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USGA GREEN SECTION RECORD

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FAIRWAYS AND THE ROUGH

The fairway is the target, but the rough often catches the shot. The quality of fairways is important, but the rough has much to do with the appearance and character of the golf course.

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FAIRWAYS AND THE ROUGH

Various aspects of Fairways And The Rough were dealt with during the day-long Conference on Golf Course Management of the United States Golf Association's Green Section at the Biltmore Hotel in New York City on January 29, 1965. The chairman of the meeting was Henry H. Russell, of Miami, Fla., Chairman of the USGA Green Section Committee. Abstracts of remarks made by various speakers are presented here.

IN THE FAIRWAY

WILLIAM C. CAMPBELL, 1964 USGA Amateur Champion

The primary concern of the golfer is that he be able to strike the ball cleanly. This implies that the grass must be mowed reasonably short.

Many professional golfers as well as amateurs swing in such a way that the clubhead travels in a flattened arc through the hitting area. There is much less chance for an error that would result in "blading" the ball or of striking the ground behind the ball. Such tactics are ill-suited to playing from high grass. When the ball nestles in the grass, a flattened swing through the hitting area causes grass leaves to be caught on the face of the club prior to its striking the ball. The result may be a slowed swing, or a turned clubhead. If grass adheres to the face of the club, a poorly controlled shot may result.

When playing from higher cut grass on fairways, the player must adjust his swing so that grass will not be caught between the clubface and the ball. This means hitting down on the ball at a steeper angle. A slight error can, in such a case, cause "blading" of

the ball or hitting behind it.

Rolling fairways which cause the player to make adjustments in his stance may affect a player's choice of club or the way he plays a shot. Such uneven stances are, however, a legitimate part of the game and the player should learn to make the necessary adjustments when playing on sloping terrain.

Rain, wind, or a combination of these factors cause the golfer to compensate. Rain and the resultant soft ground cuts down on the roll of the ball on fairways and the "heavy" moist air reduces distance in flight. Ordinarily shots played from wet grass cannot be controlled so well. Wet grass is more likely to stick to the clubface. On the other hand, shots played to the green usually stop better.

Wind causes the player to attempt low shots which will be less affected. A low, controlled shot is very difficult to play from high grass. The most preferred fairway turf then is one which will support the ball so that it may be struck cleanly. The ball can be better controlled under all conditions. Tall grass creates uncertainty in the mind of the golfer and small errors in his swing are magnified.

IN THE ROUGH

DR. RAY KEEN, Professor of Horticulture, Kansas State University, and DR. MARVIN H. FERGUSON, Mid-Continent Director, USGA Green Section.

The rough is an area that is frequenly neglected in golf course maintenance. The golfer who strays into the rough expects to find something less than good golfing conditions and therefore the natural vegetation is most often used.

Despite the fact that the rough is hopefully avoided and is considered a low maintenance area, the nature of this vegetation contributes significantly to the character of the golf course. Outstanding examples are Pine Valley, Clementon, N. J., where the golfer whose ball goes in the rough may be confronted with sand, shrubby vegetation, pine trees or even swamp land; Prairie Dunes, Hutchinson, Kans., where roughs consist of dunes covered with tall native grasses, forbs and yucca; Southern Hills, Tulsa, Okla., where scattered trees exist in the roughs but where the chief problem is posed by the native bermudagrass; if it is not mowed frequently, it creates a serious handicap to the golfer.

The nature of roughs also leaves a distinct impression upon the spectator. Who can forget Augusta National when the blossoms of azaleas and camellias color the wooded roughs? Likewise, Chet Mendenhall's introduction of trees into the roughs at Mission Hills in Kansas provides a pleasing and ever-changing background for the game.

If you agree that the rough is important to the character of a course then we should make the point that the rough deserves more attention than it receives in the matter of long-term planning. The planting of trees and shrubs can be done during the "off season" when labor and time for supervision is available. The establishment of even a few trees and shrubs each year can change the appearance of a golf course in a few years.

Whenever a club embarks upon a tree and shrub planting program, there are a few guidelines which must be followed:

1. The plants must be well enough adapted to the environment to thrive without special care. Native plants probably should comprise most of the planting.

2. Choose a variety of foliage types, forms, and seasonal colorations for interest and contrast.

3. Group the plantings in natural appearing arrangements. Avoid straight lines and geometric patterns.

4. Space plants so that the use of large mowing units is not precluded.

5. Choose shrubs that have high branching characteristics or that can have lower branches removed without destroying the natural effect. Low branching trees and shrubs interfere with maintenance and may contribute to an increase in unplayable lies.

6. If fruiting trees are employed, they should not be adjacent to fairways and tees where the dropping of fruit will constitute a nuisance. Trees like the sweet gum in the South and some types of eucalyptus in the West may bear seed capsules that are a hazard to mowers.

Because the rough area frequently occupies the major part of the golf course, ways to minimize maintenance requirements are important. Growth retardants have come to be recognized as a valuable maintenance tool. Maleic hydrazide is a commonly used material for retarding vegetation near the bases of trees, along fence lines, fixed objects and ditch blanks. Used early in the season, it may substantially reduce the number of trimmings required.

Vegetation such as clover that grows so dense a foliage cover as to cause many lost balls may be eliminated by the use of selective herbicides. Where such treatments thin out large areas, native or adapted grasses may be sown. Usually light rates of seed are used so that the cover will not be too dense. In

It's "rough" beyond the green. The dense vegetation provides an excellent background for the hole.

some cases low-growing native annual wild flowers can be planted.

In planning for the future development of rough areas two aims should be kept in mind. First, the rough should be developed as an attractive background for the golf holes. A player off his game can at least enjoy the scenery.

The second aim should be the incorporation of plans to make maintenance easier.

Thoughtful consideration and planning with respect to rough maintenance problems can save many hours of labor. There is perhaps no other feature on the golf course where imagination and ingenuity can do so much to improve appearances and to minimize maintenance requirements.

GOLF COURSE IRRIGATION

ALEXANDER M. RADKO, Eastern Director, and LEE RECORD, Agronomist, USGA Green Section; and T. M. BAUMGARDNER, Landscape Architect, The Sea Island Co., Sea Island, Ga.

It has been said that an irrigation system is only as good as its designer. Never have truer words been spoken. Because each system is an individual problem, one good plan obviously is not suitable to all conditions. An irrigation system must be engineered to conditions of soil, turf, climate, topography, water facilities potential and wind direction, etc. on a specific site. A blueprint design alone is not suitable; there must be a thorough inspection of the course by a competent golf course irrigation engineer. A good deal of money is involved and once a system is installed, it is expected to last, therefore it is important to do it right the first time!

Sources of Information

Where can you go to find the necessary information to do the job right? The Superintendent, the Green Committee Chairman and his committee, the ones who generally spark the project, have numerous sources of information, as follows:

1. Commercial firms that specialize in irrigation equipment and employ irrigation engineers who are available upon request; most advertise in golf periodicals.

2. Private irrigation engineers, independent operators who also advertise in golf periodicals.

3. Golf course architects; they sometimes provide this type service or will arrange for it through local firms.

4. Golf course superintendents and green chairmen who served at the time their system was installed.

5. Articles published in periodicals such as THE GOLF COURSE REPORTER, GOLFDOM, CLUB OPERATIONS, GOLF BUSINESS, the USGA GREEN SECTION RECORD and others.

6. Agencies engaged in the turfgrass field. These include the Golf Course Superintendents Association of America, local Golf Course Superintendents Associations, Agricultural Experiment Stations, State Universities that are engaged in turfgrass research, the National Golf Foundation, the Sprinkler Irrigation Association, the U. S. Department of Agriculture Soil Conservation Division, and the USGA Green Section Regional offices.

Don't hesitate to explore several of these information facets—it could be dangerous to rely upon one source for all your facts.

Sources of Adequate Water

The first step in golf course irrigation study is to find an adequate sup-

ply of water. If no natural ponds, lakes, streams or fresh water rivers are on or near the property, it may be necessary to dig wells or construct a pond or lake. Before any such steps are taken, be sure to check regulations with municipal and state authorities. The use of water is an increasing problem in many areas and where water supply is not now or will not in the future be adequate to meet all needs, it becomes a social, political and economic problem.

Where use of water from streams, lakes or reservoirs is contemplated, the proper federal, state or local officials should be contacted for information regarding permits, riparian rights, apportioning regulations, costs, etc. Sources of water should be thoroughly investigated for contamination or high salt or chemical content which might be injurious to grasses. Water containing high sulphur or other chemical content may have an adverse effect on certain types of valves, pipe or sprinklers.

The amount of water required in any one season will depend on several factors such as geographic location, total rainfall and its distribution, grass variety, type of soil, course topography and length of growing season. A bermudagrass course in Arizona on flat land with sod of a sandy texture obviously will require a greater water supply than a bentgrass course in humid New England on clay soil. A bluegrass-fescue turf on a course in New England on clay soil would require less of a water supply than a bentgrass course in New England. Each special case would require a different total. As a rule of thumb we might consider the following: It is usually said that turfgrasses require one-inch of water per week to thrive. An acre inch of water is equivalent to 27,225 gallons. Therefore, 1,089,000 gallons is required each week of the growing season to irrigate 40 acres of fairway. The total amount and the distribution of rainfall will determine the irrigation pattern, and as the rainfall pattern will vary year to year it is wise to calculate the maximum requirement.

In 1964, the driest year on record since Weather Bureau records have been kept, several 18 hole courses in the Northeast reported they used between 21 and 24 million gallons of water. This was for a six-month period from May through October, the period of severe drought. In a normal season their requirement might be between 15 and 20 million gallons for a four or five month period. To apply these amounts efficiently the output should range between 500 and 800 gallons per minute. Most new installations are aiming at the higher figure.

Types of Pipe

Pipe most widely used to date has been transite (asbestos), or cast iron, or galvanized iron, or plastic pipe or combinations of these. The most recent innovation has been aluminum pipe with a bituminous coating. Each has its own attractive features in strength, longevity, price, and other areas which must be studied with care before a choice is made. For obvious reasons it it important therefore to have expert guidance in choosing the pipe, valves, heads, and fittings for this installation.

The choice of sprinkler heads will depend on the gallon per minute output (nozzle size) and the pressure involved. Firms specializing in the manufacture of heads can supply details. The trend in automatic and semi-automatic systems is toward multi-row lines in fairways, requiring many more sprinkler heads as each covers a pattern of smaller diameter.

Kinds of Systems

Irrigation is as old as history but

probably more progress has been made in the last 15 to 20 years than in all the years before. The development of new materials and automated methods have gone far toward eliminating guesswork and reducing labor costs.

1. **Hoses and sprinklers** are still in use on some golf courses although they are becoming extinct. The fact that some are still in use attests to the permanency of a system—though outmoded it is sometimes difficult to sell the members an up-to-date system. This type system consists of a small, inadequate underground layout that is supplemented with hoses and revolving sprinklers set at various intervals. It has many disadvantages—it requires close watching and frequent movement of hose and sprinklers; it can be moved by golfers or caddies when the sprinkler interferes with play and often it is not returned to the original spot so control is lost; and it is a system that requires much labor since it is tedious to move sprinklers and hose filled with water. This is the least desirable of systems.

2. **Travellers** are used when water supply and pressure are limited. It is a system that has to be moved from fairway to fairway. It also needs supervision, adding to labor costs. While the initial cost is less, the subsequent cost of labor for operation is more than for quick coupling or automatic systems. The travelling sprinkler moves along a guide-wire over a fairway until it reaches the end of the wire, then when manually reversed it moves back under its own power. It is slow moving. During periods of stress, grasses could weaken before the water reaches the area.

3. **Quick coupling** systems have underground pipe throughout the course with quick coupling valves so that all the worker need do is snap on the sprinkler head and the water flows freely. When each sprinkler has been on long enough, it is moved to another area until the round of irrigation is completed. This system requires labor and supervision, usually a night man.

4. **Semi-automatic** systems are somewhat like the quick coupling except that the irrigation pattern is regulated by a time clock. The sprinkler heads are placed on fairways to be irrigated and at a set time they irrigate, then shut off automatically.

5. **Fully automatic** systems operate from control clocks spaced at vantage points throughout the course. The clocks are set and the system operates by itself—the heads lift and shut off automatically. The only additional labor needed is for supervision to see that the system is working properly.

Many factors may still influence the decision as to the type of sprinkler system to choose for a particular course, including geographic location, climate, rainfall distribution, drainage conditions, soil characteristics, topography and elevations, type of grasses used, degree of maintenance, perfection desired and economics.

Choice of Heads

Any firm dealing in the manufacture or sale of sprinkler heads can provide details of irrigation patterns with the various heads. In the main the solution lies in the nozzle size-pressure relationship. If a quick coupling system is installed and heads are spaced approximately 90 feet apart down the center of the fairway, one head must be able to cover approximately 25,000 square feet in its irrigation pattern. In the automatic system, two and sometimes three parallel lines are installed. Here the number of heads required increases from 150 or less in the case of a quick coupling

system to between 650 and 900 for a completely automatic system. In the automatic installation less pressure and smaller nozzle size is required as each nozzle covers a much smaller area than needed for the down-the-center quick coupling system.

The heads for all but the completely automatic systems are placed in position manually. The automatic heads raise hydraulically or electrically on gear or cam driven shafts.

Pumps

Expert advice is essential in the installation of the pump house setup. This is no job for an amateur. There are several kinds of pumps to choose from—centrifugal, turbine, piston, rotary, or engine. The centrifugal pump is the most widely used. Most installations include one or two 25 horsepower motors. Some require a booster pump to increase pressure at remote and/or especially hilly sections of the course.

Specifications and Bids

When a new course is being planned or when improvements to an existing course irrigation system are contemplated, club officials are inevitably confronted with the problem of who to turn to for the best advice. If the club subscribes to the USGA Green Section Service, a natural source of good advice would be the USGA Regional Agronomist. He can recommend the necessary steps and procedures and can point out the advantages and disadvantages of the various types of systems.

The first step should be the securing of a good overall plan and adequate specifications to suit the requirements of the particular club and course, prepared by a recognized and experienced expert in the field of golf course irrigation. It is no longer possible for a local plumber or someone without wide previous experience to design a modern system.

The names of capable experienced designers as well as contractors in the same category can usually be obtained from golf course architects or by contacting clubs with successful systems. Valuable information may also be obtained from various manufacturers' representatives and from reliable dealers.

Wherever possible the next step should be to invite competitive bids from reliable experienced contractors. Where automatic and semi-automatic systems are involved . . . only contractors experienced in this type of installation should be considered.

The contractor must have some idea of the requirements of the golf course grasses, and the routine of water management. This he must get from the superintendent so that the system can be geared to these needs.

An adequate plan should include the locations and sizes and specifications for all pipe, valves, sprinklers, pumps, hydraulic tubing or electrical activating systems, controllers, switches and electrical hookups. Detailed specifications for installation procedures should also be included encompassing such things as pipe and tubing-laying procedures, depth of pipe, replacement of sod, valve and sprinkler installation and finally recommended operational procedures. Plans should also include schedules of all pipe, valves, fittings, sprinklers and other equipment necessary to accomplish the work as detailed in the plans and specifications.

Besides these items there are such important details to consider as the use and storage of explosives for blasting rock, removal and replacement of fences, rerouting if obstacles

arise, provision for workmen's compensation, and property and liability insurance.

Having the golf course crew install the system under the superintendent's supervision may reduce initial costs; however, course maintenance usually suffers, sometimes beyond simple renovation repair. Many superintendents prefer to have outside contractors do the work, meanwhile keeping close watch as the project progresses.

It is good business to require a performance bond equal to the full cost of installation and it should remain in full force until the job is completed. The system should be guaranteed for a specific period and those installing it should fill the superintendent in on all details of operation.

If an experienced designer and contractor have been employed in the installation of the system, they can offer much good advice for use of the system. A capable superintendent will quickly learn how to use it efficiently.

The types of grasses to be encouraged or discouraged will be a big factor.

The tendency is usually to water too much initially in particular areas with a new system and only experience can be the teacher in this respect. General advice normally given to start off the use of an overall automatic system under average conditions is to set the controller and clock for the first month or so to a maximum of 1/4 inch of water per hour. If a fairway sprinkler delivers 60 gallons of water per minute to an area 180 ft. in diameter at about 70 lbs. pressure at the sprinkler head, approximately 1/4 inch of water per hour will be applied. After some experience and observation at about this rate of watering the experienced superintendent can soon learn to adjust his system up and down for the various areas and needs of his course. Rainfall, topography, soil and drainage conditions, type of grasses and other factors will of course enter into the daily decisions in regard to water use.

BLUEGRASSES AND FESCUES

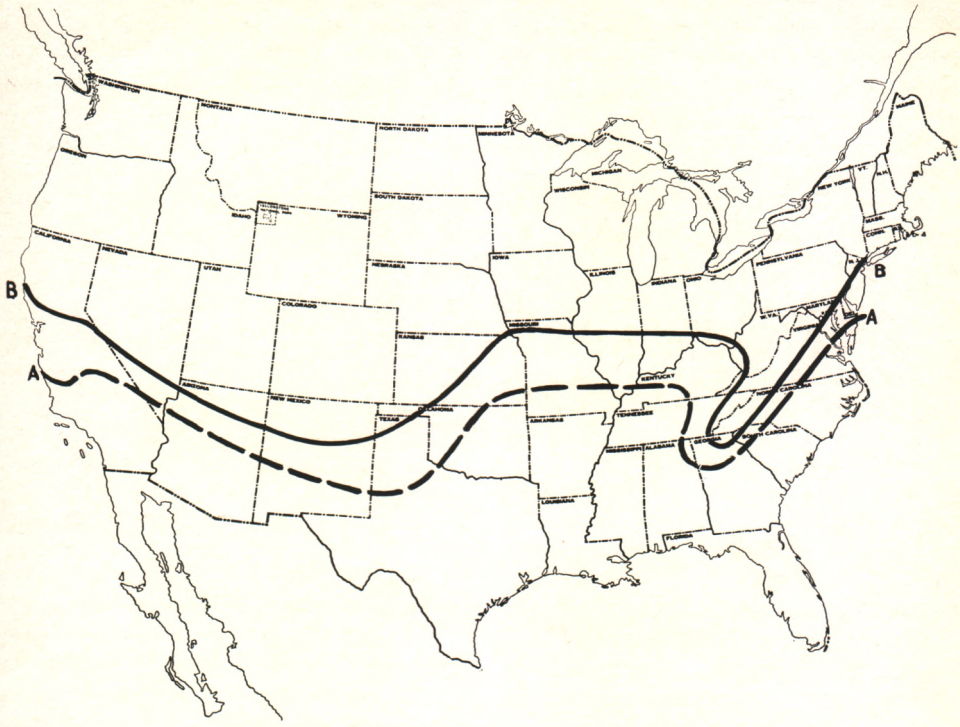
JAMES L. HOLMES, Midwestern Agronomist, USGA Green Section

Editor's Note—This is a condensation of an article appearing in the November, 1964 issue of the USGA Green Section Record.

Bluegrass and fescue turf is deep rooted and relatively drought resistant. It requires thorough, infrequent irrigations. Because it is composed of "high-stooling" plants, bluegrass and fescue turf cannot survive extremely close mowing.

The prevalence of automatic watering systems and a general trend toward light frequent irrigations coupled with growing demands for close-cut turf has mitigated against bluegrass and fescue as fairway grasses. The close mowing weakens and thins out these grasses and the frequent irrigations provide an advantage to invading species such as *Poa annua* and bent.

Bluegrass-fescue turf is more cheaply maintained than the species which will tolerate close mowing and frequent watering and such turf will withstand more adversity. However, when the golfers at a club want close-cut, heavily watered turf, they have little choice except to support the cost of a bentgrass-*Poa annua* fairway.



REGIONS OF ADAPTATION OF FAIRWAY GRASSES

South of line A-A, bermudagrass is the most important fairway grass. North of line B-B bluegrass, red fescue, and the bentgrasses are well-adapted. The area between these two lines is a transition zone where local factors such as topography, exposure, soil type, and personal preference dictate the choice. In this area Zoysia generally does well and the more winter-hardy bermudas are seldom killed.

BENTGRASS FOR FAIRWAYS

HOLMAN M. GRIFFIN, Northeastern Agronomist, USGA Green Section

Without doubt, bentgrass provides some of the best fairways in the northern regions where cool season grasses are grown. With player demands being what they are for close-clipped, dense, resilient, weed-free turf on fairways, there is no other grass so well adapted to furnish these conditions in northern climes.

Bentgrass is now being grown on greens in almost all states except the hot, humid Gulf Coast region but its adaptation for fairway use is in the areas north of a line roughly coinciding with the 39th parallel. Actually, the area lying generally between the 38th and the 40th parallels is a transition zone where bentgrass and bermuda compete for favor with neither one being entirely satisfactory.

Bentgrass for fairways does require a more intensive and costly program in most cases to achieve the desired result. A good watering system is almost a necessity, although there are exceptions to this in some areas. Insect and disease control are also essential as is good fertility and attention to soil pH. With the use of creeping bents for fairways we will also find the necessity for thatch control.

I am sure that many of our good bent fairways today are the progeny of the old South German or volunteer

bent mixtures where the best adapted strains have survived and dominated. These are excellent fairways but they have taken years to develop.

The most commonly used bents on fairways today are the colonials, Astoria and Highland which are quite often mixed with a small percentage of creeping bent such as Seaside. In the last three or four years we have heard more about Penncross but its use on fairways is still limited. However, with our improved techniques and machines for thatch control, it is well within the realm of possibility that the more aggressive creeping strains of bentgrass will soon be favored for fairway turf.

BERMUDAGRASS VARIETIES USED ON FAIRWAYS

JAMES B. MONCRIEF, Southeastern Agronomist, USGA Green Section

"Bermudagrass, *Cynodon dactylon* (L) Pers., is a warm season perennial, growing best with temperatures above 70° F. During periods of prolonged high temperatures with a shortage of moisture, growth will slow down. The lack of cold hardiness limits the northern distribution. Bermuda is known by many colloquialisms, such as wiregrass, devilgrass, creeping fingergrass, dogtoothgrass, quickgrass, Indian couch, and numerous others. The type species *Cynodon dactylon* derives from Kuon (Kun), dog, and odous, tooth, alluding to the sharp scales of the rhizome, hence one name—dogtoothgrass."*

Bermudagrass is the major fairway grass in the southern half of the United States. It is believed to have been introduced from Africa or India, and is reported to have been brought to Savannah, Ga., in about 1751. Since 1751, it has been a pest in many crops but its suitability for fairway use has been outstanding.

Bermuda can be increased by seed, rhizomes, or by stolons. The new selections of recent years are propagated by vegetative parts altogether. As yet, these new selections do not produce seed which when planted will be exactly like its parent plants. The seed harvested from U-3 does not produce plants the same as its parent.

There are about nine main selections being used on fairways. Some are being used which were not originally chosen for fairway use.

The bermuda used originally and still a popular grass is called Common bermudagrass. Common bermudagrass is planted by using seed. Improvements of the Common type have been made in the past 10-15 years. Some of our better strains of today were selected in old established Common bermudagrass fairways.

U-3 was selected in 1936. It was observed at Arlington, Va., and Beltsville, Md., and released in 1957 for fairway use. Since then, it has been extensively used from Kansas to Baltimore and farther south. It has not been used extensively in the extreme South. It has to be planted by the use of vegetative parts in order to be like the parent plant.

Ormond is a strain of bermuda originally from Ormond Beach, Fla., and has a blue-green appearance. It is vigorous, susceptible to dollar spot, but somewhat tolerant to leaf spot. It is well adapted to Florida conditions and is being used as a fairway grass throughout that state. Its lack of cold tolerance has restricted its use farther north.

Tiflawn was originally selected as Tiflaw 57 and still is known by this number but was released in 1952 as Tiflawn. It is a darker green color than Common bermuda. It makes a

**Manual of the Grasses of the United States,* A. S. Hitchcock

dense, weed-free turf and is more disease and frost tolerant than Common. It is an F_1 hybrid from pasture breeding research at the Georgia Coastal Plain Experiment Station.

Texturf 10 was originally from a country club fairway in Corsicana, Texas, and was released as T-47. It has a dark green color with an early spring recovery. It has few seed heads and is resistant to leaf spot.

Tifway is one of the latest grasses released (1960, Georgia Coastal Plain Experiment Station) for specific use on fairways and has shown that it is well-suited for this purpose. It is a chance hybrid between *Cynodon transvaalensis* and *C. dactylon* which appeared in a lot of seed of *C. transvaalensis* supplied by Dr. D. Meredith of South Africa, in 1954. The chromosome number (2n-27) and other characteristics of Tifway indicate that its male parent must have been *C. dactylon* (2n-36).

Tifway is dark green in color and at the present time shows to be disease resistant. It has stiff leaves which makes it superior, for fairway use, over some of the softer leaf bermudas. It is not very cold tolerant but does well where Common is adapted.
adapted.

There are several bermudas not released for fairway use, but which are being used with success.

Tifgreen was selected at Tifton 328 at Georgia Coastal Plain Experiment Station and was released in 1956 as a bermuda for green use. It is the best of an F_1 hybrid (2n-27) between *C. dactylon* (2n-36) and *C. transvaalensis* (2n-18). It has been planted on many fairways and makes a fine turf if properly managed.

Everglades is thought to be a hybrid between *C. dactylon* and *C. transvaalensis*. It is a natural occurring fine leaf grass selected at Bayshore Golf Club, Miami Beach, Fla. It has been used on greens but also is used on fairways and with proper management it creates a fine fairway.

Bayshore is also known as Gene Tift and was selected at Bayshore Golf Club, Miami Beach, Fla., for green use. It is light green in color and is a fine textured grass. It has been used as a fairway grass but now is being replaced with superior selections. Some courses still use it in extreme south Florida.

COMING EVENTS

March 9-11
Turfgrass Conference
Iowa State University
Ames, Iowa

March 11-12
Turfgrass Conference
Michigan State University
East Lansing, Michigan

March 11-12
Massachusetts Turf Conference
University of Massachusetts
Amherst, Massachusetts

March 17-18
Maine Turfgrass Conference
University of Maine
Orono, Maine

March 22
USGA Golf Course Management Conference
Pittsburgh Hilton
Pittsburgh, Pennsylvania

March 23-24
Turf Conference
University of Wisconsin
Madison, Wisconsin

March 24
USGA Golf Course Management Conference
The Chase-Park Plaza
St. Louis, Missouri

March 24-26
Royal Canadian Golf Assoc. Turfgrass Conf.
Toronto, Canada

March 26
USGA Golf Course Management Conference
Sheraton-Palace Hotel
San Francisco, California

March 27
Massachusetts G. A. Annual Meeting
Harvard Club
Boston, Massachusetts

FAIRWAY MAINTENANCE

WILLIAM H. BENGEYFIELD, ALEXANDER M. RADKO, DR. MARVIN H. FERGUSON,
USGA Green Section Regional Directors

Fairway maintenance is a term that encompasses a wide variety of operations. It is necessary that each operation be treated briefly in this discussion.

Mowing height and frequency deserves mention. While mowing is a routine operation, it continues to provoke discussion. The golfer prefers closely mowed turf and this necessarily places some restrictions on the species of grass to be used.

Bermudagrass and Zoysia in the South and bentgrass in the cooler regions will tolerate close mowing. However, bluegrass and red fescue are grasses which do not do well when mowed less than about 1¼ inches. It is generally agreed that close mowing must be coupled with frequent mowing. The relative percentage of the total leaf area removed at each mowing appears to have a bearing on the persistence of turfgrasses. A rule of thumb is to remove no more than one third of the leaf surface at any one mowing.

The taller growing grasses such as bluegrass and fescue require less frequent mowing and less frequent irrigation than does bentgrass. The question of how much a club is willing to pay for close-cut fairways frequently arises. It has been estimated that the practice of maintaining bentgrass as a close cut turf in contrast to bluegrass and fescue at a greater height may cost about 50% more.

Fertilization is another regular practice that may deserve another look.

Bermudagrass is known as a very heavy user of fertiizer. Bermudagrass turf has demonstrated increases in growth at rates of nitrogen in excess of 15 pounds per 1,000 square feet per year. However, this should not be adopted as a practical approach to bermuda fertilization. Throughout the South, where growing seasons are long, well-established bermudagrass will make an excellent turf when supplied with 6 to 8 pounds of nitrogen per 1,000 square feet per year. In more northerly areas, where the growing season is shorter, the rate may be somewhat reduced. It appears that most of the turfgrasses require nitrogen, phosphorus, and potash in about 3-1-2 ratio.

Bluegrass and bent require relatively less fertilizer. Two to four pounds of nitrogen per 1,000 square feet per year appears to be an adequate amount for bluegrass turf. Most of the nitrogen should be applied in early fall.

Bentgrass appears to require a similar quantity but its use should be spread out over the growing season in as many light applications as may seem practical.

Weed control has received a great deal of attention in recent years. Great advances in effectiveness and selectivity have opened up new possibilities for fairway weed control. The phenoxy compounds still receive much attention and have been considered to be relatively safe. Some recent investigations by Callahan at Rutgers have indicated that these compounds produce some abnormalities in root growth. These abnormalities may result in the loss of turf during periods of stress. Young seedlings appear to be extraordinarily susceptible to injury.

Sodium arsenite has been one of the widely used, versatile, and effective

weed control materials for many years. Recently legislation has been passed in California which seriously restricts the use of this material. This is disturbing and perplexing because the safety record in the use of sodium arsenite is remarkable. The popular but misguided attack on pesticides should not be permitted to deny golf course superintendents the use of their tried, dependable, and safe herbicidal materials.

The use of pre-emergence materials is increasing and it appears likely that they will be economically feasible for fairway use before many years. There is still much to learn, however, about the fate of these compounds in soil. Some of them appear to carry over from one year to the next and continued safe use may be contingent upon adjusting the rate of application to supplement the material already present.

Better grasses and better management practices have combined to create another problem on many fairways. The cause is too much grass and the problem is thatch. Fortunately, equipment manufacturers have been concerned for a number of years with thatch on putting greens and have devised machines to remove excess grass. There are numerous machines available, each with its own advantages and shortcomings. Some dividends may accompany efforts toward thatch control. Several machines do some aeration and some fairway leveling while removing thatch.

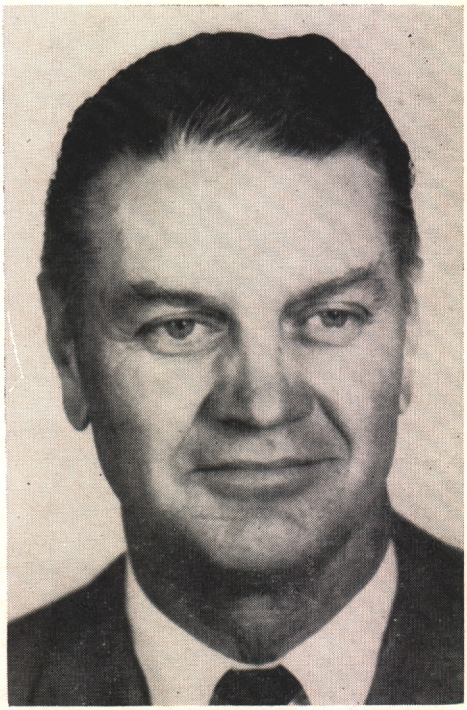
Proper irrigation and adequate drainage remain two of the most elusive factors in fairway management. Irrigation is treated more fully in another article in this issue.

Rarely does one find two drainage problems that respond to exactly the same treatment. Most often a combination of engineering knowledge and common sense will suggest a workable solution. One relatively new innovation involves the use of "reject" plastic pipe for tile drains.

Fairway maintenance has never been on so high a plain as it is today. Truly, many fairways rival the putting greens of 25 years ago. The present status of fairway maintenance speaks well for the cooperative efforts of the golf course superintendents, the manufacturers of equipment and supplies, and the investigators who have contributed better grasses and better practices.

DR. GLENN W. BURTON

Winner of the fifth annual USGA Green Section Award for "distinguished service to golf through work with turfgrass" was Dr. Glenn W. Burton, Principal Geneticist at the Georgia Coastal Plain Experiment Station, Tifton, Ga., and one of the nation's outstanding grass breeders. His selection was announced at the Green Section's annual Conference on Golf Course Management in New York City late in January.



USGA GREEN SECTION RECORD
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TURF TWISTERS

IRRIGATION

Question: Do you know of any golf courses where the greens have been watered by sub-irrigation similar to the method used for some crops? (TEXAS)

Answer: We do not know of any courses that are using the sub-irrigation method of watering their greens. Much work needs to be done on this, however, before any recommendation can be made.

DRY SPOTS

Question: We have been troubled with dry spots in putting greens. What can we do about it? (KANSAS)

Answer: Localized dry spots appear during hot weather for no apparent reason. Fork the spots with a tubular tined fork and make sure water gets down into the holes. When the soil is re-wetted you should have no more trouble getting it to take water. Several commercial wetting agents are available. These have given good results when used according to the manufacturer's recommendations.

SALT DAMAGE

Question: What amount of sodium chloride, in parts per million, can be in irrigation water before it will damage the soil on a putting green? (TEXAS)

Answer: Your question cannot be answered directly. Much depends upon the kind of turf and the drainage or percolation that you have.

Water that is high in soluble salts of any kind can be used if drainage is good. If drainage is poor, however, salt will accumulate and cause the grass to die after a number of years.

A course is known where irrigation water which contained as much as three thousand parts per million of soluble salts was used successfully.