

this would seem to hold true here also. When snow falls on ground that is not frozen and remains throughout the winter, the frost does not penetrate the ground to any marked extent, and under this condition apparently the fungus can become active during a thaw at any time of the winter. In sections where snow does not lie on the greens all winter and thaws are frequent, the patches of snow-mold may be seen as early as December. Under such conditions it would seem that snow is not necessary for the development of the fungus. It is, however, evident that low temperature and much moisture are necessary. During thawing weather large snow banks create ideal conditions for the development of the disease, and under these circumstances serious losses occur.

Although a great deal of work has not been done to determine the difference in susceptibility of the various grasses, none of the grasses tested have proved to be immune. Fescue appears to be highly susceptible, while creeping bent is much less so. Kentucky bluegrass is more resistant than fescue but not as resistant as some strains of creeping bent.

The Control of Snow-Mold

By John Monteith, Jr., and Arnold S. Dahl

In the April, 1927, issue of THE BULLETIN a report was given of some preliminary experimental work for the control of snow-mold on putting greens. The results of those first trials were so promising that further experiments were arranged in the fall of 1927 to determine whether the same treatment would prove effective in different sections of the country. During the last season the disease was not as prevalent as usual on several courses where experimental plots were placed, and since the untreated areas on those courses were not severely damaged the freedom from disease in the treated areas could not be regarded as altogether conclusive. However, some such tests in Detroit, Chicago, Minneapolis, and Madison, Wis., gave results which indicated that the corrosive sublimate and calomel treatments would check light attacks. These will not be discussed in detail, for they merely substantiate the results already reported in the April issue of last year.

During the past winter many northern courses were severely damaged by a late freeze, and the injury was so extensive that it was difficult to tell how much might have been due to snow-mold. On several courses, however, it was possible to distinguish the snow-mold damage, and some interesting reports of tests with fungicides were received. These results, taken collectively, serve greatly to advance our knowledge of the problem of the control of snow-mold.

On the course of the Grand'Mere Golf Club, Grand'Mere, Quebec, snow-mold is regarded as an important annual problem, necessitating extensive patching in the spring. The chairman of the green committee, Mr. E. B. Wardle, conducted some tests with different rates of application of corrosive sublimate, as suggested in THE BULLETIN. Reviewing his results of the past season, he writes: "The treatment of our greens has resulted in very considerably diminishing the damage caused by snow-mold. Only one green, No. 9, was badly affected, although we followed up the snow as closely as possible with brooms,

sweeping away the mold the same as we have done in previous years. There was plenty of snow-mold present, but we came through with but very little damage; in fact, I do not believe that we shall need to do any patching whatever as far as snow-mold is concerned." He concluded, "I am absolutely convinced that the bichloride treatment helped our greens as far as preventing snow-mold is concerned;" but he also states, "Our experience indicates that 3 ounces per 1,000 square feet is not sufficient."



Practice putting green of the Pine Lake Country Club, Detroit, Mich., showing the old scars of distribution of the disease on this green. It also shows how the damage may affect the putting surface well through the early playing season. At the time the photograph was taken no sign of snow-mold damage was apparent on the other 18 greens, which had been treated the previous fall with calomel and corrosive sublimate

From Detroit we have received the following observations made on the course of the Pine Lake Country Club by Dr. O. W. White, chairman of the green committee:

"In the fall of 1923 we planted our greens to Vermont bent stolons, and the following year no winter fungus appeared. In the spring of 1925 small bare spots dotted the greens, evidently from winter fungus, and in the spring of 1926 big bare patches of from 4 inches to 2 feet in diameter appeared. These did not heal until along toward the end of June. In the fall of 1926, as an experiment, we covered the greens with straw, and the following spring our greens looked as if they were completely ruined; but by carefully nursing them along they healed over by the middle of July. Toward the end of October, 1927, we tried the following: Dividing a green into four sections, we used on the first section 1½ ounces of calomel, on the second section 3 ounces of calomel, on the third section 1½ ounces of corrosive sublimate, and on the fourth section 3 ounces of corrosive sublimate,

per 1,000 square feet, while on all other greens we used from 3 to 3½ ounces of corrosive sublimate per 1,000 square feet. In the case of the lighter treatments we have a small number of winter fungus spots this year, but where the heavier application was made the greens are entirely free from the disease.

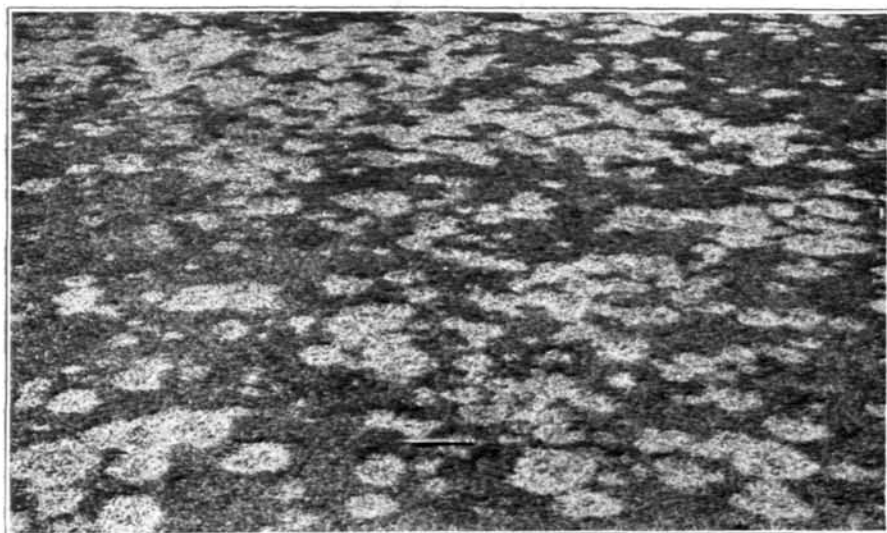
“To mention a further experiment, at the time of covering our greens with straw, in 1926, we left uncovered a practice putting green, which, by the way, was about one year old, and the following spring this green showed very little damage. Last October we purposely left this green uncovered and did not treat it in any way, with the result that it is very badly infected this spring with winter fungus. We are now convinced that by the use of corrosive sublimate in October or early November our troubles from winter fungus are at an end.”

Another report, indicating like Mr. Wardle's that heavier treatments are needed in some sections, came from Mr. J. W. Harrison, of the Pine Beach Golf Course, who wrote: “Our Pine Beach course is located in central Minnesota, near Brainerd. We have 18 Washington bent grass greens, and are considerably troubled each year with snow-mold. Last fall we treated the greens with 2 ounces of bichloride to 1,000 square feet, but were not relieved. As an experiment, we divided one green into squares, treating one square with 1½ ounces per 1,000 square feet, one with 2 ounces, one with none, and one with arsenate of lead. Between the square given 2 ounces and the one with no treatment there was a rather distinct line, though the treated square, while less seriously affected, nevertheless called for some patching. This seemed to indicate that a heavier treatment might perhaps check this trouble.”

Mr. T. McClenahan, greenkeeper of the Mayfair Golf and Country Club, Edmonton, Alberta, Canada, reported as follows: “Each green was divided into four equal parts by running a weeding line north and south through the center and another east and west. The amount of corrosive sublimate for one quarter was put into a 50-gallon barrel and sprayed on with a pump fitted with agitators which keep the solution mixed. As soon as one quarter was done we thoroughly watered it in. It was a rather slow job, but results have shown that it was time well spent. Where we applied 1 ounce per 1,000 square feet, the fungus appeared, but not nearly as badly as in previous years. Where 2 ounces were applied, faint traces of snow-mold could be seen. Where 3 ounces were applied, there was absolutely no trace of the fungus and the turf looked good and healthy. One interesting fact came to light, namely, that provided the corrosive sublimate is properly dissolved, more than 3 ounces per 1,000 square feet can be put on with perfect safety; for example, the spot in the center of the green where the lines crossed received a double dose, but when the snow left it was the healthiest spot on all the greens. Previous springs our 9th green was covered with snow-mold. This green is in a rather shady spot, and the snow melts on the front of the green but remains piled up at the back. As the snow melts at the back and the water runs down it deposits the fungus on the front of the green. In a case like this I think that 2 ounces per 1,000 square feet will take care of the back of the green, where snow is lying, but the front must have a heavier application.”

The treatments reported above were all put on the previous fall

before snow-mold developed. The question often arises as to what treatments should be given a green after the disease has appeared. On many courses where the disease does not occur every year it appears impractical to put on the fall precautionary treatment. It is thought best to wait until the fungus appears and to try to control it then if possible. There is little information available as to this type of delayed treatment. There are several objections to the use of chemicals for such purposes. The disease may develop to cause serious losses before it is detected, even when the greens are carefully watched during the winter. Anyone who has tried to treat northern greens with chemicals during the winter months will appreciate some of the difficulties of such work as well as the danger of making deep wheel or foot impressions in the turf during periods of thawing when snow-mold is active. However, applications of chemicals can be

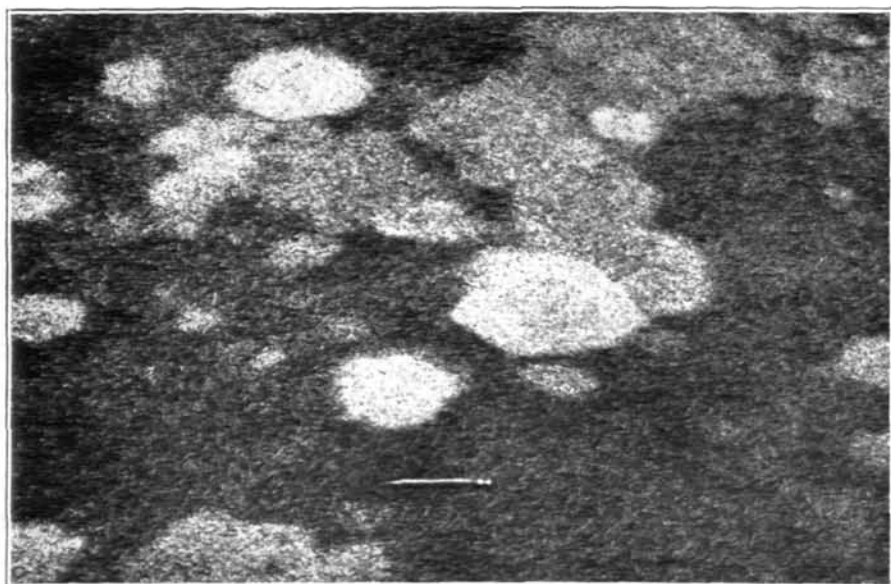


Snow-mold injury on No. 2 green of the Masonic Country Club of Western Michigan, Grand Rapids, Mich. The light areas in the photograph show the damage caused by the fungus. Note the pencil in the foreground, which serves to indicate the size of the affected patches

made with safety if proper precautions are taken, and such treatments offer a promising recourse in emergencies, especially for clubs in the southern part of the snow-mold region. Early in January Mr. A. E. Arnold, greenkeeper of the Masonic Country Club of Western Michigan, reported a severe attack of snow-mold on all his putting greens. Following our suggestion, he applied corrosive sublimate at different rates, mixing it with sufficient sand to give bulk for even distribution. This method made it possible to put on the chemical without water. The weather throughout the remainder of the winter was such that the disease did not develop much more seriously on his course even on the untreated parts. However, he did report that on his treated areas the disease was soon checked and the turf recovered quickly in the spring. The severity of infection on one of his greens is shown in the accompanying illustration. On a near-by municipal course of Grand Rapids, Mr. L. H. Gork, city forester,

also conducted similar tests and found that the midwinter treatment with corrosive sublimate checked the disease.

The experimental work to date therefore indicates that the preliminary results of control treatments reported in April, 1927, can in general be expected to be effective throughout the snow-mold belt. The lighter application of 1 ounce to 1,000 square feet will apparently check mild attacks of the disease, whereas even the heavy application



Control of snow-mold by midwinter treatments of corrosive sublimate. Diseased patches on No. 1 green, Sleigh Municipal Course, Grand Rapids, Mich.

The few lighter spots are the patches which were practically killed by snow-mold before any treatment was applied. The other patches, gray, are the diseased areas where a treatment with corrosive sublimate the second week in January checked the snow-mold fungus and the turf had started to recover from the damage when the photograph was taken, April 3, 1928. Note the pencil in the foreground, which indicates the size of the patches.

of 3 ounces to 1,000 square feet must be exceeded to prevent injury where the fungus is unusually destructive. It is also apparent that an application of 1 or 2 ounces of corrosive sublimate to 1,000 square feet in midwinter or later, after the disease is active, is worthy of much further testing on courses where no preventive treatment has been applied the previous fall.

Fall burning of the rough.—We repeat that in the fall it is generally good practice to mow the rough, clean it up, and compost the salvaged material, or burn it. This practice will get rid of hosts of weed seeds and insects, and will make the rough more presentable the following season.

Humus in Soil Stores Water.—One of the important explanations of the desirability of having a quantity of humus or decomposing organic matter in the soil is found in the capacity of humus for soaking up and storing water which is thus made available later for use by growing plants. Experiments have revealed that 100 pounds of sand can hold only 25 pounds of water, and 100 pounds of clay soil