THE BULLETIN

of the

UNITED STATES GOLF ASSOCIATION GREEN SECTION

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Contents

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The Weed Problem with Suggestions for Control

By B. R. Leach, Riverton, N. J.

The problem of controlling weeds in the fine turf of golf greens is still a source of great annoyance and expense to most golf clubs. Much experimental work has been done during the past few years on this general proposition of weed control and it is proposed in this article to correllate the main results of these investigations together with certain results obtained in my own experimental work at Riverton, N. J.*

The Source of Weeds

There are two main sources of weeds as far as their being in greens is concerned: 1. Certain weeds such as dandelions, have very light seeds and these are blown onto the green from the surrounding rough and fairway. From the standpoint of weed control alone it pays to mow the rough at frequent intervals, thereby preventing in a large measure the ripening of these windblown seeds. 2. The second source of weeds is the topsoil used as an ingredient of the topdressing. Topsoil nearly always carries an abundance of weed seeds and it is the topsoil used in topdressing that is one of the leading sources of weeds in greens.

Weed control methods may be arbitrarily classified under the following headings although they merge to a certain extent. 1. Weeding by hand. 2. Acid-reacting fertilizer. 3. Composting. 4. Steaming and baking of compost. 5. Arsenate of lead.

Hand Weeding

It may be stated as an axiom that regardless of all the methods employed in controlling weeds *some* hand weeding will be necessary. This is the case because no method or combination of methods will give 100 percent weed control. Under the circumstances it would seem advisable to use common sense in the management of hand weeding operations. Unfortunately most clubs resort to one extensive hand weeding campaign about the height of the crab grass season and do very little weeding during the rest of the year. This is a fundamental mistake in fine turf management and can only result in poor and thin turf.

Fine grasses can not compete with some weeds under the closely mown conditions of the modern golf green. If you study the grass in the immediate vicinity of a weed you will note how the weed dominates the situation with its broad leaves, denser growth and in many cases a tap root of tremendous water and food obtaining capacity.

* This is one of the turf investigation projects sponsored and financed in part by the United States Golf Association.

The bigger and broader the weed the more it drains the vitality of the fine grass in the immediate vicinity.

Under the circumstances *hand weeding should be made an important part of the routine work throughout the growing season.* At the beginning of the growing season particular attention should be paid to this detail of course management.

As a result of this early weeding the fine grass has its own way and, provided proper fertilization and topdressing is practiced the turf will be thick and heavy by the time crab grass begins to make its appearance. This thick heavy turf will be less infested with crab grass because the soil surface is already crowded with fine grass and the crab grass has more difficulty in getting established.

Ordinary observation will prove the truth of this statement. Examine a green at crab grass time and you will note that the crab grass is thickest where the fine turf is thinnest. The moral therefore is to spend the time and money throughout the season prior to crab grass time in weeding, fertilizing, topdressing, etc., with the object of thickening up the turf to withstand the crab grass invasion.

It is better to spend money in the above way than to waste it in digging out masses of crab grass in August leaving the greens looking badly and in poor playing condition. A green thus cleared of crab grass is a thin and sorry sight but it is a sorrier job to thicken it up at that time of the year when growth is naturally beginning to slow up. In fact it is an impossible job. If you want a nice *Poa annua* green this is the easiest way to get it.

Fertilizers

From the standpoint of weed control fertilizers, particularly acid-reacting fertilizers such as ammonium sulfate and ammonium phosphate are valuable for two reasons. 1. They cause the soil to gradually become acid in nature thereby creating a soil condition most favorable for the growth of fine grasses such as the bents and fescues and least favorable for the growth of many (but not all) weeds. 2. They stimulate the growth of the fine turf grasses and create a thick, heavy and luxuriant turf, in which weeds have a greater difficulty in gaining a foothold. From both these angles proper fertilization is of the utmost importance in weed control. Irregular fertilizer applications means that you are giving the weeds the edge. Fine turf can not prosper without this feeding but weeds can and do.

Watering

Careless and indifferent watering gives weeds the edge because most of them are deeper rooted than the fine turf and can withstand drier soil-surface conditions.

The Treatment of Topdressing Compost

In view of the fact that the topdressing is such a fertile source of weed seeds there have of late been many advocates of the treatment of compost in such a way that these weed seeds will be killed before it is applied to the green.

Allowing the ingredients of the compost pile to rot for a year or more before using, in addition to making the ingredients more desirable for topdressing, also results in the death of many short-lived weed seeds but it does not kill many of those weed seeds possessing hard coats.

Steaming the Compost

Several articles have appeared in THE BULLETIN within the past year describing methods of treating topdressing material with steam for the purpose of killing weed seeds as well as toning up the compost so treated. Steaming is a very efficacious method of so treating compost. Unfortunately, it is an expensive method inasmuch as the apparatus is costly and the labor and time involved is considerable. Furthermore, it is quite possible to oversteam soil, thereby devitalizing it for long periods of time. From the standpoint of the average greenkeeper I doubt if steaming will ever become a very popular method in modern greenkeeping practice.

Relative Value of Topdressing Treatment for Weed Seed Control

Steaming or similar treatment (properly given) will kill most of the weed seeds in topdressing so treated and to that extent it is of value. Nevertheless the consistent treatment of all topdressing in this way, while it will aid to a certain extent in keeping the greens free from weeds, will not solve the weed problem entirely since topdressing is after all only one source of weed seeds. We still have wind and water borne weed seeds to contend with thereby necessitating hand weeding. Experience only will determine the value of topdressing sterilization for the individual golf club.

Arsenate of Lead as a Weed Control

Five years of experimental work have shown the value of this chemical as a control for grubs and worms and incidentally as a weed control in fine turf. It is being used in greater quantities each year. Those interested are referred to the article in the February, 1927, number of THE BULLETIN for detailed instructions regarding the use of this material.

The experimental plats at Riverton are at this writing a source of very interesting study. Plats poisoned with arsenate of lead at the rate of 35 pounds per 1,000 square feet of turf at the time of planting the stolons are practically free of crab grass and other weeds. Plats not so treated but topdressed with poisoned soil for two seasons show decided weed control while plats which have received no arsenate of lead contain crab grass and other weeds in abundance.

The value of arsenate of lead as a weed control agent is due to the fact that not many plants will grow in soil containing the chemical. The majority of weeds common to fine turf succumb to the poison and in fact many weed seeds fail to germinate in soil so treated. The fine turf grasses on the contrary seem to be stimulated in their growth by the arsenate of lead. From the standpoint of grub,worm and weed control the use of arsenate of lead would seem to be the easiest and cheapest method for the modern golf course. It is suggested that it be given a trial by those clubs having problems of this nature to cope with.

Conclusions

Weed throughout the season, making it an important part of the routine work. Thicken up the turf by proper fertilization, topdressing and watering before the beginning of the crab grass season. The weed problem can be lessened to a certain extent by steaming or some similar treatment. Give arsenate of lead a fair trial as a means of controlling grubs, worms and weeds.

Last year the Riverton Country Club had a force of 18 boys weeding the greens during August. This year they have a force of 4 boys, and the weeding is being adequately handled. The greenkeeper, Mr. Charles Ewers, attributes the decreased weed growth, the decidedly smaller weeding personnel and the consequently appreciable financial saving to the extensive use of arsenate of lead in all topdressing applied during the past year.

Some U. S. Golf Association Decisions on the Rules of Golf

A ball has been driven from the tee and apparently lost. A provisional ball has been put in play and only one stroke played with it. After one stroke had been played with the provisional ball the original ball was found. Has the player the privilege to cease playing the provisional ball and revert to the original ball, bearing in mind that the player only played one stroke with the provisional ball?

Decision.—The reason for playing a provisional ball is to save delay. If a player's ball seems to him to have lodged in territory where it might be lost or unplayable, he is entitled to play a provisional ball. This must be done, however, before he leaves the tee. A player is entitled to play a provisional ball until it is opposite or past the spot where the original ball is presumed to be, no matter how many shots this takes. He then must search for his original ball for five minutes or until it is found. If it is lost he must continue play with the provisional ball. If it is found the provisional ball must be picked up, unless the player considers his original ball unplayable, in which case he may continue play with the provisional ball.

Kindly advise the ruling of the U. S. G. A. with reference to a ball lost near to a water hazard. Is it assumed to be in the hazard if not found?

Decision.—If it is reasonably certain that the ball entered the hazard it may be treated under Rule 27. Local committees should see to it that the water hazards are marked with stakes so that the limits may be clearly defined, leaving little doubt as to where the ball ultimately came to rest. They should also have the grass cut so that it would be very difficult to lose a ball outside the limits of this hazard.

Drainage will not only dry and warm land that is wet and cold, but it has a marked effect upon the physical structure of the soil. Clays are usually very plastic and sticky when wet, very hard when dry, and permit the percolation of water very slowly, if at all. After drainage the same soils become looser, forming into small grains or crumbs. The granular structure gives large pore spaces, through which the water passes downward by gravity more freely, and breaks the continuity of the tiny capillary tubes by which the moisture moves upward as evaporation dries the ground surface. Therefore the drained clay neither remains saturated so long nor dries out so thoroughly as before drainage, but retains a film of capillary water about each soil grain, while the gravitational water passes out and is replaced by air. This is the soil condition necessary for a healthy growth of the usual cultivated crops.

1927 Experiments on Brown-Patch Control

By John Monteith, Jr.

During the summer there were comparatively few attacks of large brown-patch on the Arlington Turf Garden and none of these caused the serious damage so often resulting from this disease. Small brown-patch, on the other hand, appeared early in the season and occurred repeatedly throughout the summer, on several occasions causing much damage to turf which had received no preventive treatments. Observations on control of large brown-patch were therefore unfortunately limited and the results reported here are in the main those obtained in experiments for the control of small brown-patch.

Efforts were chiefly devoted to further testing the effectiveness of various chemical compounds containing mercury. Following in general the plan of the preliminary tests of the previous summer a large number of experiments were conducted to compare the inorganic mercury compounds with the two commonly used organic preparations, Uspulun and Semesan. Some new trade mixtures were tested; much additional work was done with calomel and corrosive sublimate; various combinations of mercury fungicides and nitrogenous fertilizers were kept under observation during the season; and a number of promising new control measures were worked with in a more or less preliminary way. As a result of this season's experimental work we feel much more confident in our knowledge of the possibilities and limitations of the mercury fungicides. Much of the other work is still too preliminary to justify any general conclusions and it will not be reported until tested for at least another season.

Organic and Inorganic Mercury Fungicides

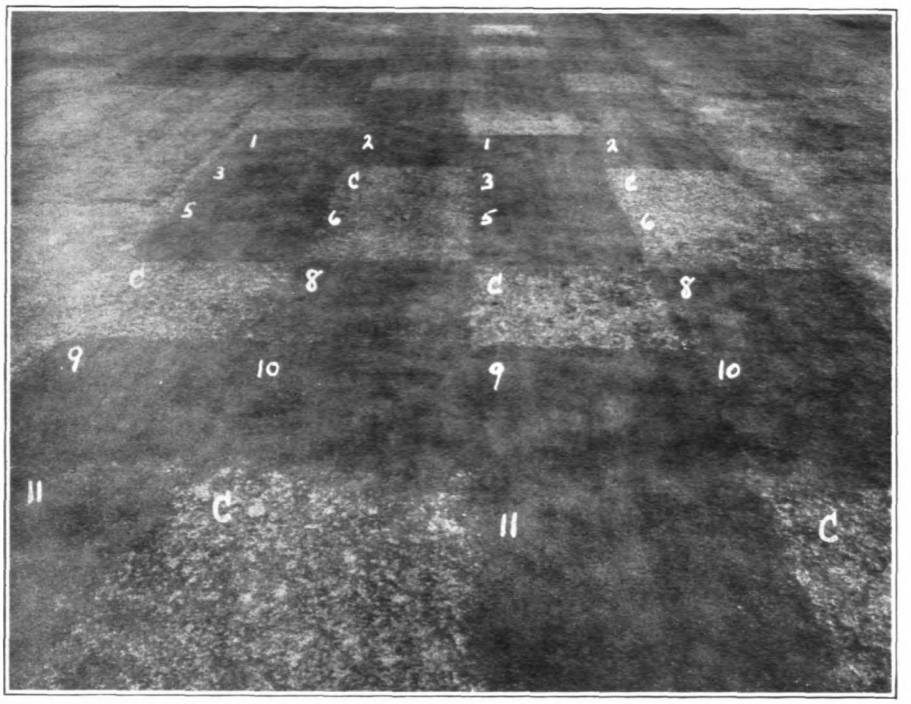
In our previous work with a number of organic mercury preparations and corrosive sublimate it became evident that each would control brown-patch. This suggested the possibility of finding an equally or even more effective chemical among the less expensive inorganic combinations readily available on the market. Therefore, during the summer of 1926 a group of these chemicals were selected and tested in a series of adjacent plots at Arlington, as reported in the October, 1926, BULLETIN.

In arranging these tests the chemicals were applied at such rates that each plot received a like amount of mercury. Since the percentage of mercury contained in the different compounds varies over wide limits, there was a big difference in the quantities used on the individual plots. Below is given a table showing the percentage of mercury in each compound tested and the weight of the chemical required to give one pound of mercury:

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

The column at the right will have perhaps more significance if one thinks of it as representing the number of pounds needed for a green of slightly over 6,000 square feet—based on the usual recommendation of one pound per 1,000 square feet for Semesan or Uspulun. It will be noticed that the amount of Semesan or Uspulun used was approximately five and a half times greater than that of the mercuric oxide and five times greater than calomel.

The results this year repeatedly confirmed those obtained the preceding season. With the exception of mercuric sulphide, all controlled the disease. Most of the time it was practically impossible to pick out one of these plots as superior to the others. This is shown in the



CONTROL OF SMALL BROWN-PATCH WITH SEVERAL MERCURY COMPOUNDS

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.

accompanying illustration in which the dark squares of healthy grass are practically uniform in appearance. When compared with the badly spotted check plots, where no preventive treatment was used, with the exception of mercuric sulphide, they show how effectively these chemicals checked small brown-patch.

Late in the summer some tests were made with a mixture of metallic mercury in powdered chalk, using an amount of mercury equal to that used in the above series. It was found that this also was effective in checking the disease and that mercury in this form was apparently as efficacious as when combined in any of the above chemical compounds. Therefore, considering simply the control of small brown-patch, when comparing values among any of these chemicals, it seems that the chief item to be considered is the actual amount of mercury they contain.

There are, however, other factors that must be considered other than that of control of the disease. One of the most important of these is the effect each chemical has on grass. All of the mercury preparations that have proved to be effective in controlling brown-patch are liable to injure turf if used in excess. For reasons thus far undetermined, a dose of any of these chemicals which at one time is found to be perfectly safe, at another time under somewhat different conditions may prove to be greatly excessive. Also, as with other chemicals, some strains of grass are more susceptible to injury than others, but these differences vary in the same way with all of these mercury compounds. From the standpoint of injuring turf, mercuric cyanide is apparently impractical for use on golf courses. We have used it many times without observing any serious burns, but on other occasions it has caused severe injuries. Mercuric chloride (corrosive sublimate or bichloride of mercury) has long been recognized as a dangerous chemical on greens if used carelessly or in excess. It is by no means as dangerous as the cyanide, but rates second on the list from this standpoint. It nevertheless has several points in its favor, and in spite of occasional injuries it undoubtedly will continue to hold an important place in brown-patch control. Of the group which controlled the disease, calomel again proved to be least likely to burn the turf. Calomel and corrosive sublimate will be discussed more fully later.

The duration of the period in which a chemical will protect turf from brown-patch is another factor worthy of consideration. It has been found that none of them will offer protection for any definite period. An application which at one time may prevent the disease for four to six weeks at another time may be effective for but two to four days. In a general way the conditions which limit the period of protection for one mercury compound likewise shorten the time that any of the others remain effective. There were, however, some differences noticeable in the plots throughout the season. The cyanide and bichloride plots usually were the first in which the disease reappeared, whereas the calomel plots were the last of the series to become reinfected. At times these differences were apparent for several days, but many times they were of little importance.

The promptness with which a chemical checks a disease is also important, especially in the case of large brown-patch. The cyanide and bichloride, which are more likely to injure turf and give the shortest protection, appear to be the most rapid in checking the fungi causing both types of brown-patch. Calomel, which gives the longest protection and is least liable to injure turf, proved to have the disadvantage of being the slowest to check these diseases. In most cases, however, calomel acts quickly enough in controlling small brown-patch, but in controlling large brown-patch it is usually too

slow. It acts as a preventive just as the other mercury compounds, but when applied to check a rapidly developing case of large brown-patch its action is delayed long enough to permit the disease to produce bad scars.

Calomel

In the preliminary tests in 1926, calomel gave very promising results when used against small brown-patch. The more prolonged protection, relative freedom from burning and reduced cost made this chemical stand out as one of the most promising of the group of mercury fungicides. During the past summer numerous tests were made to determine its value and limitations.

Calomel, throughout the season, proved to be an excellent fungicide for the control of small brown-patch. It regularly protected the turf longer than any other chemical containing an equal amount of mercury and at times this increased period of protection was sufficiently long to make this an important point in its favor. The tests this year showed that it was by no means the "fool proof" chemical, from the standpoint of burning, that the preliminary tests indicated. The discoloration of turf due to uneven application or excessive amounts of calomel usually does not become evident as soon as that resulting from excess of the other mercury compounds. In some cases the discoloration did not appear for three or four days after the calomel was applied. However, it repeatedly proved to be the least likely to burn of any of the mercury compounds which control brown-patch, and in no case did we observe any actual killing of turf unless it was used in quantities several times in excess of the recommended rate. The injury was usually confined to a uniform yellowing and unhealthy appearance which, though unsightly and decidedly objectionable, resulted in nothing more than a temporary injury of comparatively short duration. The lesser injury and slowness with which it appears is probably due to the fact that calomel is practically insoluble in water, and it is probably only gradually changed to some other more available compound in the soil. This slower action is objectionable when used against an active case of large brown-patch, for at such times immediate action is desired.

Following a report of results at Arlington last season, a finely ground grade of calomel was marketed under the trade names Calogreen and Turfcalomel. It was claimed that, due to their more finely divided condition, these preparations would be much more effective against brown-patch than the ordinary grade of calomel. Our tests showed that in the more finely divided form, calomel is likely to be somewhat more quickly available. This results in a little more prompt checking of disease, but also tends to make it somewhat more likely to burn and shortens slightly the period of protection. One of the chief objections against the finely ground material was due to its tendency to form large lumps while in the packages. This made it difficult to mix thoroughly with water or with compost and defeated the chief object of fine grinding, that of providing more even and thorough distribution. Early in the season this objection was brought to the attention of the chemical companies producing Calogreen and Turfcalomel. It was suggested that a mixture be made with this finely ground calomel and some inert material which would be harmless to grass, but which would serve to prevent any lumping of the fine particles of calomel. Both com-

panies quickly cooperated in furnishing us such mixtures, which were then tested at Arlington. The most promising of these was the one containing finely ground clay as a filler, which gave a bulky mixture that had no tendency to form stubborn lumps.

Combinations of Calomel with Other Mercury Compounds

Since calomel acts slowly and for that reason is not desirable for control of active large brown-patch, an attempt was made to combine it with a more quickly effective chemical to provide a combination treatment which would have the advantages both of the immediately active chemical and of the more lasting calomel. Since corrosive sublimate and the oxide of mercury check large brown-patch almost immediately, these two appeared to be the most promising for such a mixture since they possessed certain other desirable features besides that of lowest cost. An application of one ounce of corrosive sublimate per 1,000 square feet proved to be entirely satisfactory in checking active large brown-patch. Therefore a mixture of one ounce of corrosive sublimate with two ounces of calomel was applied to a number of plots and it was found to give the desired results. Other proportions were tested, but it appeared that the ratio of one-third corrosive sublimate and two-thirds calomel was best. The demonstration plots of the turf garden, which are cared for as putting greens should be, were treated with such a mixture previous to the meeting of greenkeepers in August. When a mixture of these two chemicals is combined with a little fine clay, to add more bulk, it makes a very satisfactory brown-patch remedy.

We found that the oxide of mercury was likewise effective in combination with calomel, used in the same proportion as was the corrosive sublimate and calomel. There are two common oxides on the market (red and yellow), which proved to be equally effective against these turf diseases. The oxide is less likely to burn than is corrosive sublimate and lasts a trifle longer. It should prove to be a valuable chemical for this work.

Method of Application

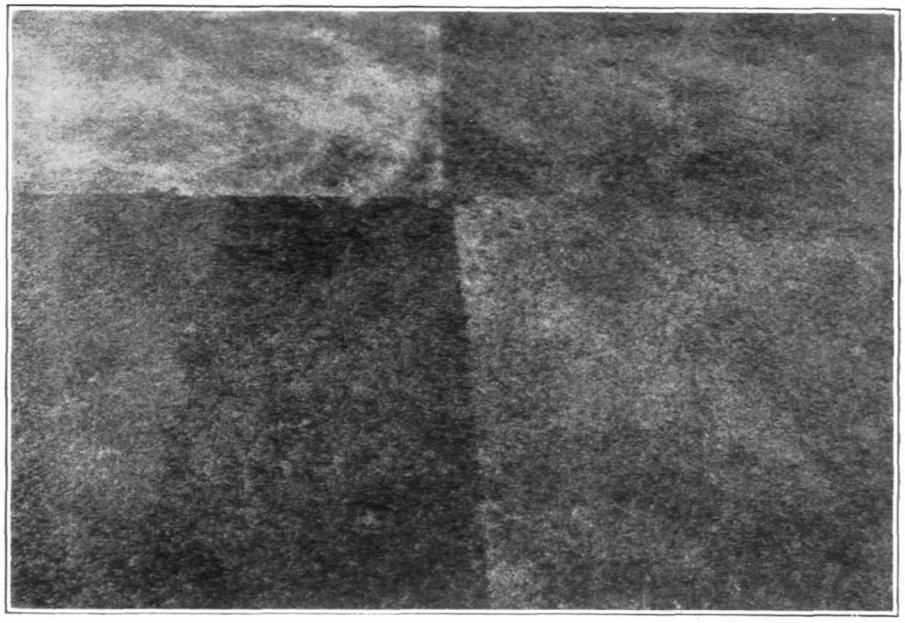
In using any of these chemicals, either alone or in mixtures, it appears advisable to use the full amount (about three ounces of the calomel, corrosive sublimate or oxide, and one pound of Semesan or Uspulun) for the early season applications. At such times the danger of burning is greatly reduced and the lasting effect of the chemicals during this period is greatly prolonged. In the middle of summer it is wise to reduce the amount to one-half or less. This avoids serious injury but necessitates more frequent application.

Any of these mercury chemicals may be used in water, or mixed with enough soil to give sufficient bulk for even distribution. This latter method has many advantages, provided there is someone available on the course who can scatter the mixture uniformly over the turf. Our tests this year again showed that by mixing the chemical in moist soil and allowing it to stand overnight or longer, there was a decided reduction in the amount of burning. The greatest danger from burning occurs when the chemical is applied in water. Mixing with sand usually does not reduce the burn below that of the liquid method. However, if care were used in making the application and the quantity were reduced sufficiently during hot, humid periods, any of these methods could be used with safety.

Mercury Fungicides Combined with Fertilizers

The use of fungicides and fertilizers combined in a single treatment is a labor and time saving procedure. Our tests this season have confirmed those of previous summers in showing that it is entirely feasible to use such combinations and that neither the fungicidal nor the fertilizing qualities of either ingredient are decreased thereby. When greens need plant food a mixture of this kind is to be recommended, but if brown-patch occurs when turf already is amply provided with food it may be dangerous to use fertilizers with the fungicide. This is especially apt to be the case where large brown-patch is prevalent.

The most desirable fertilizers to use when treating turf with the dry method of application proved to be those of the organic group, including cottonseed meal, soybean meal, Milorganite, or poultry manure. All of these gave good results when combined with corrosive sublimate or calomel. When a little fine compost or sand is added to such a mixture it can be quickly broadcast over turf.



BURNING WITH CORROSIVE SUBLIMATE

The square at the upper left received an application of corrosive sublimate, at the rate of one-half pound per 1,000 square feet, mixed in sand. A like amount of corrosive sublimate was applied to each of the squares at the right, mixed with cottonseed meal (one pound per 1,000 square feet). For the plot at the upper right the mixture was prepared the previous day. The mixture for the plot at the lower right was prepared just before it was applied. The plot at the lower left received no treatment. This illustrates how it is possible to reduce the severity of chemical injuries by mixing with cottonseed meal and allowing the mixture to stand for several hours. It will be noted that this is a heavy application of corrosive sublimate. The plots were treated July 29 and the photograph was made August 2.

If corrosive sublimate is mixed with cottonseed meal (or other similar fertilizers) and allowed to stand for some time, the severity of burns is greatly reduced—just as is the case in mixing with soil. For this purpose the mixture should be slightly moistened. In the accompanying figure this reduction of burning with bichloride is illustrated. While reducing the amount of injury, such a mixture

apparently does not reduce the effectiveness of the mercury compound, but tends to increase the period it will control the disease.

When using chemicals in liquid, either in a sprayer or sprinkling device, it is more desirable to use one of the soluble fertilizers. Ammonium sulphate, Ammo-phos, or urea have for some time proved to be satisfactory for such purposes. The combinations are much more likely to produce injury to turf than are the insoluble mixtures referred to above. Of these, urea is perhaps the greatest risk from the burning standpoint. Nevertheless, even the mixture of urea with the mercury chemicals can be used with comparative safety if the total quantity is reduced during periods when turf is most sensitive to chemical burns.

During the season there has been a mixture of this type widely distributed for brown-patch control. This has been sold under the trade name of Nu-Green and has a composition equivalent to one-half Uspulun or Semesan and one-half urea. At Arlington this compound was tested in comparison with similar plots where other combinations were used. Thus one pound of Nu-Green was compared with a plot receiving a treatment of one-half pound Semesan and one-half pound urea; another plot receiving one and a half ounces calomel with one-half pound urea; and another receiving one and a half ounces corrosive sublimate and one-half pound urea. All of these plots controlled brown-patch equally well. Nu-Green proved to be effective against brown-patch, but we hesitate to give it our full endorsement, due to the fact that in purchasing fungicide and fertilizer in this particular form one pays an excessive amount for the nitrogen it contains.

Mercury Compounds with Arsenate of Lead

A number of clubs have recently treated their greens with arsenate of lead for grub control. The question was raised as to whether this chemical would in any way affect the action of the mercury compounds in checking brown-patch. Our tests at Arlington have indicated that arsenate of lead alone will not check brown-patch. Applications of different mercury compounds to soil which had been poisoned with arsenate of lead were as effective against diseases as like applications on soil which had received no lead treatments.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, OF THE BULLETIN OF THE UNITED STATES GOLF ASSOCIATION GREEN SECTION, PUBLISHED MONTHLY AT WASHINGTON, D. C., FOR OCTOBER 1, 1927.

District of Columbia, ss:

Before me, a notary public in and for the District of Columbia personally appeared G. T. Cunningham, who, having been duly sworn according to law, deposes and says that he is the business manager of The Bulletin of the United States Golf Association Green Section, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business manager are: Publisher, United States Golf Association, 110 East Forty-second Street, New York, N. Y.; editor and managing editor, R. A. Oakley, Washington, D. C.; business manager, G. T. Cunningham, Washington, D. C.

2. That the owner is the United States Golf Association, a corporation organized and existing under the law not for profit and having no capital stock.

3. That there are no outstanding bonds, mortgages, or other securities.

(Signed) G. T. CUNNINGHAM, Business Manager.

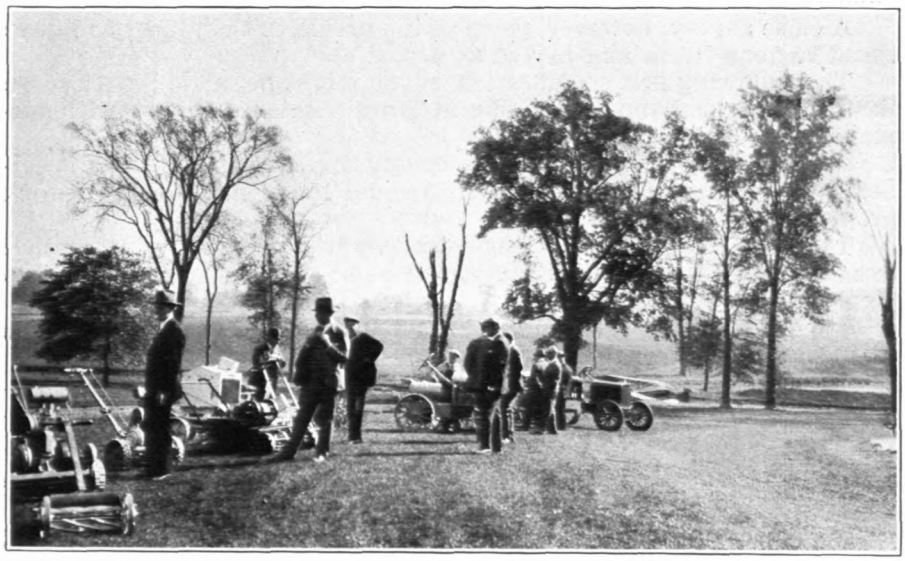
Sworn to and subscribed before me this 22nd day of September, 1927.

(Seal) (Signed) BERNARD CONNOR.

(My commission expires July 30, 1932.)

Demonstration of Equipment at the Shackamaxon Country Club

A demonstration of golf course equipment sponsored jointly by the New Jersey State Golf Association and the Service Bureau of the Metropolitan Golf Association at the Shackamaxon Country Club, Westfield, N. J., on October 27, was most interesting and attended by approximately 250 greens committee chairmen and greenkeepers. Miscellaneous golf course equipment and supplies were on exhibition throughout the day. After luncheon there were demonstrations of tractors and fairway units, compost machines, power mowers, hand mowers, greens mowers, greens topdressers, fairway topdressers, sprinklers and worm eradicators.



Thirty-three manufacturers or dealers exhibited equipment, and an interesting innovation in golf course machinery made its appearance in a tractor-drawn triplex putting green mower.

In the evening the club entertained the visitors at dinner. Mr. B. R. Leach then gave a talk on Japanese beetle control, during which the point was made that the Metropolitan District was subject to infestation not only by the Japanese beetle but also by two similar species which have been found in Connecticut.

Golf Course Architecture and Construction.

Specifications. By William S. Flynn

In addition to laying the course out and designing holes that hold the interest of the player, the architect must prepare specifications for the construction of the course along with his plans.

Specifications for the building of a golf course cannot be made as definite as for the building of a house or bridge for obvious reasons. While no two courses are similarly designed, yet in most cases acreages to be prepared are more or less the same.

For instance, in 18-hole golf courses the amount of actual fairway to be prepared will hardly vary over 5 percent. The same applies to rough, etc. The amount of material to be moved in building greens, tees and bunkers can be very easily figured from the architect's plans and the quantities of the various materials required, such as seed, fertilizer, stolons, tile, etc., can be very easily estimated from the acreages on which each is used.

On the face of it, it would seem hard to the layman to figure out what the cost of a golf course would be from the architect's specifications, but one with experience in this class of work over a period of years becomes so familiar with the problems involved that figuring it becomes more or less simple. The items that help increase the cost of golf courses are clearing, rock excavation or covering, water supply and drainage.

A close survey, however, permits the architect's engineer to figure these various items and arrive at a cost.

The following is a specification which might be made for a course in the New England or Middle Atlantic States, coupled with explanations:

Architect.—The course is to be constructed as per plans and specifications of (architect's name) made and to be made as the work progresses.

The architect is to make periodical visits during the construction to see that the work is being carried out in accordance with his plans and specifications.

When the course is completed, it must pass the final inspection of the architect before being accepted for the club.

The building of a golf course, while primarily a construction job, is really more like painting a picture from the architect's standpoint. As the construction progresses, he may see flaws that, if corrected or modified during the construction, complete the picture. In other words, the architect's job is to fit his course to the ground, and he should have the liberty of modifying the original plans so as to produce the best possible job.

Greens.—The sub-contours of the greens shall be fashioned as per plans. The greens at this point must pass the inspection of the architect before further work is done on them. After approval of subgrades the green is plowed and probed for stones, and stones four cubic inches and over are taken out. Following this operation topsoil is placed to a depth of not less than six inches over the surface of the green. Well-rotted manure (*) cubic yards per thousand square feet shall be spread over the surface of the green and thoroughly disced in. If, in the opinion of the architect, any green should require additional manure, it shall be applied in accordance with his orders.

Following these operations the greens are prepared for planting in the customary manner.

Great care should be taken that no surface pockets exist on the greens, and to avoid this the gradients should be checked with a level.

Before planting, organic fertilizer (tankage) shall be applied at the rate of (*) pounds per thousand square feet, after which the green shall be planted with a proven strain of creeping bent stolons or any grass seed acceptable to the club.

The architect in designing his greens provides for the material to be taken principally from the bunkers adjacent to the greens, except where the green is cut into a slope, in which case the cut generally takes care of the fill. In

cases where the bunkers are not sufficiently large to accommodate the fill for the green, he designates where this fill is to come from. Generally this is taken from a point in close proximity to the green, but out of the line of play. Wherever material is taken from that area is prepared and seeded similar to the rough.

Fairways.—Fairways indicated on the plans shall be cleared where necessary, said clearing to pass the inspection of the architect.

Playing areas indicated shall be plowed to a depth of not less than eight inches, and shall be disced from time to time and kept fallow until ready to be planted.

Playing areas shall receive an application of not less than (*) cubic yards of manure per acre. If it is necessary, in the opinion of the architect, to apply additional manure per acre on any area, it shall be done in accordance with his orders.

Manure shall either be thoroughly disced in or plowed in and incorporated with the soil.

Playing areas are prepared for planting and a fine seed bed made by sufficient cultivation.

Before planting playing areas shall receive an application of organic fertilizer (tankage) at the rate of (*) pounds per acre.

Playing areas shall be planted with a mixture of four parts Kentucky bluegrass and one part recleaned redtop at the rate of 150 pounds per acre. An additional 10 pounds of South German mixed bent per acre shall be mixed with the above.

Rock ledges shall be covered with at least six inches of soil and an additional four inches of topsoil, as directed by the architect.

Removing of stones and roots in fairways is included under the heading of clearing.

Tees.—Tees other than those shown on the plan may be put in by the architect, but the total number to be built shall not exceed 45 in number.

Tees should conform as much as possible with the existing natural surface, but should it be necessary to build artificially the only requisite is to make them practically flat with enough slope to take care of surface drainage.

Banks and slopes outside the tees, where practicable, should be constructed in such a way as to make it possible for them to be cut with a tractor mower.

The preparation of the tees for planting should be practically the same as the putting greens. Well-rotted manure (*) cubic yards per thousand square feet shall be spread over the surface of the tee and thoroughly disced in.

Great care should be taken that no surface pockets exist.

Organic fertilizer (tankage) shall be applied at the rate of (*) pounds per thousand square feet before seeding, after which the tees are seeded with four parts Kentucky bluegrass and one part recleaned redtop at the rate of 200 pounds per acre.

It is not necessary in building tees to have any particular slope, the player has the advantage of teeing his ball, which should be sufficient help. A tee may very readily pitch forward, backward to the right or left, and be a suitable tee so long as it does not hold surface water.

Rough.—All rough areas between tees and fairways and approximately 12 yards on either side of the fairways shall be plowed, after which they are prepared for seeding and seeded with a 50 percent mixture of sheep's fescue and recleaned redtop at the rate of 75 pounds per acre. The preparation of the rough shall be similar to

that of the fairways except that the application of organic fertilizer (tankage) and manure shall be eliminated.

All back slopes of the greens shall also be seeded in the above manner.

Rock ledges coming in the rough shall be covered with at least six inches of soil, as directed by the architect.

The object of keeping the fertilizer out of the rough is to make the growth as sparse as possible. The grass seed used, sheep's fescue, produces a tufty growing grass, which generally presents a bad lie, keeps the cost of upkeep down, and reduces ball hunting to a minimum.

Bunkers.—All mounds or bunkers adjacent to greens must be built in conjunction with green construction and be properly drained either by surface or tile.

Fairway bunkers other than those shown on the plan may be built or designated by the architect and drainage shall be taken care of either by surface or tile.

All slopes of bunkers, mounds, etc., shall be seeded with the same mixture as used for seeding the rough and at the same rate.

A ribbon of sod shall be used to outline the limit of sand in all bunkers.

Bunkers should be designed and built so as to keep surrounding surface water from running into them and to let what water falls in them drain off naturally. Nothing interferes more seriously with the game than water in a bunker, and tile drain, while correcting the condition to a certain extent, does not permit the water to drain off rapidly enough to overcome this situation. Outlining the bunkers emphasizes the architect's ideas and gives the course the character which he has planned for.

Drainage.—Tile drains shall be put in to take care of drainage of greens and fairways wherever found necessary.

If springs show up after ground has been broken in construction, same shall be taken care of with either tile or French drains.

Before a bid is made on the construction of the course the architect, with his engineer, determines where drainage is necessary and the amount required.

Water System.—A dam shall be installed along the creek on the property at the point determined by the architect. This dam shall be so constructed as to provide and insure the storage of enough water to produce not less than 300 gallons per minute at any time. A power plant shall be installed in connection with this for pumping the water to fairways, greens and tees of a capacity not less than 300 gallons per minute.

This water shall be piped so as to water all fairways, greens and tees. The pipe to be of sufficient size to take care of friction and distribute the 300 gallons per minute over the course in the customary manner.

The pipe line shall have outlets along the fairways either 75 or 100 feet apart, as designated by the architect, and shall have outlets at greens and tees.

A complete sprinkling system shall be installed with this plant to take care of the watering of greens, tees, and fairways, and must include all necessary hose. The complete water and sprinkling systems must be installed and be in operation prior to the planting of greens and tees.

In conjunction with the water system the architect's engineer prepares a plan showing pipe sizes and amounts to cover the above.

Clearing.—All trees, stumps, roots, bushes, vines, stones, stone walls, interior fence lines, and other obstructions coming in the line of play, exclusive of buildings, shall be removed to the satisfaction of the architect. Removal of buildings must be disposed of under separate contract.

Practice Field.—The practice driving field shall be plowed and prepared similar to the fairways, except the amounts of material may be reduced at the option of the architect, and shall be seeded with a mixture of four parts Kentucky bluegrass and one part re-cleaned redtop at the rate of 150 pounds per acre.

The application of manures is generally omitted in preparing the practice field.

Practice Green.—The practice green shown on the plans shall be built identically the same as the other 18 greens and planted similarly.

Grass Seed.—All grass seed used on the course shall be analyzed for purity and germination by the United States Golf Association Green Section or some reliable seed laboratory.

Temporary Ditches.—Temporary ditches shall be installed as indicated by the architect wherever necessary to prevent excessive surface wash on fairways. These ditches shall be left open until the rainy season is over in the spring of ....., at which time they shall be filled up and sodded by the club's organization at the club's expense.

Regardless of what specifications are made for the building of a golf course, the club must depend upon the integrity of its architect for the kind of course they will get.

The club first of all places confidence in the architect, and he would be a poor example of manhood who would take advantage of such a situation.

The same thing applies in the making of a contract for the construction of the course. The club puts itself in the hands of the contractor, after having decided on who is to build the course. No matter how rigid the specification there is always an opportunity to beat it, and no contract has ever been written but what can be driven through with a horse and cart by some smart lawyer.

The most important thing in a contract is for each party to understand the other. The contractor indicates in the contract what he is going to do and the club understands exactly what he means. Boiled down it is nothing more than "faith." If a club finds that an architect or contractor has been unscrupulous in his dealings, they should not hesitate to tell the world. On the other hand, when relations have been amicable and a good job has resulted, the club should not hesitate to pass the word along.

*** In view of the fact that amounts of materials vary with the course these have been omitted in this specification in order to avoid confusion.**

Lime carbonate in sand.—A number of clubs are submitting samples of sand to chemists for analysis and are having more complete analyses made than are necessary. Determinations of the content of silica, iron, alumina, etc., are unnecessary. It is only the amount of lime carbonate, the so-called calcium carbonate equivalent, which affects the reaction of the soil, because it is lime in this form

which makes the soil less acid. This determination is quickly made and the cost should not exceed several dollars. Sands containing more than several percent of lime carbonate should be looked upon with suspicion, if clover control is desired in greens.

If samples of representative sand are sent to O. J. Noer, 304 Breeze Terrace, Madison, Wis., lime carbonate determination will be made without charge, and results will be reported in a future issue of THE BULLETIN.

"Most of the areas in front of a green should be level and true; but there are holes where slight ridges, little swales and swells, the latter often barely raising their heads, may be used to call forth a variety of fine shots."—*The Links.*

Drainage adds no plant food to the soil, except the nitrogen that certain plants gather from the air, which replaces the water drained away. But the presence of air and the higher temperature induce the growth of bacteria that release certain food elements from insoluble compounds and make them available for the use of plants. In this way does drainage increase the fertility of soils. Moreover, a drained soil offers a deeper feeding ground for the plants. The roots of most cultivated crops will not go into a saturated soil, and will die if kept in water without air for more than a short time.

"To make great holes, hazards need not be numerous. A few well placed are quite sufficient to arouse any amount of lively interest and to call forth shots of which the best golfer may well be proud."—*The Links.*

QUESTIONS AND ANSWERS

All questions sent to the Green Section 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 Section.

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.

Pig manure as a fertilizer.—We have difficulty here locating or procuring any other kind of fertilizer than pig manure. Can it be used at all on the golf course? (Illinois.)

ANSWER.—Inasmuch as pig manure is somewhat difficult to handle we would suggest that you compost it with top soil and use it after the mixture reaches a consistency where it can be spread easily. Pig manure is a very valuable fertilizer. The only objection to it is the difficulty of handling it.

Copper sulfate in water.—We have just completed installing 18 grass greens. We have also just built a swimming pool. The water for the 18 greens is furnished through a pressure system from the

swimming pool. The capacity of the pool is 134,000 gallons, and the water quickly becomes unsightly for swimming, due to the rapid growth of a green moss or algae. To combat this, we use 30 ounces of copper sulfate every other day. Nine greens are sprinkled per day, and approximately 67,500 gallons of water from the pool are used for the nine. Will you kindly advise us if the amount of copper sulfate used is injurious to the grass, as it would be ruinous to our approaching playing season to have anything happen to these new greens? (Arizona.)

ANSWER.—According to the figures contained in your letter, you are using 30 ounces of copper sulfate every other day in the pool, which contains 134,000 gallons of water, and that you use approximately 67,500 gallons of water every day for watering nine greens. This means that you are applying an average of 1 2/3 ounces of copper sulfate to each green every other day, and assuming that you water each green 150 days in the year you are applying an average of a little over 15½ pounds to each green per year. This is too much copper. We believe that it will only be a period of a few years at the most before you will have an accumulation of copper in the soil which will be very detrimental to the turf grasses.

Sand as a winter topdressing of putting greens.—In the BULLETIN, November, 1925, page 262, answer to question 7, you advise against the use of sand on putting greens for winter covering. Several years ago the greens on our course were extremely hard, and, in my judgment, required more sand to improve the mechanical condition of the soil. We have dressed the greens in the early winter for several years with a light dressing of sharp sand. I think it has improved the condition of the soil materially. We plan to dress them again this winter unless you advise against it in our particular case. We intend to apply only about one cubic yard of sand to a green, just about enough to lessen the slippery condition of the grass when the greens are used after light frosts. We topdress our greens pretty heavily in the early spring and fall and about monthly through the playing season. Would you advise us to use a winter dressing of loam instead of sand? We prefer to avoid the use of loam so that the greens may be as playable as possible most of the winter. (Pennsylvania.)

ANSWER.—We do not see any way to avoid the use of light dressings of sand where greens are played on in winter. In our judgment, sand is the best material to use for this purpose. We have always advised, however, against heavy applications of sand, and, as we stated in the paragraph to which you refer, "when sand is used as a topdressing the tendency is to use it altogether too liberally." In many cases it has been found that the use of sand, especially on a heavy soil, results in a sort of cement forming on top of the surface. We have seen putting greens covered with a half-inch dressing of sand. If pure sand is used, a mere coating is all that is necessary, as anything like even one-eighth of an inch covering is certain to do the greens harm. If you apply a thin coating of sand to your greens in the winter, we would advise you to scratch the surface of the soil well in the spring before applying your topdressing of compost, in order to break up the coating on the surface which the sand will in all probability leave.

AS WE FIND THEM

Heard one greenkeeper say, "This modern scientific stuff is the bunk, and I'll have nothing to do with it. Didn't I take care of a good golf course years before there was any scientific greenkeeping? They can't tell me anything about running greens."

A fellow greenkeeper promptly answered, "I suppose if you were Noah returning to this world today you would say, 'This modern scientific navigation is just fairy tale stuff. Didn't I take a successful cruise years before science cluttered up ships with steam, oil, electricity, radio, and all that other trash. They can't tell me anything about running big boats.'"

Another guardian of the greens told me he didn't regard ammonium sulfate as a fertilizer, and therefore had decided to quit using it. Someone had told him the only thing worth while in ammonium sulfate was the nitrogen. Someone else told him nitrogen was a gas and that air was full of it. Promptly he put two and two together to make sixteen and concluded "a gas can't be a fertilizer; therefore ammonium sulfate is not a fertilizer."

Let's hope no one tells that fellow that nitrogen is one of the chief components of human foods (proteins). Such a theorist might decide to economize and depend on the air for his personal nitrogen supply. It surely would cut down his living expenses, for he could then give up all meats, fish, eggs, milk, beans, peas, and the like.

Still another admitted earthworms were exceptionally numerous on his greens. He knew he could get rid of them, but "Nature put them there, and they must have some purpose. I am not going to interfere with Nature." How we do admire such devoted reverence to Dame Nature. But wait till the club members get wise to that sweet sentiment. May we hope Nature never sends that greenkeeper one of her masterpiece donations—a human tapeworm.

One keeper of the greens remarked, "This fuss about different grasses and different strains of grasses is just some more of that scientific tommy-rot. They can talk about grass strains all they want to, but, after all, 'grass is grass.'"

How true that is! Likewise "A car is a car," though there be Fords and Packards, trolley cars and kiddie cars.