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## Water Systems and Watering

This issue of THE BULLETIN is devoted chiefly to a consideration of the ever-present problem of watering. Any discussion of water systems for golf courses will naturally be of greater interest to clubs contemplating the construction of new courses or to those remodelling the old; nevertheless, even on the oldest courses green committees are constantly faced with the question of watering and problems relating to the water system. It is obvious that no individual or group can lay down a general rule defining exactly the best way to supply water to all greens and fairways in the country. The source of supply, the demand, and the many other local conditions that must be considered make it impossible to recommend any system of watering even in a general way. The purpose of this discussion is to present different viewpoints which may be helpful to those who must decide on some system for a course.

When one visits numerous golf courses and discusses with greenkeepers and green committees the many problems of course maintenance he can not fail to be impressed with the frequency of poorly planned and wholly inadequate water systems. The false economy practiced in the installation of this indispensable feature of a course is perhaps one of the most serious evils of the construction period. In order to save enough money to build a few worthless mounds and bunkers, building committees with limited resources are frequently tempted into the mistake of reducing the allotment for the installation of the water system. Of what value are a few extra mounds and bunkers if, due to inadequate watering, players are deprived of good turf on the parts of a course where good turf is essential? A saving in the installation cost due to the use of smaller mains, for instance, is always insignificant when compared with the added expense of maintenance and the possible added cost of replacement and the interruption of play when ultimately larger mains are substituted. When visiting courses we never hear the complaint "our mains are too large"; on the other hand, the complaint "our mains are much too small" is so frequent that it becomes almost monotonous. In addition to the complaint that mains are too small, one hears a constant repetition of the complaints that pumps are inadequate, supplies are limited, laterals or outlets are too small, pressure is too low, and the like. A few of these common mistakes are briefly referred to by writers in this issue of THE BULLETIN. The mistakes of others are valuable if one has sufficient breadth of vision to utilize them.

The question as to what is the best amount of water to apply to a given area of putting green or fairway is one which is frequently asked but one which can probably never be answered definitely. The amount required on each course will depend entirely on the local conditions. This point is well brought out by the different writers; but

it is a phase of the watering problem which can not be over-emphasized. It seems self-evident that different soils, climates, weather conditions, and other varying factors will influence the water requirements of different courses. Nevertheless it is quite apparent that on many courses this variation is little understood. Many of the difficulties in maintaining good turf are due to insufficient watering. It might readily be shown that as many, or perhaps more, difficulties can be traced to over-watering or poor judgment in the application of water as can be attributed to drought. Sandy or well drained soil seldom receives too much water, but some of the courses where clay soil is general may easily be ruined by careless watering. The daily water requirement must frequently vary decidedly on the different greens about the course. It may seem unnecessary to warn that a green located in a low pocket where there is little air circulation and correspondingly less evaporation will require much less artificial watering than one located on a hill where it is exposed to constant air currents and excessive evaporation. The frequency of a standard daily watering for all greens even on courses where such extremes exist shows clearly that such warnings are not uncalled for. A green located in an air pocket, with perhaps a stream beside it maintaining a water table not far below the surface, dries relatively slowly even though it may be underlaid with adequate tile drainage. Yet how often one sees such a green being mercilessly watered simply because it was "its turn for watering." Such a green is usually referred to as "the worst green on the course to keep in condition." After hearing a recitation of the frequent attacks of brown-patch, the baked surface, green scum, and other evils that haunt that particular green, one questions how much of this difficulty may be due chiefly to an over-zealous adherence to a uniform schedule of sprinkling. When such a system of uniform watering is criticised, one is often reminded that nature waters all alike and we should make our artificial watering comply as nearly as possible with that provided in the natural rainfall. The reply to such a reminder is simple indeed. Nature does water all alike; but nature produces one group of plants on the slowly drying, air-pocketed lowlands, and quite another on the hilltops. Golf clubs choose to grow the same grass on all greens, regardless of location. Those who choose to "beat nature" on that score need feel no hesitancy in tampering with some of the other wise provisions of the natural order.

In recent years there has been a tendency to rate sprinkling systems primarily on considerations of speed of delivery. There can be no question as to the savings in labor costs, as well as the reduction in play interference, attendant on the use of sprinklers with extremely rapid delivery. On the other hand there is a very serious question as to whether this seeking after speed has been altogether in the direction of progress. Many soils will absorb water as rapidly as it can be applied with any of the modern sprinklers. Other soils, however, can absorb water but slowly. Rapid application on these latter types of soil results in much waste of water, for most of it will invariably run into low pockets or off the green entirely, leaving little on the higher areas, which are most in need of moisture. No rule can be laid down as to the most efficient rate for applying water, since each course will vary, and individual greens may vary on the same course. There is, however, a simple way to determine the proper rate for watering. After watching a sprinkler operate for an average period

on a green, it can readily be observed whether water is collecting in pockets, and a few cuts into the turf in the high and low areas will soon indicate whether the water is penetrating properly. If water collects in pockets and there is little penetration into the soil on the higher parts of the green, it is evident that the particular sprinkler in use is delivering water too rapidly. Simple as this test may be, it is surprising how seldom it is fully utilized. Sprinklers are too frequently bought, and perhaps operated for years, merely because "Mr. Smith uses them on his course, and Smith's greens are always in good condition." The sprinkler in question may be best for Smith's conditions, with his more porous soil; but after all, an old-fashioned jackknife, properly used, can furnish information on watering that is of far greater value than the opinion of all the neighbors no matter how well kept those neighbors' greens may be. There is available on the market a great variety of good sprinkling devices, which makes it possible for a club to select something which will deliver the water at the most efficient rate for its local needs—provided, of course, it is equipped with a water system which will deliver water properly at the sprinkler. As has been pointed out elsewhere in this issue, even with the best mechanical devices for sprinkling it is usually found that some hand watering is necessary to keep turf in good condition on the higher areas from which water runs easily.

When soil is thoroughly dried out it requires heavy watering gradually applied to bring it back to the proper moisture content. The behavior of droplets of water on a dry, dusty surface is well known to everyone. It is often difficult to moisten a dry powder to form a thick paste, but when the powder is once thoroughly moistened and worked into a paste there is little difficulty in making it absorb more water. The same principle applies in a general way to soil thoroughly dried out as compared with soil even slightly moist. At times soil may become excessively dry, due to some disturbance below ground. Grubs working just below the surface, a layer of sand, a large stone, copper poisoning, and other similar conditions may cause large patches to dry out very rapidly, and these areas may become so dry and powdery that the soil is seemingly impervious to water and requires unusual care to wet it and to keep it properly moistened.

We are frequently asked, "When is the best time to water turf?" Grass apparently is like humans in at least this one respect; it can be safely fed and watered at any time that is most convenient, provided the frequency and the quantity are wisely proportioned. In the different discussions here given it is apparent that the writers have no fear of injuring turf by watering when the sun is shining. Some time ago there seemed to be a rather general belief that watering foliage during sunny periods would result in any number of evils, such as brown-patch, sun-scald, and yellowing. It was pointed out that when nature watered plants the direct sunlight was cut off, and in order to imitate this provision all watering should be done in the absence of direct sunlight. This theory now apparently has little influence on golf course watering programs. There are, however, certain considerations, such as interference with play, periods of difference in water pressure, disease, or other factors, which may have important bearings on the most suitable time for watering on many courses. Such questions must be determined by those in charge of the individual clubs, and, as indicated in the accompanying articles, there may be several "best times for watering."