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Brown-Patch and the Bordeaux Treatment

LYMAN CARRIER

Greenkeepers are now having their first experience with plant diseases. If there is any truth in the statement that "misery likes company" there should be much consolation from the fact that fruit growers and gardeners have been forced to combat these pests for many years.

In nature there is a well-organized balance which keeps the face of the humid parts of the earth clothed in vegetation and peopled with animals big and little. When certain plants try to hog the earth there is always a remedy. Some bug or other enemy will step in and keep the obstreperous plant in its proper place. If this bug or other enemy gets puffed up with its own importance and develops porcine habits of "bug-land über alles," some bird or rodent will come along and deplete its population. Nature loves a mixture, plays no favorites, but rewards the fittest.

When man upsets the settled order of nature by attempting to grow one thing, and one thing only, he must give it protection from its natural enemies or there is going to be trouble. He may get along for a few years seemingly without a care, but sooner or later he will have to fight to protect his crop. Peaches, cotton, beets, beans, and potatoes in the good old days were grown without the depredations of a single serious pest. Now peaches have the jaundice and scale; cotton has its boll-weevil and pink boll-worm; beets, the crown rot; beans, anthracnose; and potatoes, bugs and blights. There is no use to bewail the fact and vainly wish for the care-free days. The grower must find the remedy and apply it. These remedial treatments should be considered as essential as plowing, harrowing, or harvesting, and be charged accordingly to the cost of growing the crop.

Brown-patch, a most troublesome plant disease, has come to match its power to spread and destroy fine turf against the greenkeeper's ability to prevent its ravages. This is the price that must be paid for extra fine turf. If golfers were satisfied with the mediocre results which

they can get with the old-fashioned shotgun mixture of grasses of all shapes, shades, sizes, and habits, there would be little or no trouble from brown-patch. But with a fine, velvety turf of bents or fescues there will always be the danger of infestation of this disease, and so it is up to the greenkeeper to provide the remedy.

The disease is now pretty generally recognized by most greenkeepers, but as some are still unfamiliar with it a repetition of the symptoms by which it is diagnosed may not be out of place.

DESCRIPTION OF THE DISEASE

Brown-patch is caused by a fungus, which is a term applied to a large group of plants. Fungi have no green in their make-up. This is a distinctive difference between a fungus and an ordinary plant. There are many different kinds of fungi. Some are large as toadstools, mushrooms, puff-balls, etc. The ones which cause disease are of a much smaller growth, often too small to be seen unless magnified.

A fungus not having the green chlorophyll of higher plants must get its food from other organic matter. It can not manufacture food for itself out of raw materials, as grass and trees do. Some fungi live only on dead tissue, as the mushrooms, toadstools, etc., while others attack living things. The brown-patch fungus thrives on a large number of living plants and takes an enormous toll from our farm crops. It is the organism which causes one of the serious blights of potatoes and tomatoes. Grass escaped the depredations of this fungus until greenkeepers began growing its favorite species in compact, closely clipped turf, where it could easily spread from leaf to leaf. Fungi draw the sap or juice from their host-plants by means of little thread-like filaments called *mycelium*. The mycelium of brown-patch can be seen by the unaided eye when the disease is active. It forms a cobwebby, tangled growth among the grass leaves like mildew. Fungi do not bloom and seed in the same manner as the higher plants. They do not need to, as they have a much more efficient means of spreading. Some form spores, which are little one-celled bodies that serve the same purpose as seeds in the higher plants. Anyone who has ever kicked a ripe puff-ball and noted the cloud of dust which rose in the air can appreciate the possibilities which that fungus has for spreading. Each particle of that dust is capable of producing another puff-ball if it falls in a favorable location for it to develop.

There are other fungi which are still more devilish in their ability to spread. They do not take the trouble even to form spores, but propagate by the "vegetative method." Those who have compared the propagation of creeping bent vegetatively against seeding, will recognize the advantage which these fungi possess. Small resting bodies form on the thread-like filaments, or mycelium, which are capable of growing even after prolonged drying. This method of propagation corresponds to the growing of a crop of potatoes from planting the tubers. These little bodies by which the fungus exists while it is not actively growing are called *sclerotia*. The brown-patch fungus possesses this latter method of propagation, which makes it no nice friend of the greenkeeper.

When a brown-patch sclerotium or tuber sets up housekeeping in an exclusive neighborhood of fine, velvety turf plants, it sends out its mycelium, which penetrates the cells of the grass leaves and appropriates

the food which the grass by hard work has made out of soil, air and water.

The first evidence which a greenkeeper has of the disease is a small smoky-looking spot when seen early in the morning. This spot has much the same appearance as would result from pouring boiling water on the grass. A close inspection will reveal the cobwebby mycelium. If the day is clear these spots will turn to a brown color by noon. The damage appears all to be done at night.

The spots may not be larger than a silver dollar the first day, but they spread rapidly if the weather is favorable for the fungus. Where there is but one point of infection the disease spreads in concentric circles and the patch keeps a circular form. As frequently happens, there are many points of infection which soon join together in an irregular area.

Brown-patch was common before the nature of the disease was understood. Sun-scald and drought injury have often been assigned as the cause of the trouble. We still find typical cases of brown-patch where the greenkeeper is making frantic efforts to overcome the trouble by treating the soil. Top-dressing, aeration, and watering or not watering are commonly resorted to. As turf hit by brown-patch frequently recovers in the course of a month or six weeks without any treatment, it is difficult to convince some greenkeepers that the remedy which they applied is not a sure cure for the disease.

White clover, bluegrass, and certain weeds, so far as our observations go, are immune to brown-patch. When the disease attacks a green it often selects the bents and fescues and leaves untouched the white clover and bluegrass which may be growing in the turf. This is a helpful characteristic for identifying brown-patch in its final stages. Dry weather is not so discriminating in regard to the kinds of plants it injures.

WEATHER FAVORABLE TO BROWN-PATCH

There is much yet to be learned in regard to the climatic conditions which are favorable or unfavorable to the fungus. Each year brings outbreaks of the disease, when, according to all the rules of the game, it ought to be dormant. A few years ago it was thought that the trouble need not be expected except on hot, muggy nights of July and August. Last year it proved to be more than "a midsummer night's dream." The first appearance here about Washington was noted in May. A heavy outbreak occurred in early July, followed by an encore in September. The disease appears to be extending its depredations to the winter turf in the extreme South. There is no way of predicting an outbreak of brown-patch. It may at any time make its appearance whenever there is good growing weather for grass. So far the spring and fall months have been fairly free from the trouble.

While it is not possible to accomplish much in the way of curing grass that is sick from brown-patch, the trouble does not always kill the roots, so anything that is good to make grass grow will help the recovery of a green that has been hit with the fungus. Top-dressing with compost or fertilizers, and judicious watering, are advisable.

TREATMENT

The only remedy which has proved successful so far is the well-known fungicide, Bordeaux mixture. This material has long been used for spray-

ing fruit trees and other crops which are subject to blights. The value lies in prevention rather than cure. After grass has become infected with the fungus nothing can be done for the areas that are hit. By the judicious use of Bordeaux, it may, however, be kept from spreading to healthy grass. Those who have had brown-patch on their greens in the past had better not wait for the disease to appear before beginning the treatment. The chances are much in favor of its reappearing in successive seasons, and the sooner the Bordeaux is applied after hot weather comes the more likelihood there is that it will hold the fungus in check.

At the Arlington experimental farm last year the plats which received Bordeaux were about the only ones that survived the combination of drought and brown-patch, which made the rest of the turf garden look as if it had been burned.

DRY VS. LIQUID BORDEAUX

Bordeaux mixture is now on the market in a powdered form, which is very convenient to use. This is the form which was used last year at the Arlington farm. Liquid Bordeaux, so far as a limited number of experiments show, is just as effective in controlling the disease as is the powder. At present we have no evidence that there is any difference between the dry and the liquid Bordeaux so far as preventing brown-patch is concerned. The choice of which form to use then should be decided on, first, which is the more convenient to use, taking all things into consideration, and secondly, which is the cheaper.

PREPARING BORDEAUX MIXTURE

Bordeaux mixture owes its beneficial effects to copper sulfate. But copper sulfate when used alone in a strength sufficient to prevent fungus disease will burn the grass. It is necessary to counteract the caustic effect of the copper sulfate with lime.

Bordeaux mixture is made in several different strengths, of 2 to 6 pounds of copper sulfate combined with equal weights of quicklime and enough water to make 50 gallons of the spray. For spraying grass, a mixture containing 5 pounds of copper sulfate is perhaps best. The procedure is as follows: Take 5 pounds of the copper sulfate in a muslin sack and suspend or stir it about in a barrel two-thirds full of water until dissolved. In another barrel slake 5 pounds of lump quicklime such as builders use for plastering. Be sure it is freshly-burned lime and not air-slaked. It is best to start gradually, pouring on a little hot water until the lime becomes active, then adding slowly more water until it is thoroughly slaked into a milky liquid. When ready to use, mix this milk of lime into the dissolved copper sulfate and add enough water to make up the 50 gallons—that is, an ordinary vinegar barrel full. The mixture should then be strained through muslin to take out any lumps or dirt which might clog the nozzles of the sprayer, after which the material is ready for use.

Stock solutions of dissolved copper sulfate and milk of lime may be made up in quantity, and they will keep indefinitely if not mixed together. Then all that is necessary when wanted for use is to measure out the proper proportion of each and mix. In mixing these two materials together, one or the other should be very dilute; for if strong solutions are mixed they will form a curdled mess that will be difficult to spray. It is for that reason that the directions given above call for two-thirds of a

barrel of water for the copper sulfate. Much less water will dissolve 5 pounds of copper sulfate, but it should be diluted to that quantity before adding the lime.

Thus prepared, however, liquid Bordeaux mixture must, to be effective, be applied immediately after it is made up, and no more should be made at one time than can be used the same day it is prepared. If it is desired to stabilize the mixture so that it will keep indefinitely, this can be done by the addition of one-eighth of an ounce of ordinary granulated sugar for every pound of copper sulfate used.

EQUIPMENT FOR MIXING

Where only a small quantity of Bordeaux mixture is needed two barrels, ordinary pails, funnel, etc., are all that are required in the way of equipment for preparing it. But where a considerable quantity is required, such as will be necessary for frequent sprayings of eighteen greens, it is advisable to build a platform high enough from the ground so the liquid can be allowed to run into the spray tank by gravity. In that case, the mixing barrel should have a faucet at the bottom which can be opened and closed, and water should be piped to this platform. All that has to be elevated by hand labor is the lime and copper sulfate. Stock solutions of copper sulfate and lime are prepared in advance. When ready to use, measure out enough of the copper sulfate solution to be equivalent to 5 pounds of the crystals. Put this in the mixing barrel and fill about two-thirds full with water. Measure out the milk of lime to give 5 pounds of the burned lime and stir this into the dilute copper sulfate. Fill up the barrel with water. Tie a muslin sack over the faucet of the mixing barrel, and let the mixture strain through into the spray tank.

SPRAYERS

Sprayers are on the market in great variety of styles and sizes from the little pop-gun hand-pumps to the 250-gallon or larger power outfits. If spraying the greens is to be one of the regular lines of work on a golf course, it would be advisable to equip at the start with a large power sprayer if the layout of the course will permit of its use, so that one loading of the machine will answer for spraying all of the greens. With such an outfit, the actual time required to spray a green should not be more than a minute or two. But, of course, it will take considerable time for a man and team to haul the machine around to all the greens.

Mixing and using liquid Bordeaux is nasty work at its best. The men do not like it. On windy days they get more or less covered with the spray. Clogged nozzles, leaky hose, and other mishaps make the work disagreeable. Remember, liquid Bordeaux mixture should be applied in a spray, so that every bit of the grass foliage is covered. An ordinary sprinkling pot will not answer.

APPLYING DRY BORDEAUX

The writer prefers using the dry Bordeaux powder to the liquid. It is more nearly fool-proof and less disagreeable to handle. One man alone can apply it, while with the liquid it is necessary to have a team to haul the sprayer. There is now no special machine on the market designed for spreading Bordeaux powder on turf. There are several dust-guns which are made to throw out a cloud of dust to cover fruit trees, small



Fig. 1. A dust-gun used for applying Bordeaux powder to a putting-green

fruits, grapes, cotton, etc. Whether these will answer for turf work remains to be seen. In Figure 1 is shown one of these dusters, which works by hand. Dr. Harban has had a wheelbarrow grass-seeder equipped to handle the powder. This apparatus appears very satisfactory. It covers a wide strip of turf and applies the powder evenly and lightly (Figure 2). With either of these devices there is a great saving of Bordeaux powder over what is taken when it is scattered by hand, and the work is done in a small fraction of the time.

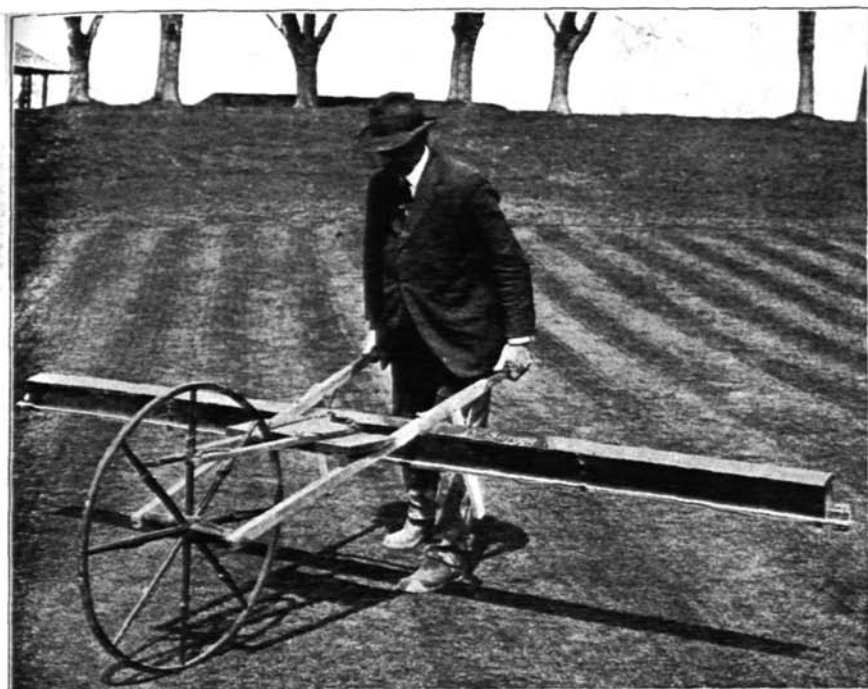


Fig. 2. A wheelbarrow grass-seeder adapted to the spreading of Bordeaux powder

AMOUNT OF BORDEAUX TO USE

Our experiments have not progressed to a point where we can say what minimum amount of the powder and how few applications will prevent the ravages of brown-patch. The first purpose has been to find a remedy; the second, to determine the most economical use. Experiments are planned which should give an answer to the second objective.

It is only by keeping at all times a covering of the Bordeaux on the leaves of the grass that we feel safe. This makes the treatment of turf grass much more difficult than is the case with farm crops. The frequent mowing and constant renewing of the growth of grass on putting-greens make it appear imperative that the Bordeaux be applied every two or three days during the periods of most danger. The plan we followed was to apply the powder after every rain or watering of the grass, and in no case did we wait longer than a week between applications, until late in the season. We hope that such frequent applications may not prove to be necessary, but it is well to be on the safe side. No more Bordeaux need be used than is necessary to give a light dust covering on the grass. When applying it by hand, as we did last year, it took about one pound of the powder to 1,000 square feet of surface. When applied with a dust-gun or the wheelbarrow seeder, one pound should cover a much larger area, say, an ordinary sized green of 6,000 square feet. It should be kept clearly in mind that Bordeaux does nothing but prevent the disease from attacking healthy plants; it is easily washed off the leaves, and should for that reason be applied after

and not immediately before watering. A heavy rain may render an application of Bordeaux of no value and another treatment should be applied soon after the rain stops.

EFFECT ON THE GRASS

The only effect on the grass noticed during the growing season last summer from the use of the Bordeaux was beneficial. The grass receiving the treatment was healthy, vigorous, and had good color. During the dormant stage of winter, however, there was a marked difference in the appearance of these plats when compared with those which were untreated. The leaves of the grass receiving Bordeaux turned to a reddish bronze color, and the plants were slower in starting growth this spring. At the time of this writing they have practically all recovered, and the new growth gives no indication of any injury. This peculiar color of the grass makes it advisable to study the cumulative effect from frequent applications of Bordeaux, as too much copper sulfate may prove detrimental when carried on over a period of years. There are no data on this point, as there are no experiments on record where so many treatments with Bordeaux have ever been applied before as we used last year on this grass.

EFFECT ON EARTHWORMS

An interesting side-benefit resulted last year at the Arlington farm from the use of Bordeaux powder for brown-patch. We discovered in the fall that there were no earthworms in the plats where Bordeaux had been applied during the summer. Repeated tests with mercuric chloride both last fall and this spring failed to bring out a single worm from the Bordeaux plats, while plenty of them could be found on the adjoining untreated turf. Of course, it is unsafe to draw conclusions from just one season's work, but the results were so definite that there seemed to be no mistaking the fact that Bordeaux mixture was effective in eradicating earthworms as well as controlling the brown-patch. If this holds true in the future there will be the added inducement for using Bordeaux.

Soil Beds for Use on Golf Courses and How They Can Be Made at a Very Small Cost

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At the Detroit Golf Club in 1920 some of the fairways were in bad shape with cuppy-likes in places. The soil is of a very sandy nature and no amount of rolling seemed to do any good. The grass was fescue and grew in tufts.

Top-dressings with compost of manure made in a pile by the usual method, we figured, would be very expensive and unnecessary. So we set about to make soil beds on various parts of the course in the rough and near the fairways which were to be top-dressed, thus saving long hauls. We selected about a quarter acre and covered it to a depth of one inch with clay (3½ cubic yards), and about the same quantity of manure. After the clay had dried out we rolled the beds in order to break up the lumps, and then disked them with a disk harrow. The next operation