

Effect of Watering Putting Greens on Occurrence of Brownpatch

By Arnold S. Dahl

The watering of putting greens is a necessity in most sections of the United States in order to maintain turf of the quality demanded by present-day golfers. There is a wide difference of opinion as to the amount of water necessary to keep turf in best growing condition. Bent grasses are supposed to require an abundant supply of water, but there is a difference of opinion as to what constitutes an abundant supply. There is, therefore, much variance in the amount of water that is applied and in the time of its application. It is impossible to make a general recommendation as to the amount of water that is necessary to keep turf healthy and vigorous because of the special factors that affect the water after it has been applied. If a soil is heavy and poorly drained, only a small supply may be an abundance, while light sandy soils require a much larger supply to meet the needs of the grass. It is impossible also to predict how much water will be necessary during any particular season, because of the variation in the amount of rainfall. The amount of water that should be applied during a wet season would not be sufficient during a dry season. However, it is possible to determine whether a green has too much or too little water at any time during a season.

It has been observed for several years that brownpatch is more prevalent when greens are soaked with water. Recommendations have been made that greens be watered in the morning rather than in the evening, because of the knowledge of the moisture requirements and other growth characteristics of the fungus causing the disease. There have been no adequate experiments which have tested what would be the most favorable amount of water or the best time of application. For the purpose of conducting such an experiment, arrangements were made in 1932 with a golf club near Washington, D. C., to allow the Green Section to use two greens on its course and to make provision for fertilizing, treating with fungicide, and watering. The club continued to maintain the greens in other respects and to keep them in play throughout the experiments. Each of the two greens was divided into quarters. The first quarter was heavily watered in the morning, the second lightly watered in the morning, the third heavily watered in the evening, and the fourth lightly watered in the evening. These quarters were given similar treatment otherwise. The experiment began late in June and continued until mid-August. The rainfall during the three months, June, July, and August, was more than 6 inches below normal.

The quarters were watered between 6 and 8 o'clock in the morning and 6 and 8 o'clock in the evening. The heavily watered areas were watered for 50 minutes and the lightly watered areas for 10 minutes. The hose line delivered approximately 16 gallons of water a minute.

The lightly watered quarters were given enough water to keep the grass in a healthy condition. That the grass was growing sufficiently to keep a good putting surface was evidenced by the amount of clippings that were removed. At no time during the experiment was there any general wilting of the grass due to lack of water. Although the grass was not growing as vigorously as may have been desirable,

the turf was maintained in a good putting condition. The purpose of the experiment was to apply as little water as possible and still hold a good covering of grass so as to observe the occurrence of brownpatch under that condition. These areas were not soft enough to hold any but well-played pitch shots which, as discussed in the February, 1932, number of the Bulletin, is the desirable condition of the turf from a playing standpoint.

It is recognized that in a wet season the amount of water that was applied on these lightly watered areas would have been excessive. In a drier season, on the other hand, it might not have been enough to keep the grass alive. Similarly on greens with different soil conditions, the amount of water applied to areas thus lightly watered might be too light to maintain turf or too heavy for best growth of grass, depending on whether the soil was light and well-drained or heavy and poorly drained. It is impossible to prescribe the exact amount of water to be applied to turf that will provide the best growth of grass. Thus the amount of water that was applied to these plots is not to be taken as recommended rates of watering. Each green should be studied individually, in relation to the type of soil, drainage, and water-holding capacity in order to determine the amount of water that it should receive, and the amount that it receives from rainfall should be considered before the amount to be applied can be determined.

The amount of water that was applied to the heavily watered quarters was five times that applied on the lightly watered sections. It was desired to keep the turf and soil soaked with water in order to observe the occurrence of brownpatch under that condition. The amount of water that was applied in these experiments kept the soil soggy at all times and induced a very vigorous and rank growth of the grass. There was, however, no evidence of direct injury from excess water, although had the experiment continued longer such damage might have occurred. The amount of water that was applied to the heavily watered plots also might have been more or less than the amount that would have been necessary to water heavily the same greens in some other season, or indeed greens with different soil types or with more or less effective drainage. The amount that was applied in these experiments kept the soil soggy and was too much to keep the grass in the best growing condition.

At intervals during the course of the experiment, treatments of corrosive sublimate were made at the rate of 1 ounce to 1,000 square feet. This rate was used to check the disease and to provide for only a short period of protection, since the object of the experiment was to test the effect of watering greens on the frequency of disease attacks. Thus the attacks of disease were more frequent than would have been the case had higher rates of application been made.

The plots were watered daily by hand, one-half in the morning and one-half in the evening. The approximate amount of water which each plot received is given below:

Green No. 1 Heavy watering, 522 gallons to 1,000 square feet or .84 inch a day.

Green No. 1. Light watering, 104 gallons to 1,000 square feet or .17 inch a day.

Green No. 2. Heavy watering, 463 gallons to 1,000 square feet or .74 inch a day.

Green No. 2. Light watering, 92 gallons to 1,000 square feet or .15 inch a day.

Green No. 1 had a Washington creeping bent turf and was built of a very heavy soil. It was situated high on the course but the under-drainage was poor. The green sloped slightly to the front and had some low areas on one corner. It was somewhat smaller than No. 2, and for that reason received more water on each unit of area. On this green the soil quickly became soggy on the heavily watered area because of its poor texture, and some of the water ran down the approach to the green, as was evidenced by the green turf there as contrasted with the grass of the fairway which was dry from lack of rainfall. At any time of the day free water could be pressed from a plug of turf cut from the heavily watered area. The quarters were not watered during heavy rains, which occurred only occasionally during the experiment. The lightly watered area received enough water to keep the grass growing and healthy.

PERCENTAGES OF AREAS OF TWO PUTTING GREENS COVERED WITH PATCHES OF BROWNPATCH UNDER LIGHT AND HEAVY AND MORNING AND EVENING WATERING

Date of Readings	Morning watering		Evening watering	
	Light	Heavy	Light	Heavy
<i>Green No. 1 (Washington bent on heavy, poorly drained soil)</i>				
July 7.....	10	50	10	40
July 13.....	15	50	30	40
July 18.....	0	50	0	40
July 25.....	0	70	0	60
July 29.....	5	70	40	50
August 8.....	10	30	10	40
Average	7	53	15	45
<i>Green No. 2 (mixed bent on loamy, well-drained soil)</i>				
July 7.....	10	60	30	60
July 13.....	15	60	50	60
July 18.....	10	40	20	50
July 25.....	0	30	0	60
July 29.....	5	30	20	60
August 8.....	30	60	30	80
August 11.....	20	80	30	60
Average	13	51	26	61
<i>Average of both greens.....</i>	10	52	21	53

Green No. 2 had a mixed bent turf and was built of a good loam soil and had good underdrainage. It was situated in the bottom of a ravine with a small brook running in front of it. Since it was much better drained and did not receive as much water on each unit of area because of its larger size, it did not become as soggy as did green No. 1. However, free water could be pressed out of plugs cut from the turf several hours after it had been watered. The lightly watered quarters on this green received only sufficient water to keep the turf growing, while on a few occasions the turf on limited high areas

began to exhibit symptoms of moisture deficiency, especially on the section watered in the evening, which dried out more during the day; no turf, however, was lost from lack of water.

The amount of water that was applied on a quarter directly affected the amount of disease which occurred on that area. Readings of the percentage of the area of the quarters which was diseased were made at intervals during the course of the experiment. These percentages are given in the accompanying table. On an average of all the plots there was three times as much disease when the turf was heavily watered as when the turf was lightly watered. Not only was there less disease on the lightly watered plots but the disease that did occur there was not nearly as serious. The patches on the heavily watered areas were badly diseased and did not respond to the fungicidal treatments as readily as the patches on the lightly watered areas. On green No. 1, which was turfed with Washington bent, which is fairly resistant to brownpatch, the difference was even greater, there being nearly five times as much disease on the heavily watered areas as on the lightly watered areas. Green No. 2 was turfed with mixed bent, which was more susceptible to brownpatch, and although the soil was not as soggy as that of green No. 1, there was more disease. On this green there was over twice as much disease on the heavily watered areas as on the lightly watered areas.

The results of the test showed that when the greens were heavily watered there was approximately the same amount of disease on both morning- and evening-watered quarters. On green No. 1 the morning-watered section lay slightly lower than the evening-watered section, and more disease occurred on the former. On the first of August the evening- and morning-watered treatments were reversed and the greater amount of disease still persisted on this same plot, which was then, however, being watered in the evening. On green No. 2 the plot heavily watered in the evening had 10 per cent more disease than the plot heavily watered in the morning. On the heavily watered areas on both greens, the difference between the morning and evening-watered quarters is so small as to be insignificant. The topography of the two greens is a factor that may have affected the difference in amount of disease on the heavily watered sections on each green. However it illustrates the danger of accepting the results of any experiment confined to a single putting green.

The areas which were lightly watered, however, demonstrated that the morning watering materially reduced the amount of disease. On both greens there was twice as much disease on the areas lightly watered in the morning as on those lightly watered in the evening. When climatic conditions were favorable for fungus development, the disease always occurred on both sides, but there was always more of it on the areas watered in the evening, and the patches were more seriously diseased. At the time of several of the readings the disease was equal on both portions, but at other times there was much more disease with the evening watering, and in one case there was 8 times as much disease with the evening watering as compared to the morning watering.

This experiment substantiates observations made elsewhere that the amount of water and the time of watering greatly influence the frequency and severity of brownpatch on putting greens. The

amount of water that was applied on the heavily watered turf was more than is usual on most courses, yet it is not unusual to find greens that have been overwatered in which the soil contains more water than was contained in the areas here involved. Putting greens constructed of heavy soil should be watered with especial care, since the soil does not allow the water to drain away quickly and the soil remains soggy for long periods. Water should be applied to greens only when necessary, and this is determined by examination of the soil. It is advisable to keep the soil a little on the dry side, rather than too wet.

When greens are watered moderately much less disease will occur when watered in the morning than in the evening. When water is applied in a reasonable amount in the morning, the turf soon dries, and if dew is present the drying is more rapid than if no water had been applied. When watered in the evening, however, the surface of the soil and the leaves are wetted much earlier than normally wetted by dew, and usually remain wet much longer because the larger amount of water in the soil due to the recent watering encourages an abundance of dew. Therefore turf that is watered in the evening not only is wet earlier in the evening but also remains wet much longer in the morning, thus creating conditions under which fungus development may be rapid for a long period of time.

From the results here given it is evident that the careful use of water greatly diminishes the amount of brownpatch that occurs on putting greens. It is, therefore, apparent that the cost of controlling this disease can be greatly reduced by correct watering.

Books and Pamphlets for the Greenkeeper's Library

By Kenneth Welton

The Green Section has frequently been asked to recommend books and pamphlets of value to those interested in turf culture. Several years ago we included in our exhibits and golf shows a collection of books and pamphlets containing information directly or indirectly related to golf-course maintenance. Many who saw this exhibit asked that a list of books and bulletins of interest to greenkeepers be published. In response to these requests the Green Section published a greenkeeper's library in the Bulletin for June, 1929. The following list is more complete and is a revision of the list published in 1929. Although no attempt has been made to include all the literature in this field the list has been selected to cover a wide range as a basis for a greenkeeper's library. While several books and other publications are offered under each classification it is not intended that all are necessary for the greenkeeper's library. Ordinarily only one book on each subject is needed, together with United States Department of Agriculture publications and state publications which apply particularly to those problems in which the greenkeeper is interested. A large number of the United States Department of Agriculture bulletins and state bulletins are included, which, although dealing chiefly with farm problems, contain information applicable to golf-course construction and maintenance.