

is 65 to 80 percent sand and 5 to 10 percent clay, (3) using a soil that has a moderate amount of organic matter, (4) managing a soil to prevent layers, and (5) establishing good drainage at the base of the soil. These are basic requirements for good soil oxygen relations. Note they parallel the requirements for soil water management. Without these the task of maintaining good turf in severe weather becomes far more difficult than necessary.

What constitutes good watering? Good watering has three requirements: (1) Watering when the grass has the need. This is decided largely by the appearance of the grass, plus observation of the soil. Some grass types or species require water sooner than others. When grass roots are short or fail to function, the watering frequency must be greatly increased. High temperature increases the urgency for watering. "Blue" wilt on a turf area is a serious warning of urgent water need. The importance of avoiding unnecessary water and the criticalness of applying water prior to serious wilting cannot be over-stressed.

Some prefer to water well in advance of critical dryness. This may be necessary if the watering system is inadequate,

but it should be remembered that any unnecessary use of water:

- (1) Increases disease
- (2) Ruins soil structure and brings compaction
- (3) Encourages weeds
- (4) Costs money

Watering should be timed carefully with rainfall. A predicted rainstorm or a forecast for continued drought should alter watering procedures.

(2) A second requirement for good watering is applying the moisture at a rate the soil will accept. The rate may be tediously slow, but nothing but harm and waste results from rapid application. Devise the system and techniques that give the proper rate.

(3) A third requirement of good watering is applying the amount needed to recharge the effective root zone. This may be two inches or more with deep rooted grasses or a fraction of an inch with a grass that has lost its roots.

Individual judgment is of greatest importance in watering. The critical moment requires immediate action. On behalf of the superintendents, I have the greatest admiration for the faithfulness and delicate attention they give to watering through a long hot dry summer.

## *Sprinkler Types for Golf Courses*

By WILLIAM BERESFORD

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I consider it a great honor and privilege to present to you my experience with sprinkler systems on the West Coast. During my 32 years at the Los Angeles Country Club, the past nineteen as Superintendent of Grounds, we have operated eighteen holes (South course) on a hose system. This system was installed in 1911, a 6" main coming in at around 160 lbs. pressure which has since been reduced to 90 lbs. in the past 5 years causing some turmoil during the summer season. Most of the mains were oil well casing at that time, and are still in use. These mains were installed down the middle of the fairways; all laterals were galvanized; ¾" garden valves in boxes were spaced about 150 ft. apart; a few laterals were spaced in the rough for the convenience of watering trees and rough.

Tees and greens have adequate valves

to insure proper watering. These are off to the side and around the greens and tees. Soils on this golf course are clay. They do drain fairly well yet hold moisture.

Good turf plays a very important part in the use of water. We, at The Los Angeles Country Club, are considered to have the finest fairways of Bermuda in the United States during 12 months of play. This grass is more drought resistant than any grass for this purpose.

Our irrigation season during normal winter rainfall starts April 1st until December 1st. All sprinklers used on fairways are rainbird No. 70's. It requires three men 8 hours, six nights per week to cover 18 holes which includes tees and greens. Each man has six fairways, six tees and six greens. He keeps 100 ft. of hose at each green, 50 ft. at each tee and

1,000 ft. for fairways. When he starts to irrigate, he screws on his sprinklers in the valve boxes one fairway ahead and follows up the next night with his hose until he makes his round. All sprinklers attached to hose are mounted on portable sled bases. The size nozzle we use is 1/4" x 3/16". The amount of water put on varies due to weather conditions. All instructions governing the length of time these sprinklers must run comes from my office daily. Much damage to turf has been caused by too much water. I believe in keeping the soil in a good moist condition to a depth of 12" but not saturated at all times, as grass cannot exist with wet feet. We average about 1/2" per week. This method of irrigation I can say is not the most economical today, when one considers labor at a seasonal cost of \$9,600.00; hose replacement \$750.00; and sprinklers and parts \$200.00; which add up to a total of \$10,550 for one 18-hole golf course.

No doubt a more modern system of irrigation will give us a much better set of figures however, I must admit this system has certainly given a lot of service with a very low cost of installation. It is to be replaced by a modern automatic system in the near future.

During 1928, the North course was rebuilt and at that time a new manual control battery system was installed coming in from an 8" service main which carried 210 lbs. pressure, but it has also been reduced to 157 lbs. maximum in the past 5 years.

All mains were installed down the center of the fairways; all laterals were galvanized; 1" risers were spaced at a distance of 65 ft. These batteries, on one control, carry as many as 12 to 14 screw-on sprinkler rainbirds No. 70. Tees also come under this system; greens are separate, using hose from valve boxes around the greens. No. 40 rainbird sprinklers are used on all greens, nozzle size 3/16" x 1/8". The soils on the North course are heavy clay fairways undulating, and poor sub drainage; yet this system has worked well through the years and continues to do so.

It requires three men, six nights per week to irrigate this course as each man cares for six greens, six tees and six fairways. All fairways are watered once per week; the length of time sprinklers are

allowed to run depends on weather conditions. As I have stated before, keep the soil moist to a depth of 12" but not saturated. Each man carries a total of 24 rainbirds for fairway use; each green is equipped with two hoses and two sprinklers.

Seasonal cost of operation: labor \$9,600.00; hose replacements \$450.00; sprinkler replacement and parts \$300.00, which adds up to a total of \$10,350.00 for one 18 hole championship golf course. Figures do not seem to vary on these two systems; however, there is a difference in acreage: under hose system, South course, 90 acres; under battery system North course, 140 acres.

Irrigation of greens to me is very important, especially during July, August, and September when all Superintendents are at the mercy of unusual weather conditions. I have yet to gain confidence in any system other than the old standby—the hose with which you can change the location of the sprinkler from one location to another around the green. Too often at this season of the year when sprinklers are stationary, some areas of the greens will get too much water. As we find no two greens are alike in design and drainage, a good irrigator will change the location of his portable sprinkler every time he irrigates so that he avoids overwatering. Therefore, greens must be handled on an individual basis.

An estimated cost today to install an 18 hole hose system using transite mains and plastic pipe is about \$90,000. Estimated cost of installing a manual system is about \$110,000. When galvanized pipe is used, figures are about 15% higher.

Let me impress upon you, water and sprinklers alone will not give you a good golf course. It requires fertilization, aeration and weed control to build good turf which will require less water at a considerable saving in dollars and cents annually.

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## INSECT DAMAGE

Louisiana State University reports that insects nullify the work of one million working men annually. There are 86,000 named species of insects in the United States, and of these, at least 10,000 species are harmful to man or animals.