season. It is impractical to maintain sod nurseries sufficiently large to replant extensive areas which may be destroyed during exceptionally bad seasons.

The soil for the sod nursery should be prepared similarly to soil for a putting green. If the nursery is planted on heavy clay and the sod from it is placed on a putting green of quite different type of soil, the layer of clay will remain in the soil and perhaps cause trouble later. It is not necessary that the sod in the nursery be kept growing as vigorously as putting green turf, but it should be weeded, cut, watered, and topdressed often enough so that it can quickly be developed into putting condition.

The sod nursery should be planted with grasses similar to those used on the putting greens of the course. The practice of resodding areas with a different kind of grass spoils the appearance of putting greens and should be avoided unless it is definitely planned ultimately to convert the putting greens to that particular kind. Only in those cases where the putting greens have been planted with an undesirable type should the sod nursery be of a different grass.

DISEASE CONTROL WITH FUNGICIDES

Cultural practices influence to a great degree the frequency and severity of diseases. Many nonparasitic diseases can be corrected only by proper cultural practices. These practices, however, can not completely control fungus diseases, but they may, to a great extent, lessen the frequency and severity of the attacks. If, by cultural practices, the amount of disease can be materially diminished, the cost of controlling it with fungicides may be greatly reduced. It should be the aim of every greenkeeper to use those cultural methods which tend to discourage fungus diseases. If he depends on fungicides alone, he not only uses more of them, with consequent greater cost, but he also finds that in extreme cases, which are likely to arise, injured turf dies before he has a chance to treat it.

In selecting a fungicide to use in treating a disease several factors should be considered. These are length of time required to check the disease, length of time turf is protected against subsequent attacks, chance of chemical injury to grass resulting from the treatment, ease of applying the chemical, and the unit cost of the material in relation to the amount that must be applied to obtain the desired results. Fungicides often have advantages and disadvantages which must be weighed one against the other in order that the most desirable one may be selected.

Development of Fungicides

In the seventeenth century, as indicated on page 100, men attempted to check diseases by coating plants with some common materials, usually those distinguished by color or odor. This method was extended to include the many chemicals now used as fungicides.

Practically all of the common fungicides in use today were discovered during the last half of the nineteenth century. Corrosive sublimate was first used as a soil disinfectant about 1864. The discovery of the germicidal value of formaldehyde was made in 1888, and its use for seed treatment began in 1895. The common use of copper sulphate, also the use of lime with copper sulphate, for seed treatments, began in 1873. From 1883 to 1885 the use of Bordeaux mixture for powdery mildew on grapes was developed. The discovery of Bordeaux mixture (lime and copper sulphate), however,

was accidental. It became the practice in some vineyards around Bordeaux, France, to sprinkle lime and bluestone (copper sulphate) on the outer rows of vines to give the fruit a poisoned appearance for guarding against pilfering by passers-by. These outer rows of vines were found to suffer very little, or not at all, from powdery mildew, and the beneficial effect was ascribed to the lime and bluestone, with the subsequent development of one of our most important fungicides.

During the twentieth century most of the work on the prevention and control of diseases has taken place. As each disease became a serious problem it was studied with respect to control measures. The development of definite methods and rates of applications of Bordeaux

Figure 16.—Dusting a putting green in 1922 with Bordeaux mixture for disease control. This was the first fungicide in general use for controlling turf diseases on golf courses. The fungicidal properties of Bordeaux mixture are due to copper sulphate, which had been used as a fungicide for over a century before being brought into use on golf courses.

mixture, copper sulphate, sulphur, lime-sulphur, formaldehyde, mercury compounds, and other fungicides was made during this period.

A Variety of Fungicidal Remedies Are Now Available

In the later development of plant-disease control, chemicals effective as fungicides have become increasingly important in checking injury to plants. These are used for disinfecting soil and seeds and for spraying or dusting the whole plant. Soil disinfection is usually accomplished by dry heat, steam, or fungicides, the most common of the fungicides being formaldehyde, sulphur, and mercury compounds. Seeds and tubers may be disinfected with solutions of formaldehyde, corrosive sublimate or other mercury compounds, or powders such as copper carbonate, copper sulphate and lime, and mercury compounds. Fumes of sulphur and formaldehyde are also used for dis-

infecting seeds and tubers. Hot water or dry heat is also sometimes effective. The purpose of soil and seed disinfection is to kill the disease organisms present in the soil or in the outer coats of the seed. Treatments with sprays and dusts are for the purpose of protecting the uninjured parts of the plants. The most important sprays are Bordeaux mixture and lime-sulphur. For dusting purposes, copper and sulphur preparations are commonly used.

Development of the Use of Fungicides in Turf-Disease Control

In 1917 experiments were first made on golf courses to test Bordeaux mixture as a fungicide for the control of brownpatch. By 1919 its use was general on courses on which the disease was serious. Corrosive sublimate was used successfully as early as 1920 in the Chicago district. The disadvantages of Bordeaux mixture led to the testing of other fungicides in brownpatch control. In 1923 careful study of turf diseases and the organisms causing them was begun by the Green Section, in the laboratory and in the field, and the results of this work have been published in the Bulletin from time to time. Many chemicals are useful as fungicides, but it is not a simple matter to find one that will kill fungi and at the same time not injure the plant on which it is used. A great many chemicals have been tested at the Arlington turf garden for the control of turf diseases.

The following is a list of the fungicides tested at the Arlington turf garden in 1925. The numbers preceding the names in this list are the plot numbers on which the respective fungicides were used, as shown in figure 17.

1. Semesan	1 pound	to 1,000	square feet
2. Formalin	1 quart	to 3,000	square feet
3. Sulphur	4 pounds	to 3,000	square feet
5. Copper sulphate	1 pound	to 3,000	square feet
6. Mercuric chloride	1 pound	to 3,000	square feet
7. Uspulun	1 pound	to 3,000	square feet
9. Corona 620	1 pound	to 1,000	square feet
10. Corona 640	1 pound	to 1,000	square feet
12. Germisan	1 pound	to 1,000	square feet
13. Corona 640	1 pound	to 1,000	square feet
14. Corona 640	1 pound	to 3,000	square feet
15. Uspulun	1 pound	to 1,000	square feet
17. Bordeaux	1 pound	to 1,000	square feet
18. Copper stearate	1 pound	to 1,000	square feet

This illustration shows a row in which there were several plots of the same strain of grass. Plots 4 feet square were treated in a row. The numbers appearing on the several plots in the illustration correspond to the numbers of the respective treatments in the foregoing list. The treatments were sprayed, except in the case of copper stearate, which was applied as a fine dust. The light spots in the photograph are dollarspot and the dark areas are healthy turf where the disease was controlled by the treatments. The treatments in plots 12 and 14 did not overlap and the disease was active in the strip between the two plots. The copper compounds (plots 5, 17, and 18), proved ineffective in controlling the disease. Sulphur and formalin appeared also valueless. Only on those plots which were treated with mercury fungicides—Semesan and Uspulun (chlorophenol mercurials), Corona 620 and 640, and mercuric chloride (corrosive sublimate)—was the disease effectively checked.

The lower cost of mercuric chloride (corrosive sublimate) as compared with the other mercury compounds tested in 1925 induced

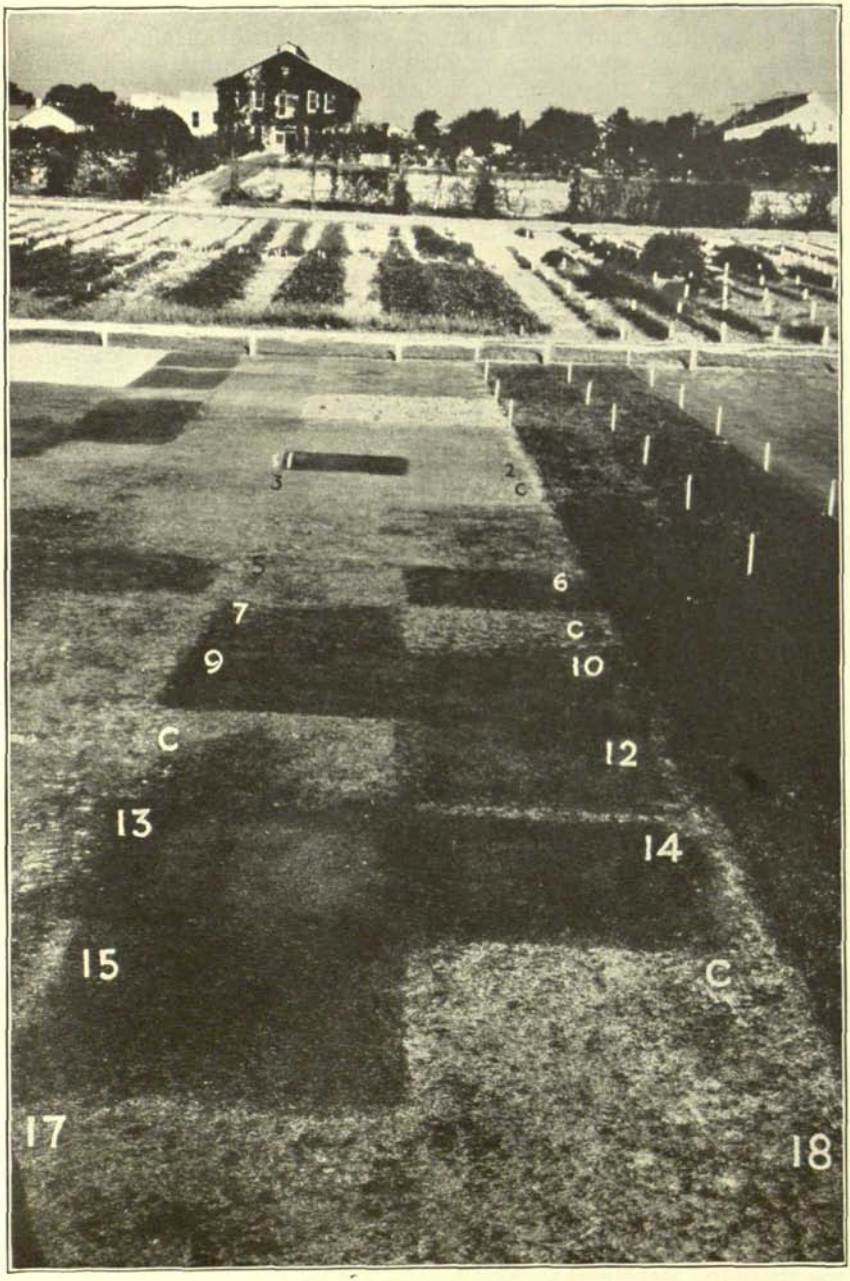

Figure 17.—Comparative tests of 14 different fungicides in the control of dollar-spot at Arlington turf garden. The number on a plot indicates the fungicide used on the plot as listed in the table on the opposite page. The plots marked C are check plots and received no treatment. Light-colored areas indicate damage by the disease.

further tests of this chemical during the following season, with a view to establishing clearly the advantages or disadvantages it might possess. At the same time a number of other inorganic mercury compounds were tested to determine their effectiveness against disease in hopes of finding one which would prove effective for longer periods with less chance of injuring the turf.

In 1927 these tests were repeated. The chemicals used in the experiment, the percentage of mercury in each, and the number of pounds required to carry 1 pound of mercury are shown in the following table.

Chemical	Percentage of mercury	Pounds required to carry 1 lb. mercury
Mercuric oxide	92.61	1.08
Mercuric sulphide	86.22	1.16
Mercurous chloride (calomel)	84.98	1.18
Mercuric cyanide	79.41	1.26
Mercuric chloride (corrosive sublimate)	73.88	1.35
Mercurous nitrate	71.48	1.40
Mercuric sulphate	67.62	1.48
Semesan	16.50	6.06
Uspulun	16.50	6.06

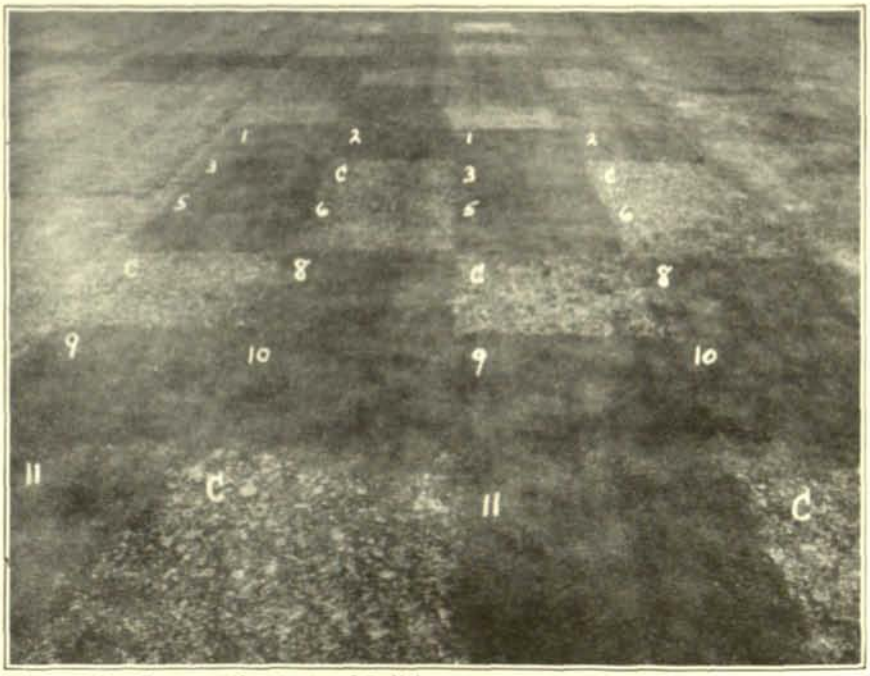

Figure 18.—Comparative tests of 9 different mercury compounds in the control of dollarspot at Arlington turf garden. Each treated plot (16 square feet) received the same amount of mercury (see table in text). This illustrates the similar effect obtained from the different chemicals with the exception of the sulphide. The spotted check plots, which received no fungicides, show how generally the disease was distributed throughout the area tested. The series at the left was on Metropolitan creeping bent; that on the right was on Washington creeping bent. Plot No. 1 received corrosive sublimate. Plot No. 2 received mercuric sulphate. Plot No. 3 received Semesan. Plot No. 5 received calomel. Plot No. 6 received mercuric sulphide. Plot No. 8 received mercurous nitrate. Plot No. 9 received mercuric oxide. Plot No. 10 received Uspulun. Plot No. 11 received mercuric cyanide. C represents check plots, no fungicides.

The rates at which the chemicals were applied were such that each plot received the same amount of mercury. The column at the right shows the number of pounds of the chemical needed for a green of 6,000 square feet if one is to apply 1 pound of mercury. Figure 18 shows treatments on four-foot squares of Washington and Metropolitan creeping bents at the Arlington turf garden. The spotted appearance of the check plots severely injured by dollarspot, when contrasted with the dark squares of healthy turf, shows that all the mercury compounds were effective with the exception of mercuric sulphide (No. 6).

It was found that while all of the chemicals were effective in con-

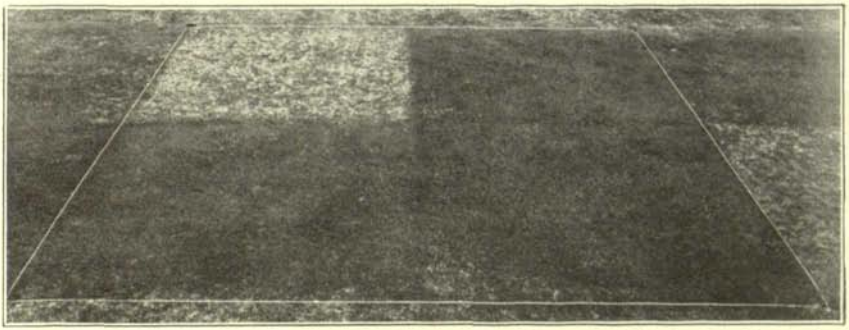

Figure 19.—Control of dollarspot on Metropolitan bent at Arlington turf garden. Of the four plots within the white lines, the lower left was treated with metallic mercury carried in chalk, the lower right with mercuric oxide, the upper right with calomel, and the upper left, reserved as a check plot, received only powdered chalk. The control is complete except in the check plot.

trolling the disease there were slight differences in the rapidity with which the disease was checked, in the length of time that a recurrence of the disease was prevented, and in the danger of burning the turf.

In some tests made later in the summer metallic mercury was applied on plots using the same amount of mercury as in the foregoing series of tests. Mercury in this form was as effective in controlling the disease as in the compound forms, indicating that when considering fungicides for dollarspot the mercury content is the important factor. Figure 19 shows four plots, one of which was treated with metallic mercury carried in powdered chalk, two of which were treated with inorganic mercury compounds, and one of which was untreated.

Fungicides of the Copper Group

Copper Sulphate, bluestone.—This is a common fungicide used mainly for seed treatments. It has been used on golf courses to control algae on greens. It also checks the growth of algae in lakes, ponds, or water hazards where it may be added at the rate of 1 pound to one million gallons of water.

Bordeaux Mixture, copper sulphate and lime.—Experiments with Bordeaux mixture and other copper compounds led to injuries which were far worse than the disease they were intended to cure. This injury was copper poisoning, resulting from the accumulation of copper in the soil; it is likely to develop more rapidly in some soils

than in others. Some of the golf courses which had used Bordeaux mixture for several years were forced to rebuild some of their putting greens to eliminate the soil containing copper. Another disadvantage of Bordeaux mixture was that it would not control dollarspot.

Bordeaux mixture proved effective in controlling brownpatch only when the leaves and stolons of the grass were covered with a protective covering of the fungicide. Therefore it was necessary to treat the greens after each rain or after each watering, which required daily treatments in many cases. It was used as a spray or dust to cover the leaves and stolons with a thin film. The rate of applica-

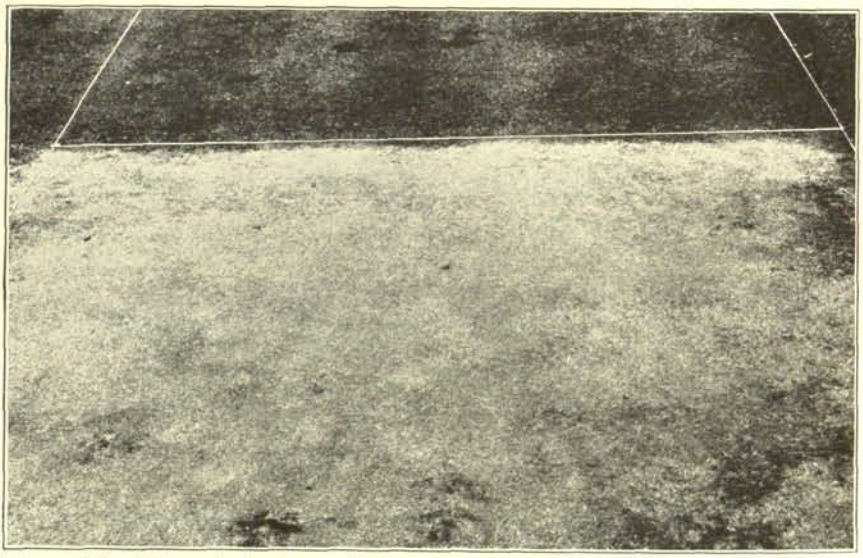

Figure 20.—Injury to turf caused by repeated applications of Bordeaux mixture used to control brownpatch. The light injured turf in the plot in the foreground is a result of accumulation of copper in the soil. The adjoining plot in the background where the turf is a dark healthy green received similar care except that no copper compounds had been used on it.

tion was about 1 pound to 1,000 square feet of turf. The frequency with which Bordeaux mixture had to be applied led to experiments with copper stearate in the hope that the latter would be found to adhere to the leaves for longer periods.

The use of Bordeaux mixture and other copper fungicides was discontinued after the development of the mercury fungicides, which are more effective and which do not leave any injurious residue in the soil.

Fungicides of the Mercury Group

The fungicides most widely used on golf courses are those containing mercury in combination with other chemicals. Mercury in the pure form is a familiar liquid metal which is commonly called quicksilver. This metal combines readily with many other chemicals to form numerous compounds which are widely used in medicine and in commerce. As has been previously explained, either metallic mercury or many of its compounds are effective in controlling certain turf diseases. The effectiveness of these fungicides is largely in proportion to the actual mercury content of the materials applied.

The chemicals with which mercury is combined may be organic or inorganic. The organic chemicals were formerly believed to be products of living organisms but later it was found that they could be manufactured without the aid of living matter. Since that discovery many organic chemicals have been manufactured but the term organic has been retained for them. When mercury is combined with an organic acid it is termed an organic mercury compound. When it is combined with an inorganic acid it is termed an inorganic mercury compound.

Corrosive sublimate (bichloride of mercury) and calomel (chloride of mercury) both are combinations of mercury and chlorine. Corrosive sublimate is formed when mercury in the form of vapor is brought in contact with an excess of chlorine, and calomel is formed when mercury vapor is brought in contact with a small amount of chlorine. When the corrosive sublimate is formed, twice as much chlorine combines with the mercury as when calomel is formed, and for that reason the former is called bichloride of mercury.

Other mercury compounds which are formed when mercury is combined with various chemicals differ in their characteristics of solubility and chemical stability, which characteristics are not limited to either organic or inorganic mercurials. Some of the organic mercurials may be soluble and chemically stable and others insoluble and unstable, and the same is true of the inorganic mercurials.

When mercury compounds, both organic and inorganic, are applied to the soil it is probable that both forms react with the organic acids which are present in the soil and may become very similar in their chemical composition. These reactions are carried on until the mercury in the soil becomes inert and has no further fungicidal effect. This tendency to change in the soil probably accounts for the similar behavior as fungicides of most of the mercurials, both organic and inorganic, when applied at comparable rates. This was explained above in the tests for effectiveness against disease.

Since the active constituent of mercury fungicides is the mercury contained in them it is natural that in general the greater the percentage of mercury the greater will be the effectiveness of the fungicide. Corrosive sublimate and calomel contain 74 per cent and 85 per cent of mercury, respectively. The organic mercury compounds contain smaller percentages of mercury and are usually mixed with some inert material. This further lowers the percentage of mercury in the preparation so that the cost of the mercury becomes excessive.

Mercury fungicides should be bought on a mercury basis. If one pound of corrosive sublimate, containing 74 per cent of mercury, costs $1.00, one pound of mercury in that form costs $1.35. At that price the mercury in one pound of fungicide containing 10 per cent of mercury would be worth 13½ cents.

Comparison of common golf course fungicides at present market prices shows that the actual cost of a single normal application based on the mercury content of the fungicide for 18 average-sized putting greens varies from $20 to $290.

The mercury fungicides which are marketed in pure form for golf course use are corrosive sublimate and calomel. The latter is sold by one manufacturer under the trade name of Calogreen. Combinations of corrosive sublimate and calomel are sold under the two trade names Calo-clor and Pfizer Mixture. Fungicides which are

mixtures of mercury compounds and some inert material which has no fungicidal value include Semesan, Nugreen, Turfcalomel, Barbak 211, Barbak XX, and Fungo.

Corrosive Sublimate, bichloride of mercury or mercuric chloride. —This is used extensively as a disinfectant in medicine. It also is used for treating tubers to control potato diseases, for seed treatment in a few of the cereal diseases, and for soil treatments in hot beds and greenhouses. Corrosive sublimate has been used extensively on golf courses both as a fungicide and as a vermicide. It was the first mercury compound reported to control brownpatch and its use as a vermicide was general before it was used as a fungicide.

This fungicide has been found to be the most quickly effective of the mercurials in checking active attacks of dollarspot and brownpatch when applied at rates containing equal amounts of mercury. A smaller quantity of this fungicide is necessary to check active attacks of these diseases than of any other mercury fungicide. The chief advantage is its rapidity of action, which is especially important in treating brownpatch. In severe attacks corrosive sublimate is the most effective of all mercury compounds. The period of prevention of corrosive sublimate is somewhat shorter than with other mercury fungicides.

Corrosive sublimate causes discoloration to turf when applied at high rates. Its tendency to burn, however, is somewhat greater than is the case with other mercury fungicides when all are applied at rates of relative strength. When conditions are favorable for brownpatch the grass is susceptible to burning, and any mercury compound which checks the disease effectively may cause some discoloration.

Corrosive sublimate is completely soluble in the dilutions used for spraying putting greens, but difficulty is sometimes experienced in preparing the solution. This difficulty can be eliminated by adding common salt to the solution. This matter is discussed in methods of application on page 130.

Calomel, mercurous chloride.—This is used extensively in medicine as a purgative and as a stimulant for the secretory organs. As a fungicide it was first generally used for dollarspot control, but it has recently been used also as a fungicide for controlling potato and other crop diseases. Calomel still is the best fungicide for treating dollarspot. It protects the turf from attacks of the fungus for a longer period than any other chemical when applied at rates containing an equal amount of mercury. This increased period of protection is sufficiently long to make it an important point in favor of calomel. It checks an active attack of dollarspot almost as rapidly as any of the mercury fungicides. It is effective as a lasting preventive for brownpatch. Since its action is slower than that of corrosive sublimate, in some cases it does not check an active attack of brownpatch as quickly as is necessary. Calomel also prevents attacks of snowmold. When calomel is used in combination with corrosive sublimate its adaptability for turf-disease control is extended, as will be discussed later.

Calomel causes less burn than other mercury fungicides when applied at comparable rates. The discoloration of turf caused by a uniform application of the fungicide at a high rate usually appears about 3 or 4 days after application has been made. Ordinarily this does not cause any damage other than to give the turf a yellowish

or browned appearance. When the chemical is not applied evenly serious burns may result which may take a long time to heal. Since lumps of calomel are likely to cause burns it is necessary to take precautions that the chemical to be applied contains no lumps. Calomel is insoluble, and even when finely ground it quickly settles in water because of its extreme weight. Therefore if it is to be applied either by sprinkling or by spraying, the water should be kept thoroughly agitated while making the application.

Combinations of Corrosive Sublimate and Calomel.—Since corrosive sublimate and calomel each had advantages not possessed by the other, it was apparent that a combination of the two could be used to advantage. This was particularly true for brownpatch. Dollarspot can be effectively controlled with calomel alone, but in the Arlington experiments active brownpatch was not immediately checked. Combinations of 1/3 corrosive sublimate and 2/3 calomel proved effective for brownpatch. For extremely active cases of the disease 1/2 corrosive sublimate and 1/2 calomel has been more effective. This treatment has advantages in that it checks the disease immediately, due to the corrosive sublimate, and gives a long period of control due to the calomel. Combinations of the two chemicals in various other proportions have also proved effective.

Such combinations were first suggested by the Green Section in the Bulletin in 1927 and since that time preparations containing mixtures of corrosive sublimate and calomel have appeared on the market with trade names.

Mercuric Oxide.—Another inorganic mercury compound that has been tested is mercuric oxide, both yellow and red. This is rated between corrosive sublimate and calomel as to effectiveness and as to injury to turf from overdoses. It checks brownpatch more quickly than calomel, but not as quickly as corrosive sublimate. Like calomel, it is insoluble in water, but it remains in suspension better than calomel. Its period of protection is not as long as that of calomel but considerably longer than that of corrosive sublimate. It does not burn the grass as severely as corrosive sublimate but more severely than calomel. Mercuric oxide has not been used to any great extent on golf courses, but may be used to advantage in some cases.

Organic Mercury.—Several organic mercury compounds have been included among the mercury fungicides tested for their effectiveness against turf diseases. One of the first of these to be used extensively on golf courses was chlorophenol mercury, the active constituent of Semesan and Uspulun. The organic mercury compounds have been effective in controlling brownpatch and dollarspot but have not exhibited any greater value as turf fungicides than mercury in the inorganic form. The organic compounds do not check brownpatch as quickly as does corrosive sublimate, but more quickly than calomel. They also are rated between those two chemicals in their burning effect on grass. Since those in golf course use are soluble they are preferred by many greenkeepers who have power sprayers which are equipped with agitators insufficient to keep calomel in suspension. The manufacturing cost of organic mercury compounds is usually greater than that of the inorganic compounds and therefore the sale prices are higher. Treatment with these organic mercurials is more expensive than with the common inorganic compounds, since it requires from five to ten times as much of them to obtain results com-

parable with the inorganic mercury fungicides. This is due to the fact that the organic fungicides contain inert materials and the mercury content is from 1/5 to 1/10 the quantity that is contained in the inorganic compounds.

Fertilizer-Fungicide Combinations.—Fertilizers are sometimes combined with mercury fungicides and sold under trade names for the control of turf diseases. The main disadvantage of such combinations is that too high prices are usually paid for the fertilizer they contain. Another disadvantage is that the recommended rates are often so small that the fungicide must be applied more often than is necessary with other types of fungicides. This greatly increases the cost of labor.

Miscellaneous Fungicides

Other fungicides which have been tested for golf turf diseases include formaldehyde, sulphur, various zinc compounds, silver nitrate, and potassium permanganate. None of these has proved to be of practical value. Silver nitrate controls dollarspot as effectively as the mercury compounds but its high cost makes it prohibitive. In preliminary tests formaldehyde showed slight control of brownpatch but subsequent tests showed that it had no practical value because of its extreme toxicity to grass. Various forms of sulphur have proved valueless as a turf fungicide and are toxic to grass. Sulphur apparently makes grass even more susceptible to dollarspot, due either to the greater acidity produced or to some effect that the sulphur has on the plant.

Rates of Application of Fungicides

The rate at which the mercury compounds should be used for turf diseases depends upon the season, the condition of the grass, the weather, and the amount of fungicide that has previously been used. Some greenkeepers treat all their greens at regular intervals whether or not disease occurs; others treat only when they notice an attack. The decision depends upon the amount of disease that ordinarily occurs. If in the experience of the greenkeeper disease occurs continually throughout the season as it does in the more southerly districts of the northern grass belt, then it is best to treat at regular intervals. On some of the northern courses, where the disease occurs only occasionally it is more economical to treat only when the disease occurs. The frequency of treatment also depends on the season. During dry seasons there is likely to be less disease and therefore fewer treatments will be necessary.

Early or late in the growing season the grass is not so tender and larger amounts of the fungicide can be used safely. A safe rate at that time is 3 ounces of corrosive sublimate or calomel or a combination of the two or of mercuric oxide, to 1,000 square feet. One pound or more of organic mercurial also can be used at this time, and this amount is necessary to give the same effect as the smaller amounts of inorganic chemicals. When the weather gets warm in the middle of the summer the grass is more easily burned and smaller rates must be used. It is necessary then to use 2 ounces of the inorganic mercury compounds or 2/3 pound of the organic. If it is extremely hot and humid and the grass is tender then the rate must be cut down to 1½ ounces or even 1 ounce of the inorganic and a relatively-decreased amount of the organic.

There is a cumulative effect from mercury compounds in the soil. The first treatments of the year are not likely to be as effective as the later treatments. When the turf has been treated year after year less mercury is required to check the disease than on turf where no treatments have ever been applied. This cumulative effect applies also to the chance of injury to turf due to chemical burn. Where much mercury has been used the grass is burned by smaller amounts than where no mercury has been used previously. The first treatments therefore can safely be much stronger than the subsequent treatments particularly if the turf is treated at regular intervals. New turf can stand stronger treatments than older turf which has been regularly treated.

APPLYING FUNGICIDES

Several methods for applying fungicides to turf are available for golf courses. The method that is used varies with the preference of the greenkeeper and the available equipment. A method may be practicable on one course and impracticable on another course because the equipment and trained help vary considerably on different courses. The method used will also depend on the frequency with which the disease occurs and the amount of turf that must be treated, since it is important to apply fungicides promptly after an attack of fungi is noticed, so that the disease may be checked quickly and the severity of the injury lessened. The method to use is that which will give the most even distribution in the shortest time and at the least cost.

The fungicides usually used on golf courses are mercury compounds which, if carelessly applied, cause injuries to turf that may be more serious than the diseases for which they are applied. The small amounts of the fungicides necessary to cover large areas make it difficult to distribute them evenly. It is usually desirable to dilute them to give greater bulk, for only rarely is it possible to apply a fungicide to golf course turf without dilution. Any of the chemicals effective in the control of turf diseases may be applied either in water or mixed with sand, soil, or other material.

It is essential to obtain even distribution regardless of whether the fungicide is applied in water or in a dry state. Uneven distribution may result in chemical burns on those areas which obtain an excess of the material and ineffectiveness of the treatment on those areas which do not receive an adequate amount of the fungicide. To assure even distribution of the material to be applied it is advisable to make the application in two parts. The first part is applied by starting at one side of the putting green and walking back and forth in parallel lines far enough apart so that the application does not overlap or that no part of the turf is missed. Great care should be taken that the treatments do not overlap since bad burns may result where overlapping occurs. After the first half of the material has been applied the second half is applied by walking back and forth in parallel lines which are at right angles to the direction of the first treatment. Treatment thus made in two directions greatly increases the uniformity of the distribution. This method is often used in seeding to assure even stands of plants, and it is useful whether the treatment is made dry in sand, soil, compost, or dry fertilizer or in liquid from sprayers, sprinklers, or proportioning machines.

The turf should be watered thoroughly immediately after the