been less if it had not been necessary to remove the old green.

The PURR-WICK method of building greens has both advantages and disadvantages. It does require exact planning, very careful installation and proper machinery for construction. The proper sand must be selected on the basis of particle size to make the final installation perform as it should. Design of the green may be restricted. But this method does give the turf manager absolute water control (playing surfaces are uniformly moist at all times) and conserves water to the maximum.

Proper green construction requires planning and close attention to detail. Improvisions by the builder seldom improve the product. Using only parts of a method of green construction which has been tested for years by competent people, or making your own combination of methods, usually leads to trouble. The compulsion to make "improvements" or to "do it my own way" are strong but seldom rewarding. Don't gamble with the club's money and your reputation. Few golf course superintendents are equipped to take on this kind of research, and most clubs are unsympathetic to poor conditions as a result of unsuccessful experimentation. As Dr. Daniels has so aptly put the phrase, "Do it right or leave it alone."

The Green Section Visiting Service: Are You Getting Your Money's Worth?

About the only thing one can afford to buy these days—and then not use—is a fire extinguisher! In your home and on the job, 1971 will be a year of cost consciousness. How can an advisory service fit into a program of good turf management and, at the same time, hold the cost line? The answer, it seems, lies largely in the type of advisory service one has in mind. The Green Section Visiting Service, we think, is unique and one that will fit the job.

Tough questions have been posed to us over the years concerning just what the Visiting Service can do for USGA Member Clubs, their Green Committees, and their superintendents. Here are some of the toughest questions. We hope you will find the answers their equal;

Question: (A new Green Committee Chairman is reviewing the budget with the golf course superintendent.) "What's this item, 'Green Section Visiting Service'? Do *you* really need it?"

Answer: The Chairman's question begs a "no" answer. If the superintendent replies "yes," an inference of incompetence may be drawn.

Actually, no one has a monopoly on knowledge or ideas. The Green Section Service can benefit any club if its experience and ideas are properly used. When teamed with the superintendent, it can strengthen the hand of the entire turf management program. Furthermore, professionals consult with one another. Indeed, doctors, lawyers, businessmen and even touring golf professionals do it constantly.

A look at the Green Section's list of subscribers will also show that most clubs with the best golf course superintendents are subscribers to the program. Not only have these superintendents encouraged their clubs to subscribe, but they have also actively supported Green Section activities through the years. Rather than a sign of incompetence, subscribing superintendents find the service of positive value! Perhaps the best answer to the original question can be found in a quotation of J.W. Jenks:

> "The inlet of a man's mind is what he learns; the outlet is what he accomplishes. If his mind is not fed by a continued supply of ideas which he puts to work with purpose, and if there is no outlet in action, his mind becomes stagnant. Such a mind is a danger to the individual who owns it and is useless to the community."

Question: With so many university specialists available, why should our club subscribe to the Green Section program?

Answer: Not only are state university specialists available, but many commercial consultants also offer a turf advisory service. In addition, turf product salesmen make frequent calls and keep customers up to date on new products. This is all to the good. Indeed, the more factual information one has, the better he will perform.

Good advice, someone once said, is only as good as its source. And, "the source" is only as good as its background, experience, and actual performance. The USGA Green Section is the *only agency in the country* devoted solely to golf course turf, its playing conditions and its management. It has nothing to sell. Each Green Section agronomist averages over 150 on-the-spot golf course visits a year. The total service offered to a subscribing club cannot be matched by any individual or agency.

Question: "Isn't $300 (for an 18- to 27-hole course) a lot of money for just one course visit a year?"

Answer: In many instances one bit of Green Section advice has saved a club many times the cost of the service. In relation to the entire maintenance budget, the Green Section Visiting Service charge is unbelievably low; less than 1/3 of 1% of most golf course maintenance budgets today. And actually, the $300 covers more than just one visit a year:

1) A second visit is made at the request of the club and at no additional cost.
2) Each visit is followed by a written report; a permanent record of problems and progress.
3) All expenses (salaries, travel, office, etc.) are covered by the original fee.
4) The USGA places part of its annual membership income in support of turfgrass research projects throughout the country.
5) By maintaining regional offices, Green Section agronomists are able to attend and participate in regional turf conferences and local superintendent meetings. They are able to keep up with the problems of their region first hand.

The Green Section service, like all USGA activities, is a non-profit enterprise. By utilizing the services, any club can improve its golf course and its playing conditions. Its only mission is to serve the best interests of golf. The $300 fee is established to cover costs only.

Question: Will the Visiting Service save our club money?

Answer: Almost anyone can study a golf course maintenance budget and soon find ways of cutting costs and saving money. The real trick is to save money without impairing the long-range quality or condition of the golf course; i.e., to spend wisely what is available. Our knowledge of golf course budgets leads to the belief that considerable sums are frequently wasted. The waste comes in a variety of forms:

1) Membership whims and requests that add little to long-range improvements but much to the budget.
2) Unnecessary equipment purchases.
3) NOT purchasing *needed* equipment and labor-saving items.
4) Purchasing high cost supplies and materials because some outside agency promises *better growth, less water use, released locked soil nutrients, eliminate tile and drainage needs, reduced labor requirements* (but doesn't get the job done), *will eliminate compaction,* etc.

The Green Section's purpose is not to tell anyone what to buy, but to point out what grass plant requirements are, how these requirements might best be met, and what other golf courses have found to be beneficial and good. The service is concerned with efficiency of operation, in developing and maintaining high golf course standards and quality turf. Wastefulness has no place in golf course operations, neither does indiscriminate cost cutting. Emphasis must be on getting the most for your money; better golfing turf for your course. Emphasis must be with *how good* rather than *how cheap.*

Since 1923, over $3 million has been spent on Green Section activities. A vast storehouse of knowledge and experience has been accumulated. This is your storehouse, and it is available to all USGA Member Clubs interested in maintaining the best possible golfing turf for their membership. The Green Section Visiting Service offers a balanced program of on-the-spot visits followed by a detailed report from conveniently located Regional Offices. In addition, substantial support is given to turfgrass research projects at universities and research stations throughout the country. In 1970, $32,000 was spent to support this work.

Are your maintenance practices up to date? Day after day; year after year the USGA Green Section has helped advance the cause of quality turf for golf. If your club is not now a Green Section subscriber, write for further information to Golf House, 40 East 38th Street, New York, New York 10016. See for yourself how we may be of service in 1971.

Growth and Cold Tolerance of Tifgreen Bermudagrass

by F.A. POKORNY
University of Georgia, Athens, Georgia

Introduction

Soil compaction and freezing temperatures are major factors contributing to the loss of turfgrass. Cultural practices such as increased fertilization rates, increased irrigation rates, soil amendments and mechanical aerification techniques have been used to overcome soil compaction. Presently mechanical aerification is the standard practice of correcting soil compaction, because removal of numerous soil cores is less costly and time consuming than complete renovation of a given area.

Loss of established turfgrass has been attributed to adverse winter conditions, such as excessive rains, poor drainage, and ice sheet formation, toxic accumulations in the soil of methane and carbon dioxide, dessication, and heavy infestations of low temperature fungi.

Since little information was found relating to the effects of soil compaction on winter injury of turfgrass, this study was undertaken.

Vegetative Development

Sprigs of Tifgreen bermudagrass were established in 6—inch metal cans in the three soil mixtures shown in Figure 1. A duplication of the three soil mixes was covered with a 3—inch layer of pine bark in an attempt to absorb compaction forces. Four months after planting, pressures of 0, 20, 40, 60, and 80 pounds per square inch (psi) were applied three times weekly for nine months.

During establishment, fertilization was based on general management practices using a 6-12-12 analysis fertilizer at the rate of 25 pounds per 1,000 square feet. Thereafter, one pound actual N, 0.11 pound P and 0.42 pound K were applied monthly. Soil pH was maintained at 5.5 — 6.0 with domestic limestone.

Grasses were cut to a height of one inch for a period of eight weeks after planting and thereafter was lowered to approximately 1/2 to 1/4 inch.

Approximately one inch of water was applied per week. Moisture levels were increased to approximately field capacity prior to the application of compaction pressures.

Temperature in the unshaded greenhouse was maintained at 60°F at night and 70—80°F on sunny days when possible. During periods of naturally high temperatures, the greenhouse was air-cooled using the pad and fan system.

Top Growth

Top growth was increased by amending the soil with 25 and 50 cent milled pine bark, respectively. A faster rate of growth, greater density, and leaf turgidity were characteristic of turf grown in the bark amended soils. Top growth was also greater in the non-cushioned media than in soils covered over with a 3-inch layer of pine bark (Figure 2). Cushioned soils

Figure 1. Distribution of particle separated for the three soil mixtures and the milled pine bark used as the soil amendment and the three-inch milled pine bark cushion layer.

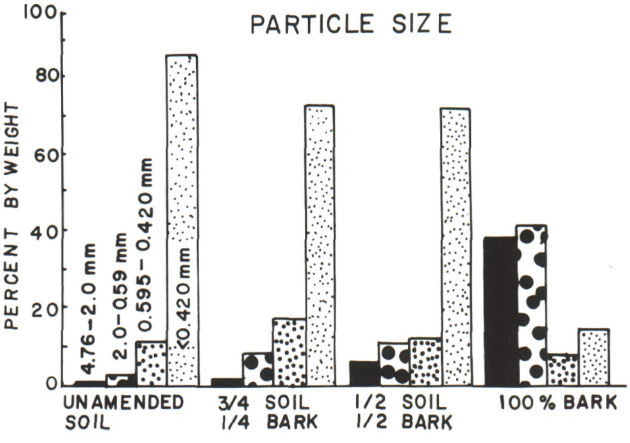
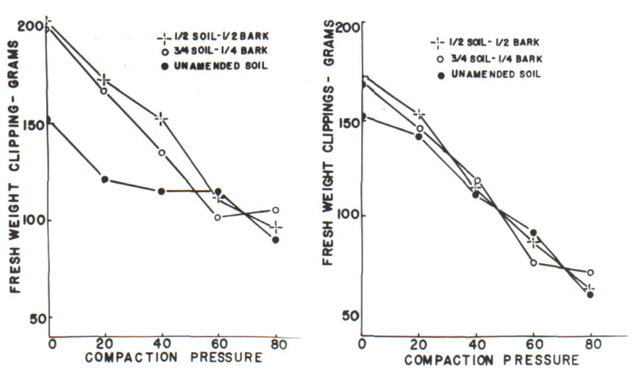


Figure 2. The influence of compaction pressures and soil mixtures on fresh weight of clippings of Tifgreen bermudagrass in: (left) non-cushioned soil and (right) milled pine bark cushioned soil.



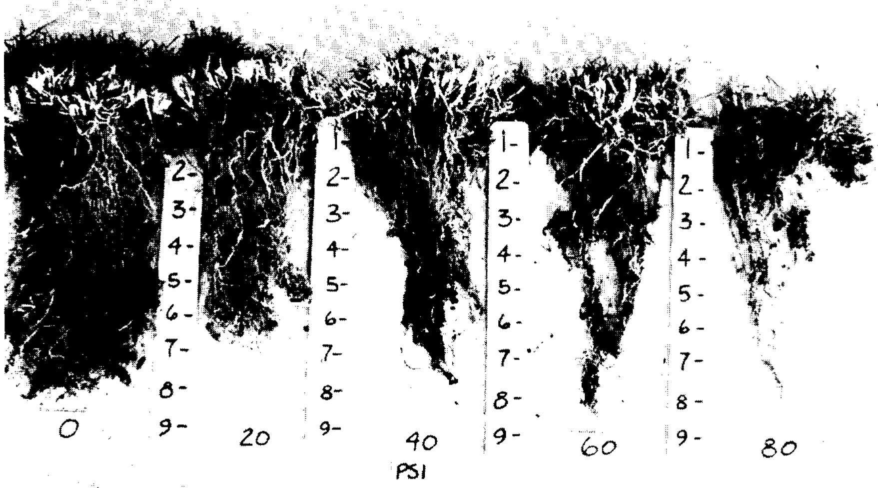


Figure 3. Root development of Tifgreen bermudagrass in a soil medium of 3/4 field soil – ¼ milled pine bark as influenced by soil compaction.

one month after the initiation of compaction treatments were highly resilient and had a high air content. Contraction and expansion of this zone was visually evident but constant compaction resulted in a gradual decline in resiliency. These soils became less productive than the non-cushioned soils. At pressures of 40, 60, and 80 psi, standing surface water, in excess of 1/8 inch was observed for periods of 24 to 48 hours after irrigation.

A 3—inch bark cushion layer also offset the value of incorporating pine bark into the soil as a physical conditioning agent (Figure 2).

Top growth decreased as compaction pressures were increased (Figure 2). Five months after compaction treatment was started, dieback was evident in the turf grown within the high compaction range (60 to 80 psi). Damage to crown tissue appeared to increase as soil compaction increased.

Root Development

Root development was enhanced by amending the field soil with 25 per cent and 50 per cent (by volume) pine bark, respectively. The root systems in the 50 per cent pine bark — 50 per cent soil mixture were active and had a high percentage of root hairs per linear inch of root. As compaction pressures were increased, root development (Figure 3) decreased. Root development was better in the non-cushioned soil than in soils cushioned by a 3—inch layer of pine bark. Roots produced in the cushioned soils, especially when compaction pressures were high, possessed few root hairs and exhibited much root breakage not found in the non-cushioned soil mixtures. In combination with anaerobic conditions caused by water retention in the cushion layer and with root breakage, high root decomposition rates were prevalent. This probably accounted for the rancid odor of these soils.

Soluble Salt Accumulation

Soluble salts were determined in the upper and the lower 2—inch soil profiles 13 months after soil compaction treatments were started. In the surface profile, salt concentration increased as compaction pressures increased from 0 to 80 psi. Soluble salt content changed very little in the lower soil profile. Addition of a 3—inch cushion layer of pine bark also resulted in a substantial increase in soluble salts in the upper 2—inch profile. This increase may be partially accounted for by the high cation exchange capacity of the pine bark and partially by the layering effect between the pine bark cushion layer and the soil mixture. Such layering apparently resulted in a restriction of water movement through the medium.

Excessive salt accumulations are apt to occur on highly compacted turfgrass soils and may become serious where a layering effect exists between the soil and the other organic or inorganic soil amendments. Serious burning of crown and leaf tissue and limited root activity can be expected unless soil compaction is alleviated and percolation rates improved so that leaching of excessive salts will occur. The use of milled pine bark as a soil amendment increased the soluble salt content of the base soil, and where no layering effect was present, the salt levels were within the limits established for satisfactory plant growth. However, when a layer of pine bark was used to absorb compaction pressures, soluble salt accumulations considered inhibitory for normal plant growth developed .

Recovery From Low Temperature Exposure

Fertilization practices were discontinued one month prior to initiation of cold treatments. All turf was transferred from the 60°F greenhouse into a 50°F holding area for a dormancy inducing period. Air temperature was gradually lowered and maintained at 40 to 45°F for a period of three weeks. Light intensity was reduced to 1,500 — 2,500 foot candles.

Containers of turf were then moved from the holding area into a thermostatically controlled cold chamber. Air temperatures within the chamber were depressed at the rate of 10°F per hour to 25°F and thereafter at a rate of 2°F per hour until the minimum of 15°F was obtained. The latter temperature was maintained for a period of five hours. A warming cycle followed the reverse of this procedure. The entire low temperature treatment was carried out in a 24-hour period. After freezing, all grasses were moved to the holding area, allowed to warm to room temperature, and then were transferred into a 60°F greenhouse for a recovery period of one to three weeks. Grasses were evaluated daily for recovery.

Recovery of bermudagrass after exposure to artificial freezing temperatures was found to be greatest in soils amended with 50 per cent pine bark, 25 per cent pine bark, and unamended soils in descending order. Differences in turf injury and recovery rates between cushioned and noncushioned soils were of no significance. Regeneration potential decreased as compaction pressures were increased. It may also be pointed out that low temperature treatments were not sufficiently low to have had a detrimental effect upon the root systems of the grasses. At no time were soil temperatures less than 35.7°F. It appears, therefore, that grasses recovered best in soils which permitted adequate soil aeration, gaseous exchange, water infiltration rates, and suitable resiliency or resistance to soil compaction. Soil receiving the least amount of applied pressure recovered more readily than did soils which received pressures of 40 to 80 psi. The former soils promoted a more extensive root system which was better able to support the regeneration of aerial plant parts. Where root systems were greatly limited in their growth and development, little support could be supplied toward development of new leaf area. Conversely, those grasses receiving pressures of 0 to 20 psi were endowed with an extensive leaf area, and therefore were better able to carry on a balanced activity which would consist of photosynthesis, respiration, transpiration and food storage, food utilization, and other metabolic processes.

Super Sam by Paprocki

Let's Start With Irrigation Design

by **GENE STODDARD**, Superintendent, Irvine Coast Country Club,
Newport Beach, California

If you're one of today's experienced golf course superintendents, chances are you're also an expert in inadequate irrigation systems. From that day long ago when someone first decided to water a putting green to todays "fence-to-fence" automatic systems — the superintendent has struggled, sweated, and sworn over irrigation. He has pulled hose, moved aluminum pipe, tangled with travelers, flushed sand from pumps and fish from screens. He has put up with poor fittings, bad pipe, electrolysis of soils, overwatering, underwatering, freezing pipes, boiling pipes and untold delays waiting for supplies. But the worst problem of all is poor design — and there's an abundance of it.

Those who design automatic systems without proper sizing of main and lateral lines, suitable spacing of heads, and lack the plain good sense of knowing a system grows weaker not stronger, are hurting the automatic irrigation industry. The expense of correcting a badly done system doubles or triples the original cost. Mistakes, whether in estimating wind conditions, sprinkler performance, or bid specifications, are too common and are inexcusable. There is only one real answer to poor design — change it! Only then will the irrigation job be satisfactory.

I will try to tell you what we did for a bad situation on our course. The system was designed with a double row and head spacing 120 feet by 90 feet rectangular pattern. Areas A and B always received less water than the other areas.

In addition, because of overlap and the type of sprinkler used, the inside circle (C and D) received four times the amount of water that other areas received.

Figure 1.

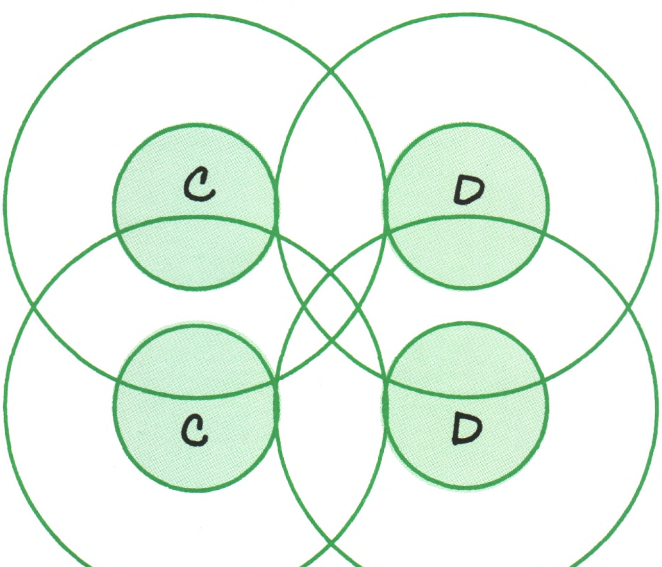
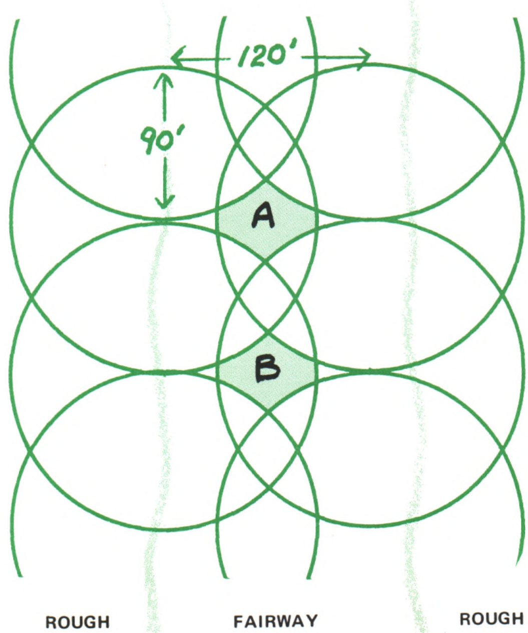


Figure 2.



We ended up with fairways dry and hard in the middle and overwatered on the perimeters!

To correct the situation, we first tested the sprinklers for performance patterns. They were not good. As a temporary stopgap, some of the original automatic heads were removed and replaced with quick coupler valves from which hose or hand set sprinklers could be used.

As time permitted, we then installed lateral lines from the existing automatic valves and respaced the system to cover a 65-foot triangular pattern. Two, three and sometimes four low-gallonage sprinkler heads were installed on lateral lines controlled by one of the original valves. Gradually the system has been converted to "head to head" coverage on 65-foot centers. We have very few wet or dry spots and — best of all — we have grass!

Fortunately, the original engineering in hydraulics and pipe size was adequate to allow us to compensate for poor original spacing and to replace the improperly selected sprinkler heads. Both problems have now been solved but it has been a costly experience for our club.

In the future, I will recommend triangular head spacing of no more than 60 to 70 feet and the use of a low-gallonage head on fairways as well as on greens and tees. Some putting green design problems may be encountered where a green is more than 70 feet across. However, this problem can be largely overcome by jockeying the triangular patterns and "giving" where necessary on putting green outline. In addition, individual sprinkler head control on greens (and even on backup heads on rear and side approaches) has proven helpful to me.

Someone once said, "You can't grow grass with water alone, but you can't grow it at all without water." How true, and how important, therefore, to have a properly designed automatic system!

STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION
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D. Free Distribution (including samples) by Mail, Carrier and Other Means	300	300
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F. Office Use, Left-Over, Unaccounted, Spoiled After Printing	743	492
G. Total (Sum of E and F)	6,719	6,500

I certify that the statements made by me above are correct and complete.
Robert Sommers, Managing Editor

TURF TWISTERS

DEAD SPOTS

Question: Has the Spring Dead Spot problem been solved? (North Carolina)

Answer: No, it has not, but research continues to show some progress. Recent information, not released, shows Spring Bak, Fore and Dieldrin still give the most promise for control.

DEAD POTS

Question: We have a readily available source of sawdust. Is sawdust a good source of organic matter for use in top-dressing and soil mixture? (Vermont)

Answer: This question is best answered by research conducted at the University of Massachusetts by D.V. Waddington, W.C. Lincoln, Jr., and J. Troll. It is best to avoid the use of fresh sawdust in turfgrass seedbeds. Nitrogen deficiencies often occur when undecomposed sawdust is attacked by micro-organisms. Furthermore, some wood materials have a toxic effect on seedling turf. Before using the sawdust, it should be well composted then "seed tested" in a pot.

DEAD SYSTEM

Question: What is the metric system and will we in the United States ever adopt it? (Oregon)

Answer: The metric system is far less complex than our present avoirdupois weight and distance measurements. The fundamental unit is the meter (equal to 3.28 feet) from which the units of mass (grams) and capacity (liters) are easily derived. Researchers in the United States are increasingly using the metric system in reporting their work. However, the cost of converting to the system would be tremendous and we know of no U.S. plans to do so. In all probability, the transition will be slow with Canadian and U.S. citizens knowing and using both systems for many years.