

growing better with simply the natural rainfall. However, in exceedingly dry seasons we sometimes do some watering, and have always followed the plan of watering at night. This has been followed empirically. We have no particular reasons for following this plan, except that we believe we get less evaporation during the night, and therefore a larger benefit from the moisture. I do not believe that Bermuda grass would be readily damaged by watering in the day time."—*Thomas P. Hinman, Druid Hills Golf Club, Atlanta, Georgia.*

"We have found from the cultivation of Bermuda grass here that the best results are from watering after the heat of the day. After 6 o'clock is better than earlier. Our Bermuda greens are not watered lightly but soaked about once a week. This, with daily cutting and monthly top-dressing, keeps them in very fine shape."—*C. B. Buxton, Dallas Country Club, Dallas, Texas.*

"In my judgment the time to water putting greens is when the surface lacks moisture. It makes little difference whether it is done in the early morning, midday, afternoon, or night. When possible without interference with play, I prefer day watering, because the workmen can see better how to more evenly apply the water and thus attain better results. Modern undulating greens can not be watered evenly by the sprinkler alone, as the water runs off the high spots, which rarely get enough soaking, and the low spots get more than is desired. I like a watering system that has a 1½-inch pipe to every green outlet, capable of being reduced to two ¾-inch outlets, to one of which the sprinkler is attached and to the other the hand hose. With this system the workman can only take care of one green at a time; while the sprinkler is playing generally, the hand hose is applying water to the high spots only. In this way a green can be evenly and thoroughly watered in a much shorter time, and the sprinkler changed more often to prevent water standing or running on the surface, a condition which at no time should be allowed to exist, since it injures the surface and is a waste of water.

"I much prefer watering every day, to the generally accepted theory of watering two or three times a week. If after the soil is once deeply moistened, sufficient water is applied each day to take care of the surface evaporation, the moisture below will be held for a long time and the necessity for long, deep watering will be avoided. Grass does not require excessive moisture, but just sufficient to supply its needs, and it should have this daily. A moderately moist soil is far better for the healthy development of turf than wet, soggy ground. It should be remembered that the roots of the bent grasses are very shallow, not more than 2 inches deep, necessitating the presence of moisture in the ground at all times, though not in excessive amount."—*Walter S. Harban, Columbia Country Club, Washington, D. C.*

Fall and Winter Top-Dressing of Putting Greens

By R. A. OAKLEY.

If the questions that come to the Green Section at this time of the year may be taken as an indication, there is a very general feeling that putting greens, in the northeastern part of the United States, at least, need protection of some kind during the winter. The feeling is particularly prevalent in the case of newly planted or seeded greens. It is apparently thought that the turf grasses in putting green condition will succumb to the low

temperatures of winter or to the alternating freezing and thawing of spring unless something is done to protect them from these vicissitudes.

A good many observations have been made on the effects of winter weather on putting green turf and on the effect of covering greens for the winter months. The studies thus far conducted indicate quite clearly that there are relatively few cases where either the bents or fescues are appreciably damaged by winter factors except in situations where either the surface or sub-surface drainage is inadequate. Ice sheets may be formed even under conditions of good drainage, and these have been known to injure putting greens, but ice sheets thus formed produce injury so seldom that winter-killing may generally be regarded as a direct result of poor drainage.

In brief, the bent grasses and the fescues used on our putting greens are not tender grasses; on the contrary, they are winter-hardy. If it be assumed that winter injury to putting greens is due chiefly to poor drainage and not to low temperature, then a protective covering could have very little, if any, beneficial effect. In a great many cases where the effect of winter covering of greens has been noted, the results have been evident. In some cases the covering material, while of very good consistency, was applied so thickly that it smothered the grass. In other cases the material was not sufficiently comminuted or shredded, so that large lumps killed the grass upon which they lay, even though the application of the material was relatively light. In still other cases coarse material, such as straw or rush hay, was applied. This material packed down so closely on the turf that the grass was injured or killed by it. Then again, winter coverings are frequently allowed to remain on the turf until too late in the spring.

The verdict at this time is very distinctly against covering greens for winter protection; but this does not mean that top-dressing with suitable material late in the fall is not a beneficial practice. It is indeed a very beneficial practice if properly done. Naturally the question is asked, What is suitable material? There are several. Thoroughly rotted and comminuted manure is one; loam and sand are others; but the very best, all things considered, is a mixture of these three in proportions to suit the conditions of the grass and the soil of the surface of the green. Good thoroughly mixed compost composed of loam or clay loam, sand, and well-rotted manure, is the ideal material for top-dressing greens in the fall, and, as a matter of fact, at any other time of the year. The proportion of the various constituents is not a very definite matter, but ordinarily 20 per cent to 25 per cent, by volume, of organic matter is sufficient. More may be used advantageously if the grass is thin and the top soil of the green lacking in organic matter. If the soil is of a rather stiff clayey nature, equal parts of loam and sand afford the right proportions. If the soil of the green is very sandy, only enough sand should be added to the loam or manure to make the compost of such a consistency that it will work down well into the crown of the grass and will not form a sticky layer on the surface. A very satisfactory rate of applying such compost as a late fall dressing is 1 cubic yard to 3,000 to 5,000 square feet. The dressing should then be worked into the turf with a brush, flexible steel mat, or the back of a rake. Before applying the compost the green should be cut to regular putting height. If this is done there will be little likelihood of the grass making too great a growth before time for cutting in the spring.

Some experiments conducted at Arlington last year indicate that ammonium sulfate may be added to the late fall application of compost at

a rate to provide 3 pounds to each 1,000 square feet of green, and very beneficial effects result from this treatment. However, more definite experiments are needed before the practice can be recommended. Frequently sand alone is recommended as a late fall top-dressing on clay soil greens. Benefit may be obtained from such an application, but the evidence of carefully conducted tests indicates that sand with well-rotted organic matter and loam gives much better results than when applied alone as a top-dressing. Pure sand really does not mix well with the soil beneath but has a decided tendency to remain in a layer on the surface. Furthermore, most sand top-dressings do not leave as desirable a surface as do compost dressings, and unless sand is applied rather sparingly it has a tendency to retard the growth of the grass.

To those who wish suggestions relative to the treatment of greens here are some for consideration:

Remove noxious weeds at once.

If the greens are located south of the latitude of Philadelphia and these suggestions are received before October 15, top-dress with 1 cubic yard of compost to which is added 10 pounds of ammonium sulfate, the mixture to be applied to 5,000 square feet of green. Apply evenly and water in thoroughly. For all greens in the northeastern quarter of the United States, whether or not they have been top-dressed by the middle of October, an application of 1 cubic yard of compost to 3,000 to 5,000 square feet of surface is recommended as late as approximately December 1. The greens should be given no other treatment for the year, as far as top-dressing or covering is concerned, and if the drainage is what it should be they may be confidently expected to survive the winter in good condition.

QUESTIONS AND ANSWERS

All questions sent to the Green Committee will be answered in a letter to the writer as promptly as possible. The more interesting of these questions with concise answers, will appear in this column each month. If your experience leads you to disagree with any answer given in this column, it is your privilege and duty to write to the Green Committee.

While most of the answers are of general application, please bear in mind that each recommendation is intended specifically for the locality designated at the end of the question.

1. ANNUAL BLUEGRASS IN SOUTHERN PUTTING GREENS.—I am enclosing a small quantity of a foreign grass which is appearing in our greens in large volume. In some cases it covers the surface in patches, but in most cases grows in tufts at an interval of one or two inches, making the greens very bumpy and almost impossible to cut low enough to make a smooth putting surface. This grass appears in the early fall and is continuous throughout the winter, and is what is generally referred to here as winter grass. Last year there was very little of it in our greens, but this year, possibly by reason of our using some top-dressing which contained the weed seeds, it is present in all of the greens and creates a very serious situation. Of course, it is not difficult to pull it out by hand, but this would be a tedious job. It can also be removed by thorough scratching with a plank containing sharp nails. What treatment would you recommend for getting rid of it? (Texas.)

ANSWER.—The grass you send is *Poa annua*, or annual bluegrass,