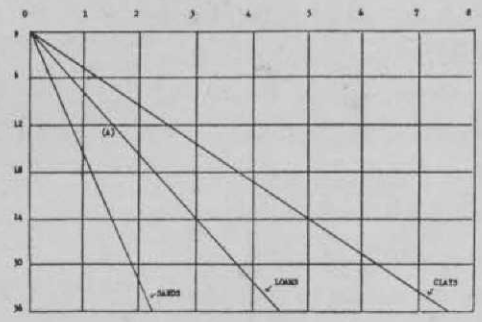
Water Management

Here is a summary of Irrigation Principles with which every Supt. should be familiar

By ROBERT M. HAGEN

(This is the second of two articles. The first appeared in June GOLFDOM.)

When you allow the soil to be dried out to a considerable depth, then you must plan on applying a deep irrigation if you are going to recharge completely the soil moisture reservoir. The following chart shows you how much water it takes to wet these soils to given depths.



(Fig. 12)

A loam soil, if you wet it to a depth of one foot after it has been dried out, requires one and a half inches; to two feet requires three inches, and so forth. If you have a clay soil, five inches would be required to wet it to a depth of two feet. One must recognize that if he is going to take advantage of deep roots and long irrigation intervals, it must be possible to apply and secure penetration of considerable depths of water where the irrigation season is short. You may be able to allow the subsoil moisture to be gradually depleted and depend upon fall rains to provide the deep irrigation. However, sometimes one sees very touchy situations created by allowing the subsoil moisture reserve to be depleted. In such cases the grass is dependent only on a limited supply. When this is exhausted, the grass may dry out suddenly and probably be lost.

The simple calculation for predicting irrigation frequency which I gave previously can be used as a useful check on your irrigation operations. It can help you to find out what is the effective depth of our irrigations or the effective depth of the roots of our grass, whichever is the shallower. The effective depth of either the grass roots or the irrigation is equal to the irrigation interval times the use rate divided by the water-holding characteristics of the soil.

Let's take an illustration. On a golf course in a hot-dry area where the water use rate is .3 inches per day and the soil is a loam holding 1½ inches of available water per foot, assume irrigation is required every 2 days to avoid wilting. Then the effective depth of rooting or irrigation is equal to the irrigation interval (2) times the use rate (.3) divided by the water-holding characteristic of the soil (1½), or (2)(3)/1.5=2/5 foot. In other words, if irrigation is needed every two days under these conditions, it means either that the roots of our grass are restricted to less than a 6-inch depth or the water being applied is penetrating to a depth of only about six inches. When you encounter this situation, it is quite likely that the irrigation water is not penetrating below this depth. A soil tube or some other sampling device will help check on this. You had better take the time to find out what is going on down there.

Let's take another illustration of a golf course where the fairways were very dry yet they were irrigated every second night using one-hour sets on the sprinklers. The water use rate in the area is about .25 inches per day. Why are these fairways so dry? Check on what is happening by a simple calculation. Many sprinkler systems will put on about one-third of an inch of water per hour. Assuming this application rate, these fairways were receiving

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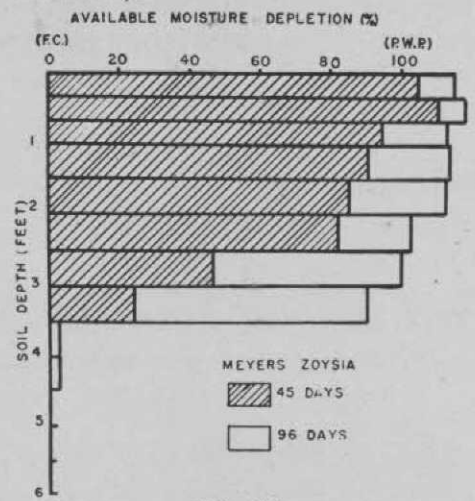
.33/2 or about .17 inches of water per day — about one-half the irrigation requirement. Thus it is no wonder the fairways were dry despite irrigation every second night. This trouble did not show up until after midsummer. During the first part of the summer, the grass got by without wilting by drawing some moisture from the subsoil to make up for the deficient irrigations. However, as the summer wore on, the grass used up the deep soil moisture reserve and became dependent upon the one-third inch handout it got every two days. If the weather turned hotter and drier, there was real danger of losing the grass since there was no reserve left to draw on. It had been depleted by borrowing on it all summer.

If you are in a situation — and unfortunately we are finding more and more of these cases — where you have to get by with less water because the water is rationed or there just isn't any water available for irrigating turf, whether it be on the golf course or on the home lawn, one way of stretching your water supply is to let your grass dry as much as possible before irrigating. This can be done safely, particularly with the grasses like the bermudas and the zoysias or even with bluegrass, provided the soil conditions and irrigation practices have been such as to permit these grasses to have deep roots. These give them a reserve supply of moisture. As a result, the grasses dry out slowly over a longer period of time. It does not run completely out of water suddenly and die.

The next figure shows the decreased use of water by Meyer's zoysia at Davis as it became dry.



(Fig. 13)

The water extracted during the first forty-five days is indicated by the cross-hatched bars. The zoysia then looked somewhat dry although it was still green. No water was applied. During the next fifty days, the grass extracted water indicated by the longer bars. The grass now appeared brown although it was still green next to the soil surface. Comparison of the area of cross-hatched bars to that of the longer bars shows that during the last 50 days as the grass was becoming progressively drier it used far less water than it did during the first 45 when it was green and growing. By postponing irrigation for the additional 50 days, less than half the water was required to maintain the zoysia although, of course, it did look dry near the end of the test period. When irrigated, it came back to a green color rapidly and looked fine. The same thing can be done with bermuda on deep soils. (A color slide was shown of a thick U-3 bermuda root projecting out of a soil plug taken at a depth of five feet.)

Formula Suggested

Despite the deep rooting potential of a grass like bermuda you sometimes see it soaked every few days. (A color slide was shown of a football stadium in summer where frequent irrigation had made the soil soggy and the bermuda was doing poorly). In most cases, less frequent irrigation would reduce costs, save water and often produce a better bermuda turf.

You will find the following formula useful in checking on the amount of water you are applying. I suggest you write it down and try it out when you get back home.

$$\text{Precipitation} = \frac{36.7 \text{ gallons water applied per day}}{1{,}000{,}000 \times \text{acres irrigated}}$$

(Fig. 14)

This allows you to convert the figure you find on some of your water bills (gallons) into average precipitation in inches per day.

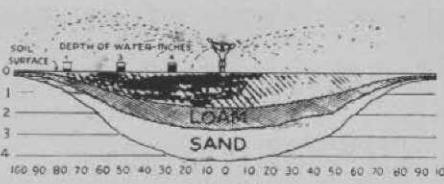
If you will carry out this calculation for your course, you may well come up with some surprising and informative results. Here is an illustration. A superintendent told me that according to his records he was applying an average of 900,000 gallons of water per day to an 18-hole golf course with an irrigated area of about 60 acres. Well, is this good irrigation? Is this anywhere near what he needs to buy and apply? Plugging these figures into the above formula shows he is applying an

average of .55 inches of water per day. For this time of the year in his area, the water use rate was only .2 inch per day. Since there are some unavoidable losses during any irrigation, he would, of course, have to apply more than the .2 inch per day. Assuming an irrigation efficiency of 75 per cent, and this is conservative, he should be applying about .25 inch per day. Actually in using 900,000 gallons per day he is applying more than twice as much as required. Yet he had some dry areas because he could not get uniform distribution of the water applied. To keep these dry spots green he was forced to apply much too much water over most of the course. Better irrigation equipment would have helped him save money and water.

Even in water-short desert areas you find golf courses using a great excess of water. (A color slide was shown of such a course where water was standing in numerous puddles and the grass just ahead of the irrigator was soggy from the previous irrigation). Excessive use of water in arid areas may in time produce a very serious problem — salinity. There are many examples of irrigation causing high ground water tables and in time a salty soil. When the ground water level is near the soil surface, water carrying salts rises to the surface. The water evaporates — leaving behind salt. (A color slide was shown of a field which looked good one year and was lost to salt the next year). I have seen on western golf courses some examples of rising water tables, accumulating salts and dying grass. This was occurring in one case alongside an unlined lagoon developed to enhance the beauty of the course. Unless steps are taken soon to prevent a further rise in water table, all will be lost to salt! In other courses consistent overirrigation is raising the water tables and with the water comes salt. These golf courses have tremendous investments which can easily be lost by nonsensical water management practices.

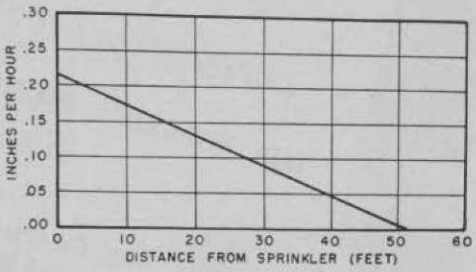
Up to this point we have been considering the "when" and "how much" questions. Of at least equal importance is the problem of "how to apply" the water. Time will not permit us to go into great detail, but I must call a few points to your attention.

Sprinkler manufacturers are doing their best to provide you with sprinkler patterns which will meet your needs. A typical sprinkler operated in one spot may give a distribution pattern as follows.



(Fig. 15)

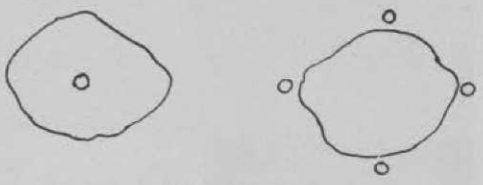
With this sprinkler, most of the water falls near the sprinkler with less and less the greater the distance from the nozzles. Sprinklers can be obtained which apply a more nearly equal depth of water over the wetted area. These may be useful for certain situations. However, many sprinklers have a so-called "conical" pattern as shown in the following figure.



(Fig. 16)

By properly overlapping the patterns of adjacent sprinklers, a nearly uniform precipitation over the wettest area can be obtained.

Time permits only a few short illustrations of serious water management problems built-in when sprinkler systems were installed. One of these is the green with just one sprinkler in the center. (Fig. 17). The sprinklers commonly plugged into this center spot will give the most water near the center and less and less toward the outside edge. The superintendent with this setup has a difficult problem. If he applies enough water to take care of the

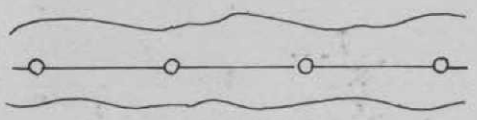


(Figs. 17 and 18)

outside edge of the green, he is putting too much water on the center of the green. One way to solve this problem is to place three or four sprinklers around the edge of the green as sketched (Fig. 18) so that by proper overlap a more uniform applica-

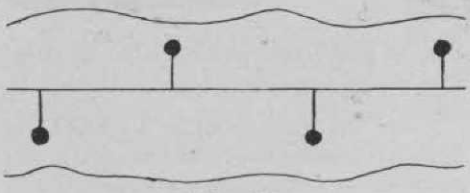
tion can be obtained over the entire green. This arrangement also has advantages in windy situations.

Fairways present similar problems. There are many fairways which have a single line of sprinklers down the center. As with the greens, if enough water is applied to keep the edges of the fairway from drying up, the center strip is badly overwatered and often soggy. With this sort of a system, you have built-in trouble and there isn't much you can do to avoid wet centers and dry edges. This problem is generally not so serious in the humid parts of the country because the rain helps to overcome the lack of uniform water application during irrigations. But even in the humid area, this single line system always gives too much water along the middle of the fairway. In arid areas where one must depend almost entirely on irrigation for moisture, this system should not be used.



(Fig. 19)

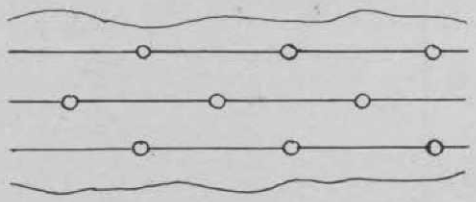
There are several types of layouts which will improve the uniformity of application on fairways. One is to run the center line down the fairway and then tee off short laterals to form a pattern like this.



(Fig. 20)

Instead of having all the sprinklers in a line down the center, this gives an offset arrangement which helps to reach the edges and reduces water in the middle.

Another possibility is to run three lines and space the sprinklers in a staggered pattern along each line as sketched below.



(Fig. 21)

Such a system, of course, costs more money. This three-line system with proper overlap gives good distribution across most of the fairway. It is an excellent system to use in an area where shifting winds are a problem. If the wind is blowing from the top in this sketch, you can operate only the top two lines; if the wind is from the bottom, operate only the two bottom lines. This gives you the flexibility you should have in any good sprinkler installation.

A brief comment about traveler sprinklers may be helpful. This is a very useful type of sprinkler, but the performance characteristics of travelers should be recognized in planning irrigation operations with them. With average nozzling and under typical operation speeds, they apply between .18 and .25 inch of water in a single pass. If the soil is dry, this shallow depth of water will wet a sandy soil only three inches deep, a loam about one and a half inches deep and a clay soil less than one inch. Unless more than one pass is used, the grass is given very little water to grow on, and it is no wonder that is is dry the next day or two thus requiring very frequent irrigations.

By sensible water management, I wish to suggest that we study our own situation and intelligently plan and carry out irrigation practices which will produce good turf at a minimum cost for water and labor. One can easily waste money, waste water and cause many turf problems either by applying **too much water** or by applying **too little water too often.**

Let's be sensible in our water management. Avoid drying up the grass if we have water and equipment to prevent it. On the other hand, don't drown it out. Irrigation is carried out for the purpose of supply water to the grass.

Canadian Amateur

The 52nd Canadian Amateur Championship will be played at Edmundton (N. B.) GC Aug. 15-18 with qualifying rounds scheduled for the 13th and 14th. The field will be reduced to 64 qualifiers for the championship which will be at match play.

Amputee Tournament

The eighth annual Amputee Amateur tournament will be played Aug. 24-25 at Lake Shore Yacht and CC, Syracuse, N. Y. Entrants will play 36 holes in six divisions which are based on skill and age. Inquiries about the tournament should be addressed to Dale S. Bourisseau, secy., National Amputee Golf Assn., Solon Center Bldg., Solon, O.