

Bulletin of the Green Section of the U. S. Golf Association

Vol. IV

Washington, D. C., April 16, 1924

No. 4

A MONTHLY PERIODICAL TO PROMOTE THE
BETTERMENT OF GOLF COURSES

CONTENTS.

	Page
Cooperative Purchasing	86
New Member Clubs of the Green Section	86
Operating a Nine-Hole Course With Five Men. By W. R. Hurd, 2d	87
Brown-Patch Investigations. By R. A. Oakley	87
Watering the Fairways. By Wm. F. Brooks	92
The Green Section Loses Carrier	97
The Japanese Beetle and Its Relation to Golf Courses. By B. R. Leach	97
Grass Experiments at Rothamsted, England. By C. V. Piper	101
Questions and Answers	104
Meditations of a Peripatetic Golfer	108

MEMBERS OF THE GREEN COMMITTEE OF THE UNITED STATES GOLF ASSOCIATION

*C. V. PIPER, Chairman	Washington, D. C.
J. E. A. OAKLEY, Vice-Chairman	Washington, D. C.
*E. J. MARSHALL, Vice-Chairman	Toledo, Ohio
W. A. ALEXANDER	Fort Sheridan, Ill.
FRANK B. BARRETT	Deal, N. J.
A. C. U. BERRY	Portland, Oreg.
J. K. BOLE	South Euclid, Ohio
WM. F. BROOKS	Minneapolis, Minn.
C. B. BUXTON	Dallas, Texas
A. H. CAMPBELL	Toronto, Ont.
N. STUART CAMPBELL	Providence, R. I.
W. C. FERGUSON	Normandy, Mo.
WM. C. FOWNES, JR.	Pittsburgh, Pa.
*DR. WALTER S. HARBAN	Washington, D. C.
DR. THOS. P. HINMAN	Atlanta, Ga.
A. J. HOOD	Detroit, Mich.
FREDERIC C. HOOD	Marion, Mass.
NORMAN MACBETH	Los Angeles, Cal.
P. D. MAXWELL	Ardmore, Okla.
SHERILL SHERMAN	Utica, N. Y.
JAMES L. TAYLOR	Manchester, Vt.
*WYNANT D. VANDERPOOL	Convent Station, N. J.
*ALAN D. WILSON	Clementon, N. J.
FRANK L. WOODWARD	Denver, Colo.

*Executive Committee member.

ADVISORY MEMBERS

James D. Standish, Jr., Detroit, Mich.

Hugh I. Wilson, Merion Cricket Club, Haverford, Pa.
F. H. Hillman, Washington, D. C.

W. R. Walton, Washington, D. C.
Lyman Carrier, Washington, D. C.

Published by the Green Committee of the United States Golf Association, 456 Louisiana Avenue, Washington, D. C. Editorial Offices: P. O. Box 313, Washington, D. C.

Subscription price: To golf clubs that are members of the Green Section of the U. S. Golf Association, \$4.00 per year (included in membership fee).

Entered as second-class matter December 16, 1921, at the postoffice at Washington, D. C., under the Act of March 3, 1879. Copyright, 1924, by the Green Committee of the U. S. Golf Association.

Cooperative Purchasing

The success of the cooperative purchasing bureaus of the Golf Association of Philadelphia, the Cleveland District Golf Association, and the Chicago District Golf Association has led to a movement in the Long Island Golf Association looking toward the establishing of a similar bureau for the golf clubs which are members of the Long Island association. In a statement issued February 15, 1924, from the office of the Secretary of the Long Island Golf Association, 280 Starr Street, Brooklyn, Mr. Wesley M. Oler, Jr., president of the Association, estimates that at least 20 per cent can be saved by each club on its total purchases, by means of a cooperative purchasing bureau. The plan is to have requisitions printed and issued to each club, with order blanks to be issued by the purchasing agent to the vendor. All prices will be checked by the purchasing agent and bills forwarded to the chairman of the green committee or of the house committee of each club for approval and payment. It will be required that all purchases, except the very insignificant ones which may be made from the club's petty cash, shall pass through the purchasing bureau. In this way representatives of vendors will be compelled to call upon the association's purchasing agent, who, by reason of his familiarity with the quality and kinds of materials needed, and his facilities for grouping the clubs' requirements, will be in a position to obtain lower prices, better qualities, and more satisfactory deliveries. It is intended to include in this arrangement the purchasing of grounds and house supplies and equipment, but not commissary supplies. The purchasing agent of a large corporation has offered his service free of charge as purchasing agent of the cooperative bureau. The only expense to the clubs will be printing, stationery, and stenographic hire, this expense to be pro-rated among the clubs according to the gross amount of purchases made. The opportunities for savings in time and money through the agency of cooperative purchasing bureaus are very great. It is believed that golf associations interested in this feature will obtain helpful suggestions by acquainting themselves with the experiences of the Philadelphia, Cleveland, and Chicago associations, the offices of which are at the following addresses: Golf Association of Philadelphia, 214 West Washington Square, Philadelphia; Cleveland District Golf Association, 603 Newman-Stern Building, East 12th Street and Walnut Avenue, Cleveland; Chicago District Golf Association, 108 South La Salle Street, Chicago.

NEW MEMBER CLUBS OF THE GREEN SECTION.—Sunset Hill Golf Club, Ossining, N. Y.; Port Chester Country Club, Port Chester, N. Y.; Burlingame Country Club, Burlingame, Calif.; Lebanon Country Club, Lebanon, Pa.; Bourbon Country Club, Paris, Ky.; Miami Municipal Golf Links, Miami, Florida; Moila Golf and Country Club, St. Joseph, Mo.; Oakdale Country Club, Rumford, Maine; Mayfair Golf and Country Club, Edmonton, Alberta; Beaumaris Golf and Tennis Club, Beaumaris, Ontario; Corpus Christi Golf and Country Club, Corpus Christi, Texas; Valparaiso Golf Club, Valparaiso, Chile; Moon Brook Country Club, Jamestown, N. Y.; Interlaken Golf Club, Fairmont, Minn.; Country Club of New Bedford, New Bedford, Mass.; New Albany Country Club, New Albany, Ind.; North Shore Golf Club, Glenview, Ill.; Colonial Country Club, Greenwich, Conn.; Sequin Golf Club, Hartford, Conn.; Shreveport Country Club, Shreveport, La.; Houston Country Club,

Houston, Texas; Southington Country Club, Southington, Conn.; Dedham Country and Polo Club, Dedham, Mass.; Sequoyah Country Club, Oakland, Calif.; York Country Club, York Village, Maine; Manufacturers' Country Club, Orelan, Pa.; Williamsport Country Club, Williamsport, Pa.; Humboldt Golf and Country Club, Eureka, Calif.; Hyde Manor Golf Club, Sudbury, Vt.; Milburn Country Club, Baldwin, N. Y.; Tumble Brook Country Club, Hartford, Conn.; Spartanburg Country Club, Spartanburg, S. C.; Augusta Country Club, Augusta, Ga.; Waseca Lakeside Club, Waseca, Minn.

OPERATING A NINE-HOLE COURSE WITH FIVE MEN.—I have not seen any discussion in THE BULLETIN as to the number of men required to operate a 9 or an 18-hole golf course, keeping the course in fair condition, and not throwing money away like water as appears to be done by the majority of clubs. I have found that we can operate our 9-hole golf course with a greenkeeper and four other men. One of these men is an all-round mechanic who likes to work out of doors in the summer. I figure that one man can take care of three greens and tees easily, including the weeding. Another man drives the tractor, which requires only two days a week, leaving him available also to drive our truck and cut the rough. The rough is cut on the average not oftener than once every two months. The cutting is done with a bar mowing attachment fitted to the tractor. This leaves the man also plenty of time to haul compost to the greens and run our manure grinder and pulverizing machine used in making compost. During seasons of the year when the grass is not growing rapidly, this man's time is devoted to the improving of bad spots on the fairways and rough, as well as to miscellaneous work which is always turning up on a golf course. We have found that with 5 men the labor charges against the course run between \$4,000 and \$5,000, depending on the length of the playing season. We are adding 9 holes to our course and building them with our own tractors and men. We have had some tough propositions to overcome, but it looks as if we would build these new 9 holes for about \$30,000, which covers also the cost of the equipment bought to build the holes and maintain the course after it is finished.—*W. R. Hurd, 2d, United Shoe Machinery Athletic Association, Beverly, Mass.*

Brown-Patch Investigation

By R. A. Oakley¹

Possibly it would be well first to outline a sort of background upon which to sketch this subject of brown-patch and its control. I have reference now to the disease we call the large brown-patch. As many of us know, there are two kinds of brown-patch. We have designated them the large brown-patch and the small brown-patch. But more about this later. For the present when brown-patch is mentioned, the large kind is meant unless otherwise specified.

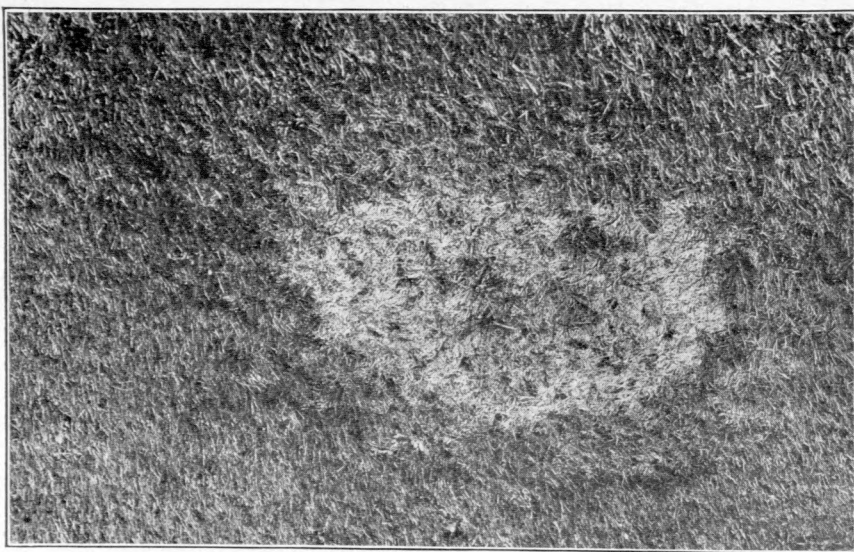
Some of us may not be entirely familiar with the history of the disease, or, in fact, with a demonstration of its destructive manifestations. Therefore I will give briefly something of its history.

In 1914 the late Fred W. Taylor, well known for his experiments with putting greens and putting green grasses, called Dr. Piper's attention to a condition that obtained on the lawn at his home in Chestnut Hill.

¹ In this article Dr. Oakley presents in substance his address delivered before the annual meeting of the Green Section in New York City January 5, 1924.

Pennsylvania. Circular areas of turf varying in size from approximately 4 inches to 2 feet in diameter had turned brown, and much of the grass within these areas was killed. While it was evident to us from the first that the patches were caused by some organism, it was not until 1915 that the causal organism was found. By the use of well-known laboratory methods, the organism was isolated—that is, separated from the organisms that were present in the turf with it. Careful examination proved it to be a fungus which lives and completes the various phases of its existence in the soil. The botanical or technical name of this fungus is *Rhizoctonia solani*. It is one of the organisms that cause blight in potatoes, and it attacks at least 500 different species of plants.

For the benefit of those who have not seen the brown-patch in action, it may be well to say that it attacks turf of bents and fescues, caus-



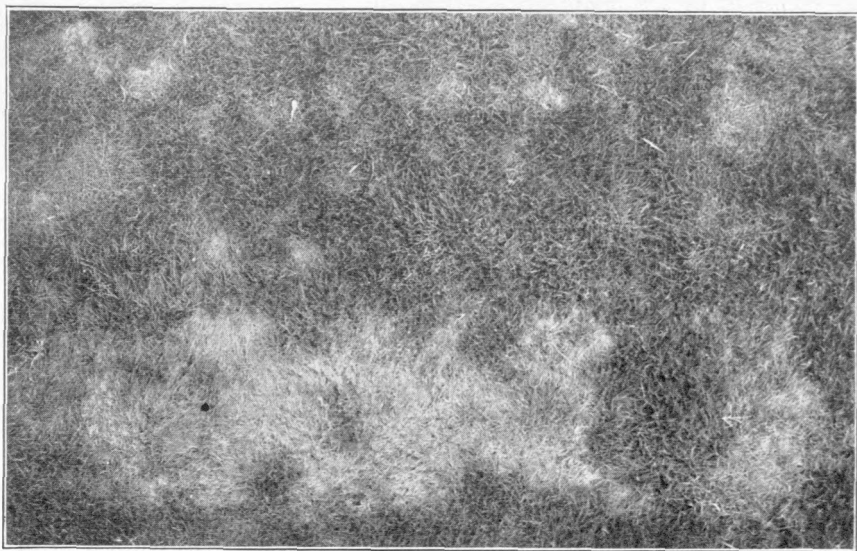
A single large brown-patch. Note the circular pattern and fairly definite margin.

ing areas of 4 inches to 2 feet or more in diameter to turn brown. It spreads from the original point of attack in more or less concentric circles. It is the cobweb-like growth of this fungus spreading over the leaves of the grass that kills or seriously injures them. This cobweb-like growth is called mycelium. It is plainly visible in the early morning when the fungus is active. Sometimes it is so abundant that it makes a fluffy mass of an inch or more in thickness.

The brown-patch fungus is rarely troublesome except in very hot weather, particularly hot humid weather. In the latitude of Washington, D. C., it is more or less prevalent from May to October. Careful observations indicate that the growth of the cobwebby mass, or the mycelium, is favored by hot, humid, quiet atmosphere. Bright sunlight seems to check its growth, and wind or any other agency which agitates it seems to make it less active. It is probable that the fungus makes most of its growth in the early morning before sun-up, but it has been observed in active condition as late as 10 o'clock on hazy or partly cloudy mornings.

In freshly attacked grass the patches appear with a distinct smoky margin and look not unlike they might have been caused by the pouring on of boiling water. Generally the patches are very distinct and in many cases regular in outline; however, when the attack is light the leaves of the grass may be only slightly brown and the margins of the spots not readily discernible.

In most cases where the patches are irregular in outline, this is due to the fact that two or more patches have united by spreading. The brown-patch fungus being a kind of plant, has the ability, as have other living organisms, of producing itself or providing for the continuance of its existence by the formation of reproductive bodies on the cobweb-like growth. They are called sclerotia, or resting bodies, and are of the nature of seeds. They are small black bodies of a corky texture, which



Brown-patch in fescue turf. The large diseased area is formed by the union of several individual patches.

have the ability to remain alive in the soil for a long time. From them, new growth is produced. The fact that these resting bodies are corky in texture is highly important, as it makes them very resistant to fungicides.

Let it be understood that not all species of grasses are subject to brown-patch. Some are immune, or at least nearly so, and, as luck would have it, they are not very good putting green grasses for our northern courses. Kentucky bluegrass, our best fairway grass, is practically immune. Crab grass, our worst putting green weed, goes scot-free, so to speak. Red fescue is very susceptible, as are likewise the bents. In the case of the latter, certain strains are more resistant than others. Redtop is not as susceptible as are the bents. *Poa annua* is very susceptible, as is likewise *Poa trivialis*. Bermuda grass seems to be immune, likewise white clover.

So much for the disease and its symptoms; now for its effects and treatment. Briefly, by proper treatment, which will be discussed later, it is possible to restore the grass within a few weeks after severe attacks.

Without proper treatment the grass would be, and frequently is, killed. As for the treatment, an efficient preventive is what is desired, one which when applied in the spring will prevent brown-patch for the entire season or at least for a long time. Such a treatment, to be effective, must kill or at least impair the vitality of the resting bodies, so that they will not produce the mycelium that injures the grass. But so far we have been unable to find a chemical that will kill the sclerotia and not impair the turf. The corky nature of the sclerotia makes them nearly impervious to the chemicals that are commonly used, a condition not encountered with a large number of other kinds of sclerotia which have been experimentally treated with fungicides. Thus far we have made little progress in the developing of preventive treatments with a view to killing the seed-like bodies.

Most of us are familiar with Bordeaux mixture and its use for controlling brown-patch. In a sense, it may be regarded as a preventive, but it must be used very frequently and systematically to be thoroughly effective as a preventive. Bordeaux does not appear to injure the seed-like bodies of the fungus in the slightest degree, but if it is on the leaves of the grass it will prevent the growth of the mycelium. Now this is the point to bear in mind, that to be effective Bordeaux must be on the leaves and not on the roots, as some have suggested. As far as we know, the disease attacks the above-ground parts of the grass only. The soil may be literally charged with Bordeaux, but if it is not on the leaves the fungus is not injured by it. Bordeaux dust is more economical to apply than the liquid. The latter has one advantage, however, in that it sticks to the leaves better than does the dust. While to be effective Bordeaux must be applied frequently, a light dusting, not to exceed 1 pound to 5,000 square feet, is all that is required in one application. Heavy applications are wasteful and likely to prove harmful if continued. Please bear in mind that too much Bordeaux can be used, and therefore I warn you to use care in this connection. The injury from excessive applications of Bordeaux does not appear until the following winter or spring; but it is likely to be serious. In fact, in bad cases the practical thing seems to be to remove the injured turf and plant or seed again. Bordeaux is the first fungicide we recommended for brown-patch, and thus far we have found nothing better.

Taken altogether, we have done quite a lot of experimenting in connection with brown-patch control. In the fall of 1921 we planted plats of pure strains of creeping bent and velvet bent, vegetatively, for the purpose of using the turf for brown-patch experiments. In 1922 and 1923 we tried a great many things on these plats; and let me emphasize this fact, that in no case was a treatment given except in the vicinity of a non-treated plat with which to compare the results of the treatment. Unfortunately for our investigations, the brown-patch was not very troublesome on these plats in either 1922 or 1923; so a number of the treatments did not have a fair test. The treatments that did not will be repeated. A list of the things we tried may be of interest to you. I shall not discuss all of the treatments, but will comment on some of them and merely mention the others.

Among the chemicals containing copper, we have tried Bordeaux mixture, copper sulfate (or bluestone, as it is commonly called), copper soap compound, and copper carbonate. We had hoped for the success of the copper soap compound, because it is a sort of sticky substance and

we thought it would stick to the leaves of the grass better than would the Bordeaux; but it did not prove to be as efficacious as Bordeaux. In fact, Bordeaux has proved the best of all the copper compounds we have used thus far.

A number of sulfur products were used, including flowers of sulfur, sulfuric acid, the polysulfides, sodium hyposulfite (or what photographers call hypo), and lime-sulfur spray mixtures. None was helpful, and some, especially flowers of sulfur, were positively detrimental. Both corrosive sublimate (mercuric chloride) and calomel (mercurous chloride) were tried, the former in various ways, in solution, directly, and absorbed by charcoal and other absorbants. There were no indications of beneficial results from the mercury salts. Speaking of charcoal, we tried it also, quite thoroughly I think, because so much had been said about it, but it neither helped nor hindered so far as we could determine.

Baking soda was tried, and it killed the grass quickly. The next time we try, if we ever do again, we will use a very light application, not more than two or three pounds to 1,000 square feet.

Zinc oxide, zinc sulfate, and zinc chloride were applied in light doses. The results in the main were harmful, particularly in the case of zinc oxide, which injured the grass permanently quite as badly as the copper salts.

Lime, of course, was tried particularly with the view of making the soil alkaline. On the adjoining plats we used aluminum sulfate, a substance similar to our common alum. This was used primarily to acidify the soil. We were trying to find out whether the brown-patch fungus prefers an acid or an alkaline soil. Our results to date have not shown it to have much preference. Formalin gave no promise of help. We tried many other things, among them potassium permanganate, with which we are still working.

In the latter part of the summer of 1923 we tried a number of complex mercury compounds, but we did not have sufficient brown-patch attacks after they were applied to give them a fair test. We hope to try them thoroughly the coming year. One in particular is being advertised quite extensively now and doubtless will be tested fully by golf clubs in the brown-patch belt.

What I have given you here is for the most part a list of disappointments; but we really got more than that out of our investigations. We have found that, contrary to our earlier belief, liberal watering, especially early morning watering, is beneficial in keeping brown-patch in check and, I might also say, in bringing about recovery of the grass after attacks.

This leads me to another feature of our investigations, that of treating brown-patch infected grass. Light top-dressings of good composts of a loamy nature to which is added some quickly available nitrogenous fertilizer—blood meal, for example, or some similar organic compound—are of great help. If, however, organic fertilizers are not procurable, ammonium sulfate may be employed, if used with care—not more than $\frac{1}{2}$ pound to 1,000 square feet of green, and watered in immediately to prevent burning the grass. This treatment, I think, is entirely sound, and if it is followed it will help greatly to overcome attacks of brown-patch.

Our suggestions now for the treatment of the large brown-patch are therefore as follows. Be on a sharp lookout for it during hot, humid weather. Water your greens freely, in the early morning if you can,

but water them thoroughly no matter at what time of the day you can do it. Use Bordeaux systematically and with wisdom, in the manner above suggested. It is necessary that the Bordeaux dust or spray be on the leaves of the grass in order that it may be effective—do not forget this. Also do not forget that it is possible to poison grass with heavy applications of Bordeaux. When grass is attacked by brown-patch, top-dress it lightly with good compost to which a little ammonium sulfate, or preferably some quick-acting organic nitrogenous fertilizer such as blood meal, is added. This treatment hastens recovery of the grass.

Some of the strains of creeping bent are much more resistant to brown-patch than are others, and when properly treated these usually recover more quickly than the more susceptible strains.

When all is said and done, the large brown-patch can be fairly well controlled in a majority of cases, and controlled in such a way that the grass will not be permanently injured by it. But the small brown-patch—well, that is different. There are some who are of the opinion that it is not caused by an organism; but evidence that it is caused by an organism seems to me to be convincing. I do not think the causal organism is the same as the one in the case of large brown-patch. We know of no treatment that will prevent small brown-patch, but our tests indicate that the treatment suggested for grass attacked by the large brown-patch may be expected to give good results in the case of grass attacked by small brown-patch. We are continuing our investigations of both forms of brown-patch and hope to have a more cheerful story to tell you next year.

Watering the Fairways

Address Delivered by William F. Brooks, Minikahda Club, Minneapolis, at the Annual Meeting of the Green Section, January 4, 1923.

Mr. Chairman and Gentlemen: I want to pay a tribute to and to thank Dr. Piper and his associates for the splendid work which they have been doing and especially as it affects us in the northwestern part of the United States. Ours is a new country; most of the courses are new. There has developed recently a great interest in golf. I think there are 22 golf courses in the cities of St. Paul and Minneapolis today, and two-thirds of them have been built and organized within the last few years.

Now I hesitate to appear before an audience like this, of men so skilled and experienced in matters connected with the care of golf courses, but we in the northwest have been suffering in the last three or four years from extreme drouth, with which I hear some of you gentlemen living near New Jersey and the seaboard have not been affected.

With us, the past season has been the fourth consecutive season of excessive drouth. The records of the Weather Bureau show that in the area of which Minneapolis is the center, the rainfall for four years has been over five inches per year below normal. In the spring, when the rains were abundant, our fairways were in fine condition. As the summer heat came, however, the fairways dried up and the higher ridges became brown and burned hard.

In 1922 we conducted some experiments in breaking up or aerating by various methods the surface of the soil on these dry hard ridges. We tried a disk, but we found that an ordinary disk, with the blades set as nearly vertical as possible, would work all right on the higher ground, but as we dropped down into a hollow it would tear or mutilate the sod. We then tried a spiked harrow with the spikes set at an angle, but no matter

how great the angle of the spikes, even though they were set in the line of the cut, this machine also tore the sod. We then built a spiked roller on the principle of the spiked rollers which were used on the putting greens and with which you are familiar. This spiked roller was made out of cement poured into a cylinder of sheet iron punctured with holes at the proper places so that spikes would protrude. The spikes were $\frac{1}{4}$ -inch iron boat-spikes 4 inches long with chisel-points. The points were put in line with the direction in which the machine would be hauled. This machine worked very satisfactorily. It broke up the surface of the ground thoroughly. On certain portions of the fairway we put the machine over once, on other portions twice, and on other portions three times, running it once north and south, and another time east and west, and crossing the cuts. This broke up the soil. Our theory was that when the rains came, with the soil broken up on the surface, every drop of water would penetrate the soil and the plants would get the full benefit of the rain. It worked all right in the fall and it worked all right in the spring, but when the drouth came we found that in those areas which had been thoroughly spiked, the weeds, dandelion, and the knot-grass grew and crept in more rapidly than in the areas that had not been spiked.

We have been cutting our course for 25 years. A great many members of the club vitally interested in the course felt that we had depleted the soil by constant cutting of the grass, and that our remedy lay in fertilizing. Therefore in the fall of 1922 we spent a large sum of money in top-dressing. We hauled in hundreds of loads of good rotted manure, and spread it all over the course, and seeded. The results appeared in the late fall. The grass came up, and in the spring we were very much pleased. But again when the drouth came, this fine, tender new grass turned brown and faded away—not as badly as if it had not been fertilized, but still we lost that good growth of grass.

We then made up our minds—and it seemed to me a simple proposition—that what we ought to have was water. Our soil is good, the majority of the soil is very suitable for raising good grasses, but what we needed was water. In the latter part of April of this year (1923) I decided to try an experiment. I staked out a circular area 50 feet in diameter and selected the worst piece of fairway that we had on the entire course. It was on a high ridge with rather poor soil; it was infested with dandelions and it had areas of knot-grass, that red-stemmed wiry weed with which you are probably familiar, so very prevalent in the western part of the country. In that area were also what we call fairy rings—a fungus of the nature of a toadstool, which grows in a circle or crescent and kills the grass and apparently depletes the soil so that nothing will grow on it; there is a complete change in the chemical nature of the soil; what it is I do not know. This area, as I say, was about as poor a piece of fairway as we could select. In the center of that fairway I drove an inch-square peg, level with the surface of the ground, and divided the circle into four sectors—north and south, east and west. Where those lines touched the outside of the circle I drove another peg. We then divided each one of those sectors into halves, and drew a line, and drove a peg. We marked all those lines with a tennis marker, with white lines, so that the marks were perfectly plain on the surface of the ground.

On the 1st day of May, 1923, we started a rotary sprinkler. That sprinkler was placed on the center peg, and the greenkeeper had orders to run that sprinkler every morning from seven until eight o'clock, ir-

respective of the weather, rain or shine. Before we started sprinkling, we seeded this area. In one quarter we sowed redtop; in the next quarter, bluegrass; in the next quarter, red fescue; and in the last quarter, a mixture of 40 per cent bluegrass and 60 per cent redtop. Then in each one of these quarters, which was divided in half, we sowed the seed in different densities; that is, in half of the quarter where the redtop was we sowed at the rate of about 100 pounds to the acre, and in the other half at the rate of 200 pounds to the acre, which, of course, is intensive seeding. Then we started watering. Our fairways had already commenced to dry up in the latter part of April, when this watering was started, and by the end of May the results had become very apparent. The new seed had begun to show, and the old grass that was in there was green and healthy, and that little circle stood out from the rest of the fairway as though it had been painted with a brush.

Along the last of May and early in June the rains came, and then the rest of the fairway began to revive; and before long, when the benefit of the rains began to be felt, the surrounding fairway greened up, but it did not have as fine an appearance as the experimental area. During all this time, the area was cut with a power mower, passing over the area at the same time the surrounding fairway was cut, so that so far as the cutting was concerned it had exactly the same treatment as the rest of the fairway. Then in the middle of July the rains stopped and the drouth came on, and we kept up the watering, and this piece of ground kept getting better and better; and day by day, as we watched it, and especially early in the morning when the dew was on the grass, we could see this new grass coming up everywhere—as the greenkeeper said, “as thick as the hair on a dog’s back.” The little fine grass grew up and mingled with the knot-grass; it grew up through the areas where the dandelions were, and apparently was driving the dandelions out. The fairy rings began to show life, and they filled up, and by the 1st day of September we had as fine a piece of fairway as you gentlemen, who are all accustomed to the very best of golf courses, would want to play over. The lie of the ball was practically perfect. And this fall just before the snow came we went on to it as a temporary green. And I want to tell you gentlemen that it was a pretty fair western green at that, right in the fairway.

Now this is not hearsay; it is something I have seen and something I know. I know that if we give that land water and seed we can maintain that fairway.

Now the question which you gentlemen have in your minds is, of course, how can you accomplish this result over a fairway of 18 holes? A little experimental area of that kind is certainly simple. I do not by any means propose to have you infer for a moment that what we did was a new invention. I have played golf in California, as a great many of you have, and I have seen their irrigation out there; I have seen the apparatus which has been in use for a great many years at the Midwick Golf Club; I have seen the apparatus at the Los Angeles Country Club; I have seen the system of irrigation which Mr. Frank Woodward has installed near Denver, which is an open system with strictly an irrigation flow. With us it was a question of how we could best develop some plan along the lines of the California clubs’, and perhaps improve on them, and which would not be prohibitive in the way of expense.

Now I want to say that, first of all, if you are going to sprinkle your fairways, it goes without saying you must have an adequate water supply.

We are fortunate in having a beautiful lake right on the border of our course, with unlimited soft water, and we have a powerful duplex pump, and a very large storage tank, with a 4-inch main running out through the center of our course, with laterals reducing first to 3 inches and then to 2½ inches, and at every putting green a 2½-inch outlet. The methods of irrigation which I have mentioned seemed to us too expensive to operate, and not convenient. The California system consists of a pipe long enough to reach across the fairway supported on pulleys, such as you have on shafting in a machine shop, with the hub bored out so that the pipe turns loosely on the pulley, and with holes bored in the top of the pipe; and by pushing the pipe up the fairway it sprays water on each side. At one time we tried the rotary system, which has been in use at some clubs—movable rotary sprinklers in gangs of two or three. At one time we bought one of those large rotaries, such as they use on the Common in Boston, and we used that in front of the putting greens to keep the approaches in good order; but that stream of water was too heavy; the drops were too large; it threw too much water, and it washed out the roots in the grass, although it did help to keep the approaches green. Now the system which we have developed is very simple. First of all, we laid a pipe parallel with the fairway, and we went to the nearest supply pipe, whatever it might be—2½, 3, or 4 inch; and we ran a lateral along the side of the fairway of 1½-inch pipe, and in that pipe we placed a hose outlet every 250 feet; and we buried that pipe about 8 or 10 inches below the ground. Of course, in our country our frost goes very deep; and our entire water system is practically on the surface, so that our pipes can be shut off and can be drained easily before they freeze. We had 1½-inch hose outlets every 250 feet. Then we took two units of 1½-inch pipe, each 54 feet long. We mounted those units on a carriage made of flat iron, and that carriage had on each end of the frame a caster-wheel—a wheel about as large as the wheel on an ordinary wheelbarrow, with a flange on the wheel rounded so that it would not mark the course in the fairway. These two sections of pipe, each 54 feet long, were connected in the center by a piece of high-grade 1½-inch hose. Each one was carried on three carriages, and each carriage had two caster-wheels on the end. Now by a "caster-wheel" I mean a wheel which will revolve and go in any direction in which you want it to go, just as you move your dining-room table or your bureau. If you wish to push this pipe in a particular direction the wheels will automatically turn and run in that direction. If you wish to draw the machine endwise, to take it from one fairway to another, a couple of men can take a rope, or you can take a little tractor and hitch on to one end, and the wheels whirl right around and the machine moves lengthwise. The boys working on the course call this machine "the sea serpent."¹ As I say, these two sections are connected by a piece of 1½-inch hose, in a U-shape, with a 45 degree ell running into the end of each pipe. That makes it flexible. If there is a hill here and a hollow there, the machine accommodates itself to the contour of the ground. If you are moving up the fairway and the fairway is 60 yards wide at that point, and as you approach the putting green it narrows to 30 yards, you can do one of two things; you can have one section across the fairway, and the other at an angle, or you can move up in a V, which—ever seems the most convenient, so that the machine does not reach out into

¹ An illustration of the "sea serpent" fairway sprinkler appears in Mr. Brooks's article beginning on page 288 of the November, 1923, BULLETIN.

the rough. Each machine is equipped with 150 feet of $1\frac{1}{2}$ -inch hose. On each one of these sections are two risers of $\frac{5}{8}$ -inch pipe, with a rotary nozzle at the top of the riser, the riser being about four feet high, and these rotaries revolving on the top of that riser, so that on the two sections there are four rotaries, and when in action one stream of water from No. 1 laps over so that there is no gap between No. 1 and No. 2, or between No. 2 and No. 3; so that the entire area covered by the machine is thoroughly wet.

Now, when we are ready to operate, we go to an outlet and we put 150 feet of $1\frac{1}{2}$ -inch hose on it and lead it down to the end of the pipe and screw it on and turn on the water. The rotaries begin to revolve, and you wet an area of 180 feet—about 60 yards. It will cover more if the wind is not blowing to disturb it; but absolutely under all conditions it will wet 60 yards in width by about 60 or 75 feet in length.

After experimenting we found it would take about four machines of this kind to handle our course. On every golf course there are certain short holes where the fairway is of no consequence. We have four short holes where it is not practical or necessary to water the fairway. That leaves us 14 holes, and we found that 4 machines would satisfactorily take care of those 14 holes. We start a machine, and one man tends the four machines. The rig is very light and one man can push it; just roll it up the fairway, right up a hill. He turns on the water and lets his machine stand there and run for 40 or 45 minutes; or if it is a real dry spot he will let it run for an hour while he goes and tends the next machine; and when he has made his rounds he comes back and shuts off the water and moves his machine up to the next area that is dry.

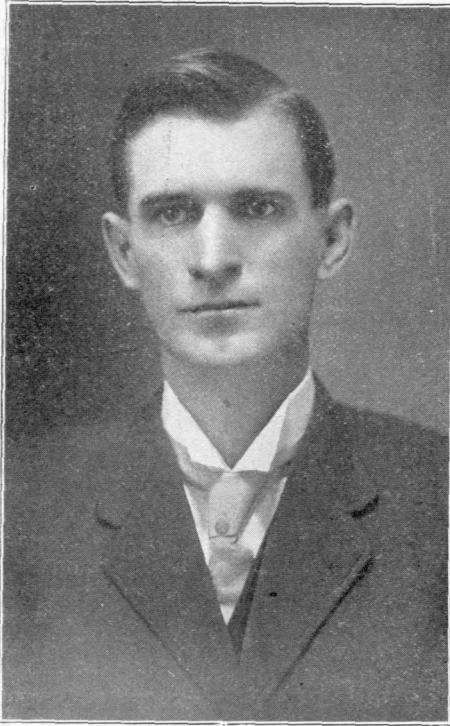
We found that we would have to water the fairways in the day time at present. We expect to water at night next year. A night crew waters the putting greens 8 hours every night. We found that we would have to increase our pumping capacity a little in order to carry all the fairway sprinklers and the putting green sprinklers at night; but that is a minor matter. We find the mechanics have figured out a method by which we can increase our pumping capacity this spring, so that we will do both the putting green watering and the fairway watering at night.

We run 12 rotaries at night on the putting greens. We water 9 putting greens on Monday and 9 on Tuesday, so that every putting green is watered every other night for six nights in the week. We do not water on Sundays unless it is very dry. Those 9 putting green rotaries, together with 3 which we keep running on the tees on the dry places, are our regular night equipment. There are 4 rotaries on each one of those "sea serpents," so that the amount of water which is used by the 4 machines is a little more than you would use in watering 18 greens at night. Each rotary is just a riser with an arm and two outlets, a T-rotary. We figure these 4 machines will water the entire fairway once a week, which will be sufficient. That is what we have done.

One of the practical difficulties that we have found in building this machine, as a great many of you men who are mechanics would know, was to make it light and at the same time rigid. On the first machine with which we experimented the pipe broke or bent and we had a great deal of trouble, so that we devised a scheme of trussing.

These machines can be built for not to exceed \$200 apiece; and we bought the pipe and put in the side line, including the labor, for \$1,800. You could equip a course which was already supplied with an adequate water system, somewhere from \$2,500 to \$3,000, including the machines.

The Green Section Loses Carrier



Lyman Carrier, Advisory Member. Prof. Carrier severed his connection with the Green Section April 15, 1924.

On April 15, 1924, Prof. Lyman Carrier severed his relations with the Green Section, to take up commercial work. By his resignation the organization has sustained a loss that is irreparable. Professor Carrier has served with the Green Section from the beginning and has made himself immensely valuable to the golf clubs of the country. His advice and suggestions have proved 100 per cent sound and helpful. As a diagnostician of sick golf courses he is unexcelled, and no one can prescribe for their troubles better than he. In his qualifications are found the rare combination of years of experience and training, good judgment and tact, and unbounded enthusiasm and devotion. Wherever he has gone he has made friends. Men of Carrier's stamp are not encountered every day, nor are the institutions of learning or the agencies of experience turning them out in large numbers. What a

real economic and social loss his leaving causes! Here is a man who is peculiarly fitted for the field in which he was engaged—a field crowded with large and important possibilities, a field which needs him and in which he can serve better than in any other. Why can not such men be encouraged to continue in the sphere of their greatest usefulness to society? Carrier's departure from the Green Section leaves a real vacancy and has greatly increased the burden of those who are carrying on. May health, happiness and success attend him! Should he ever come this way again he will be welcome.

The Japanese Beetle and Its Relation to Golf Courses

Address Delivered by B. R. Leach, U. S. Department of Agriculture, before the Annual Meeting of the Green Section, January 5, 1924.

The Japanese beetle was first observed in this country in the summer of 1916, a few beetles having been collected that year at Riverton, New Jersey. Since that time the insect has increased in numbers by leaps and bounds until at this writing the beetles infest a circular area of 2,500 square miles situated in the states of New Jersey and Pennsylvania. The center of this area is heavily infested. The degree of infestation di-

minishes as one approaches the circumference. The area of light infestation and the area of heavy infestation are both increasing proportionately in size.

A study of the insect in the course of this gradual spread during the several years of its presence in this country has thrown considerable light on its life-history and habits, while the damage and financial loss occasioned by it within the present area of infestation have given ample indication of its importance as an insect of first rank.

The life-history of the Japanese beetle is briefly as follows. The grub, which is very similar to that of our native May beetle, winters in the soil at about plow depth. In the spring it comes up near the surface, feeds upon the plant roots, undergoes certain changes, and in June and July emerges as the adult beetle. The beetles feed upon foliage, fruit, and flowers of various sorts, and deposit their eggs in the soil, preferably that covered with vegetation. After these eggs hatch the young grubs feed on decaying vegetation and live roots. The grubs grow rapidly, and in the fall, as the ground chills, go down 6 to 12 inches in the soil, where they winter over until spring.

From the standpoint of general agriculture, there have been only a few instances of injury to crops by the grubs. It is the beetle or adult stage of the insect which defoliates shade and fruit trees, ruins the foliage and flowers of shrubbery and ornamentals, and consumes large portions of the crops of such fruits as apples, plums, peaches, grapes, and cane fruits. To date more than 215 species of plants are recorded as having been attacked by the Japanese beetle.

While the adult beetle must be considered as a source of annoyance from the standpoint of golf-course upkeep, since it will injure the shade trees and shrubbery on the club grounds, the importance of the beetle stage is, from the standpoint of damage and annoyance, nevertheless essentially secondary to that of the grub stage. That the Japanese beetle grub is capable of considerable damage in this connection is evident when one considers the artificial nature of golf courses and in addition certain biological facts in respect to the insect's activities in this country.

The average golf course, located in the suburbs or open country, comprises a limited area of well-kept turf with 9 or 18 smaller areas of hand-tailored turf comprising the greens. The golf course is surrounded on all sides by fields and woods receiving indifferent care and in a comparative state of barrenness as compared with the rich turf of the course. In accord with nature's laws it follows that the golf course will be the mecca for every turf-feeding insect in the vicinity. May beetle grubs, June beetle grubs, and other grubs of various sorts are present in varying numbers with damage resulting in varying degree. Occasionally these native grubs increase greatly in numbers on a given course and cause outstanding injury to the turf; but such instances of severe damage are sporadic, because these native grubs are preyed upon by hosts of parasites which check their increase in numbers beyond the point where serious injury will result.

While the native species of grubs are held down by parasites in this way, the same thing can not be said with respect to the Japanese beetle. This insect is of foreign origin, its particular parasites were not imported with it, and the beetle has spread and is continuing to spread, increasing in numbers with virtually no natural check of consequence. Herein lies

the specific menace in respect to the Japanese beetle, a condition of affairs which will not, in all probability, be corrected until its parasites can be imported from abroad and introduced into this country to serve as a check to the insect. For this purpose we now have specialists in Japan, China, Russia, India, the Hawaiian Islands, Korea, and other places. During the last three years the Government has imported thousands of these parasites, and some of them have been liberated; and they are being continually studied at the Riverton laboratory. The earthquake in Japan in the fall of 1923 probably ruined the best year's efforts that have to date been put in on that special phase of the problem. Just prior to the earthquake the Government had a shipment of several hundred thousand parasites in a cave on the outskirts of Yokohama, all ready to go forward; but the earthquake wiped it out. The men have returned to this country in the meantime, but will go back again this spring to take up the work where it was left off. The earthquake was an unfortunate thing, in that it ruined the efforts of several years of consistent work.

The golf course, with its broad expanse of turf, furnishes an attractive breeding ground for this insect. The rich soil and heavy turf of the greens and select spots in the fairways attract the beetles, and eggs are deposited in enormous numbers during June, July, and August. Under these circumstances, the turf suffers from the destructive grub attack, and the killing of the grass is quick and pronounced. Since the putting greens are the choicest portions of turf on the course, it follows that they will be most heavily infested and suffer proportionate injury.

During summers of normal rainfall, when the grass throughout the course retains its green color, there will be a general and fairly even infestation in the fairways and rough and a heavier infestation in the greens. In dry summers the infestation will be largely confined to the moist portions of the fairways and rough and will be heavily centralized in the greens.

The story of the insect's depredations on local golf courses is as follows. It was first definitely observed injuring grass roots in the spring of 1921. During that summer the infestation in the greens of the Riverton Country Club, Riverton, New Jersey, was light (about 100 to the square yard) and the injury was confined to the edges of the green, which had not been properly watered. In 1922 the infestation in these same greens was heavier (about 300 grubs to the square yard), and injury to certain of the greens was pronounced. At the same time the Moorestown Field Club, four miles distant, on the edge of the heavy infestation, was undergoing the 1921 experience of the Riverton club. During 1923 the turf of the greens on the Riverton course was in some places ruined. The infestation in the greens was running as high as 1,000 grubs to the square yard. The situation on the Moorestown course is virtually the same as at Riverton, while the Torresdale Golf Club, in Pennsylvania, is now undergoing the 1921 experience of the Riverton club.

The observations of this laboratory indicate that the well-kept turf of golf greens is capable of supporting without injury an infestation by 100 grubs per square yard. Any added numbers will be evidenced by injury in proportion to the density of infestation. The beetle varies to some extent from year to year in the date of its emergence and subsequent egg-laying and larval development. Similarly the period when turf injury may be looked for varies with the above seasonal variation of the insect. In view of these facts it seems advisable for the clubs now infested or in

danger of infestation in the near future, to cooperate with our Japanese Beetle Laboratory at Riverton in the handling of this new problem, since no specific statements can be made at this time capable of serving as a guide for general information.

The writer recently gave an account¹ of experiments conducted during 1922 which resulted in the finding of a method of control for this grub with negligible injury to the turf. The method in brief consisted in emulsifying carbon disulfid with soap, diluting with water, and applying the mixture to the turf of the green by means of hose and special nozzles. Since the publication of that paper the experimental work has been continued, with special attention to large-scale treatments under the usual golf course conditions. The results of last year's work have corroborated the preceding year's conclusions and indicate that the method as now used will control any infestation of Japanese beetle grubs, May beetle grubs, ants, etc., in the greens. These conclusions are based on the treatment, during 1923, of the 27 greens of the Riverton and Moorestown country clubs. Those interested are referred to the October, 1923, number of THE BULLETIN for a complete account of the work to date on the control of this grub in golf greens.

We have been asked whether precautionary measures can be taken in the control of the Japanese beetle on golf courses. We do not, however, know of anything that can be done in that direction. As stated, the golf course as a whole, and especially the greens, attract the beetles. They are going there to lay their eggs no matter what you do. We have done considerable spraying around the Riverton, New Jersey, golf course, but it does not deter the beetles from laying their eggs in the greens. It is necessary to watch the course closely, and, as soon as the egg-laying is over, to get busy and treat the greens. The presence of the grub in turf may be detected by making diggings from time to time in the greens; a well-trained man will have no difficulty in finding the grubs. The beetle will, however, be noticed long before any effects of the grub are detected. Ordinarily the beetle will be present a year or two before it increases in numbers sufficient to occasion material injury to greens, so that you will know the beetle is there long before your greens are being actually injured.

The outstanding points in connection with the Japanese beetle in its relation to golf courses are as follows:

1. The insect is now causing serious injury, in the heavily infested area, to the courses above referred to.
2. Observations indicate that neighboring courses will be infested in the near future.
3. It is improbable that the spread and increase of the insect can be checked until its parasites can be introduced from abroad.
4. When the greens of a golf course become infested to a certain degree it will be necessary to resort to an annual insecticidal treatment in order to maintain the turf in condition for play.
5. An insecticidal treatment has been developed at the Japanese Beetle Laboratory which gives indication of being of sufficient value in this connection.

This control method, I should add, is effective not only with the Japanese beetle, but also with the May beetle, any June beetles which happen to be in the turf at the time of treatment, and ants. So far as

¹ "A Control for Japanese Beetle Larvae in Golf Greens," Bulletin of the Green Section of the U. S. Golf Association, June 21, 1923, Vol. III, No. 6.

ants are concerned, however, we should perhaps state that we have conducted no experiments, but Hugh I. Wilson, of the Merion Cricket Club, has done considerable experimenting with this method in the control of ants, and we understand he has discarded his other methods in favor of this one.

The cotinus, or June beetle—the one which in the late summer throws up mounds of earth on the green—is essentially a different insect to control.¹ We have said that this method will kill any of these species which are in the ground at the time the treatment is applied; but the eggs of the cotinus are laid everywhere—not only in the greens, but around the greens. As the grub of the June beetle gets larger, it comes up at night and pushes along on its back. It will travel many feet in the course of a night, so that while you may get the few cotinus grubs which are in the green, there are many outside which you will not get. We have often thought that the cotinus problem should be approached from another angle; and we believe it could be solved if the proper research were done on it; but, of course, the various phases of the Japanese beetle are now occupying all the time of the force at our Riverton laboratory. At present the only remedy we know is kerosene emulsion, which works well in limited areas.

We have also been asked whether the carbon disulfid treatment will kill earthworms. It would not be economical to use the method for this purpose. In all probability the best remedy for the presence of earthworms is some corrosive substance, such as corrosive sublimate.

Grass Experiments at Rothamsted, England

By C. V. Piper

At the Rothamsted Experiment Station, near London, England, an extensive series of experiments in the fertilizing of grass-lands has been carried on continuously for nearly 70 years, that is, since 1856. Specifically the tests are on a clay loam soil and the results are measured in hay yields. While the maintenance of grass-land for hay crops is not the same thing as its upkeep for producing turf, nevertheless the Rothamsted work is not without bearing on greenkeeping. It must be borne in mind that the results of parallel experiments in fertilizing differ with the soil and with the climate; also that the effect of fertilizers on such hay grasses as timothy and orchard grass does not directly concern golf courses. It is also to be remembered that there are many English plants that do not occur in America, and vice versa. Naturally the behavior of such plants can not be compared for the two countries. But with these limitations borne in mind, the Rothamsted results nevertheless carry lessons of high importance in the growing of golf turf.

These results are presented in a very technical book entitled "Manuring of Grass-Land for Hay" by Winifred E. Brenchley. The word manuring in England, it may be said, means the use of any kind of fertilizers, and not only of dung, as is the common significance of the word in the United States.

The data are presented first in the form of tables displaying the effects of each type of fertilizer on the mixed population of grasses and weeds that covered the land when the experiments began. The different fertilizer treatments were as follows:

¹ The control of the June beetle is discussed at length in the articles beginning on page 60 of the April, 1921, Bulletin, Vol. I, No. 4.

(1) No manure.—Unmanured since 1855; unmanured since 1864, after barnyard manure; unmanured, after ammonium salts.

(2) Mineral manures.—Mixed mineral manure; mineral manure without potash; mixed mineral manure, after ammonium salts; mixed mineral manure, after sodium nitrate; superphosphate and potassium sulfate, after ammonium salts; calcium superphosphate.

(3) Sodium nitrate with and without mineral manures.—Sodium nitrate; sodium nitrate (275 pounds per acre) and mixed mineral manure; sodium nitrate (550 pounds per acre) and mixed mineral manure.

(4) Ammonium salts with mixed mineral manure.—Ammonium salts (400 pounds per acre) and mixed mineral manure; ammonium salts (400 pounds per acre) and mixed mineral manure without potash; ammonium salts (600 pounds per acre) and mixed mineral manure; ammonium salts (600 pounds per acre) and mixed mineral manure with sodium silicate.

(5) Ammonium salts alone or with incomplete mineral manures.—Ammonium salts alone, after barnyard manure; ammonium salts and calcium superphosphate; ammonium salts and mixed mineral manure without superphosphate.

The second part of the book relates to the behavior of each kind of grass or other plant as illustrated by its response to the treatments on all the plats. It is this part of the book which is of most interest to golfers, and especially as it relates to grasses used on golf courses. The results correlate so closely with experiments in this country that they must be regarded as highly significant. Some of the more important of these results, from the standpoint of golf grasses, are given below, followed by comments by the editors of *THE BULLETIN*. The editor's comments are printed within brackets [].

MOSESSES.—The ingress of mosses was very marked on the unfertilized plats and was quite evident on those treated with chemicals only. Moss was discouraged by lime, by nitrogenous chemicals, and by organic manures.

[The use of lime on golf turf is undesirable, primarily because it encourages too many weeds. In the United States, mosses rarely appear in turf which is kept fertilized with nitrogenous fertilizers; lime is far less effective in the Arlington experiments.]

RHODE ISLAND BENT.—This grass, so important on northern golf courses in the United States, showed very marked decrease on most of the limed plats, and was not encouraged by the use of phosphates or by heavy dressings of mixed fertilizers containing phosphates and potash. It remained conspicuous on the starved soils and was more abundant on the plat treated with organic manures and on those receiving light dressings of mixed fertilizers.

[These results agree with American experiments, which show that lime is very injurious to the grass and that phosphate alone and potash alone are somewhat injurious. Acid fertilizers only should be used, especially ammonium sulfate, but barnyard manure and good compost (without lime) are desirable to use in addition.]

SWEET VERNAL GRASS.—At Rothamsted, sweet vernal grass was crowded out on the plats well fertilized with nitrogenous manures, and it was usually reduced by liming. Where ammonium salts were used, sweet vernal grass, Rhode Island bent, and the fescues were dominant. Sweet vernal grass did best on well-manured soil on which acid conditions prevailed.

[This grass occurs abundantly on some American golf courses, especially on poor soils over the northern half of the United States. Observations on this grass in the United States indicate that it behaves quite as in England, but certain American plants which do not occur in England are always present where sweet vernal is abundant.]

SHEEP'S FESCUE.—Sheep's fescue was discouraged or almost suppressed by complete mineral fertilizers. It was usually encouraged by keeping the soil starved, much so by ammonium sulfate and somewhat by organic manure. This grass was present generally in some abundance, except in the heavily fertilized plats. It was always abundant on the plats where Rhode Island bent and sweet vernal were plentiful. Generally speaking, ammonium sulfate is the best fertilizer to use.

[Sheep's fescue is perhaps the most desirable of all grasses for the rough and for cops and steep slopes. It is not desirable in fairways. If fertilized at all, ammonium sulfate gives best results.]

VELVET GRASS.—Velvet grass (not velvet bent) was entirely suppressed by the use of heavy dressings of sodium nitrate or of complete fertilizers. Liming usually effected a marked decrease. Potash also discouraged the grass. The grass was greatly encouraged by heavy dressings of nitrogenous fertilizers, especially ammonium sulfate with phosphorous and potash included.

[Velvet grass is very abundant on the Pacific Coast and makes a satisfactory fairway turf, even if pale and not attractive. On putting greens it is a nuisance, but can be kept in check by the radical method of cutting out the grass and replacing with good turf. From the Rothamsted results it would appear that it could be kept out by using either sodium nitrate or lime, but both of these injuriously affect the bents and red fescue. Apparently it is the best practice in America not to use lime or sodium nitrate on putting greens, but to remove the velvet grass bodily.]

KENTUCKY BLUEGRASS.—In the Rothamsted experiments, this grass was encouraged on all the plats which were limed, and was discouraged by the omission of lime. It was not much affected by fertilizers, except phosphates and ammonium salts.

[In our experiments at Arlington Farm, bluegrass turf seemed entirely unaffected by lime. At Rothamsted, however, they measured the results by the hay yield, not by the turf. In the Rhode Island experiments, the alkaline fertilizers gave more hay on most of the plats, but the acid plats produced the finest turf. It may be that the plats of bluegrass at Arlington which were limed would have produced more hay, but the lime apparently did not benefit the turf at all.]

WHITE CLOVER.—White clover was most abundant on plats fertilized with chemicals only. It was suppressed on plats treated with ammonium sulfate; with barnyard manure and fish guano alternately; and with sodium nitrate. The results of liming were uncertain.

[Our American data show that the use of ammonium sulfate is a perfectly effective method of discouraging white clover. Lime should not be used.]

WEEDS.—Many of the weeds recorded in the Rothamsted experiments are tall-growing species, which do not survive under continuous mowing. Such are not discussed here. Buckhorn or plantain is encouraged by starvation and by sodium nitrate. It is entirely suppressed by using ammonium sulfate; or by using barnyard manure and fish guano alternately. It seems to be decreased by liming. Sorrel seems to be encour-

aged by organic manures and ammonium salts and not encouraged by starved soils, sodium nitrate, or heavy manuring. On very acid soils it is discouraged by liming. [In the United States, sorrel seems conspicuously a plant of the poor soils. It is rarely troublesome in putting greens. On fairways it is usually on the starved spots.] Grass-leaved chickweed, at Rothamsted, was discouraged by ammonium salts and was encouraged by liming. [This weed is becoming increasingly plentiful on American golf courses, especially on putting greens. Apparently the best remedy is ammonium sulfate.]

SUMMARY.—In general, the Rothamsted results uphold the methods on golf courses now generally followed in America. Considerable allowance must be made in some cases, as the Rothamsted results are based on hay yields, not on the quality of the turf. This point deserves emphasis, as many greenkeepers assume that methods which are desirable in raising different crops, should be equally desirable in growing turf. No greater error can be made than to use such reasoning. If it were true, all plants should occur under any given condition in nature, and furthermore all plants should presumably be cultivated by the same methods. The fact that experiments on grain and hay crops do not necessarily apply to turf culture is not at all a criticism on the records of scientific agriculture. Nearly all of such contributions refer to crops and to some other end-result than turf. If one wants good crops of red clover or alfalfa, ordinarily lime must be used. If one is growing rhododendrons, lime, if used, is nearly always fatal.

QUESTIONS AND ANSWERS

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

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

1. **RIDDING TURF OF MUSHROOMS.**—We are sending you a specimen of mushrooms which at times are abundant in our turf and are exceedingly objectionable. We shall be glad to have your recommendations for getting rid of them. (Minnesota.)

Answer.—The mushroom you send is the most common of the fairy-ring fungi and is technically called *Marasmius oreades*. One of the common recommendations for destroying this mushroom is the use of iron sulfate in the strength of 1 pound to 1½ gallons of water, making 3 applications at intervals of 2 weeks. We are not certain, however, that this procedure will be advisable where the question of saving the turf must be considered, as there is a possibility that the iron sulfate will kill the grass also. We would therefore suggest that you experiment with it first on a small scale before undertaking a general treatment. Another plan would be to treat the mushroom growths heavily with Bordeaux mixture. This will not destroy the grass and will probably kill out the

mushrooms. We would suggest also that you spike or otherwise loosen the ground, as the white threads of the fungus which run through the soil have the effect of waterproofing it.

2. RESEEDING FESCUE-REDTOP GREENS WITH BENT SEED.—We should be glad to have your opinion as to the advisability of sowing German mixed bent seed on our putting greens, which already have a fairly thick turf composed of 70 per cent fescue and 30 per cent redtop. We do not wish to experiment, as our greens are fairly satisfactory. We are aiming to improve, rather than to experiment with what we now have. (New Hampshire.)

Answer.—Fescue greens or redtop greens, or a mixture of these two grasses, can be converted to creeping bent greens, and are much improved, by the sowing of German mixed bent seed on the established turf. This seeding is best done about the end of August, although in your latitude spring seeding ought to be satisfactory also. We would suggest that to each 1,000 square feet of putting surface you seed 2 pounds of German mixed bent seed this spring and an equal amount again at the end of next August. At the time this seed is sown it will be well to give a light top-dressing to the greens, which will serve in a measure to cover the seed.

3. NURSERY TREATMENT TO ENCOURAGE GROWTH OF CREEPING BENT STOLONS.—The creeping bent which we have started in our nursery appears to be making a satisfactory growth above ground but does not seem to be spreading to any extent under ground. I find many of the stolons have developed buds under the surface but they are very slow in making their appearance on top. Do you think it would be advisable to top-dress this growth above ground? (Illinois.)

Answer.—It is natural for creeping bent to grow above ground, and therefore the stolons should not be covered with a top-dressing if you want to increase them for planting purposes. A little dirt scattered on the loose runners will sometimes make them take root, but to cover the leaves of the grass would smother it.

4. IMMUNITY OF SELECTED STRAINS OF CREEPING BENT TO BROWN-PATCH DISEASE.—We have been told that there is a certain strain of creeping bent grass that is practically immune to the brown-patch disease. Is this the fact? (Ohio.)

Answer.—Some strains of creeping bent appear to be more susceptible to brown-patch disease than other strains. If you have more than one strain of creeping bent no doubt you will be able to observe which, if any, are relatively less susceptible to the disease.

5. DISADVANTAGE OF EXTENSIVE WATERING WHEN APPLYING AMMONIUM SULFATE.—It has seemed to us that we do not get as lasting an effect from ammonium sulfate as we should. In two or three weeks it seems to have gone. We water each green every other night. Do you think we use too much water in following up the sprinkling cans on this sandy soil, thereby putting the sulfate down below the grass roots? (Ohio.)

Answer.—This fertilizer is quick in action, but its beneficial effects are soon over with. This is true of any material that is readily soluble in water. For this reason it is not advisable to water so that there is much run-off from the greens.

6. INTRODUCING THE CREEPING BENT INTO OLD TURF.—In order to introduce creeping bent stolons into our present turf of fescue, bluegrass, and redtop, we propose to cut shallow furrows running east and west

into our field with an ordinary disk-harrow. Then we plan to put cut-up bent stolons into these furrows and top-dress the grass immediately, and then water them, there being adequate facilities for watering. Would you consider that this process would be successful? (New York.)

Answer.—There have been several attempts made to introduce creeping bent into old turf. We have had excellent results by plugging it into old redtop with a weeding knife. This past fall there were several putting greens treated in a little different way. The chopped and shredded creeping bent stolons were scattered over the green on top of the old turf and top-dressed with about $\frac{1}{4}$ -inch of screened top-dressing and then kept well watered. The bent is growing fine at the present time and gives promise of being a successful procedure. We will know more about it next summer than we do now. We would advise you to try this on part of your field next fall. It will be a slow job to put the creeping bent stolons down in the cuts made by the disk-harrow, and we doubt if it is necessary to go to all that trouble.

7. KEEPING QUALITIES OF BORDEAUX MIXTURE.—Will Bordeaux mixture left on hand from last year be satisfactory for use in brown-patch control this coming season? (Minnesota.)

Answer.—Dry Bordeaux powder, if kept in air-tight containers, will not deteriorate, and should be as effective for brown-patch at any time as fresh material. The liquid Bordeaux, however, loses its effectiveness very soon after being mixed, and it is for this reason that Bordeaux powder is put on the market in dry form.

8. SALT IN WEED ERADICATION.—In the construction of our golf course we have been having considerable trouble in eliminating the cane-break growth. Kindly advise us if there is anything that could be used to destroy this weed without injuring the soil. (New York.)

Answer.—We would advise using ordinary salt to kill out the cane-break growth. Salt will kill any vegetation if applied heavily enough, and as it is soluble in water it is soon washed out of the soil, leaving no permanent injury. The minimum amount of salt to use effectively can be easily determined by experiment, as it requires only a day or two to ascertain its effects on plant growth. If you do not intend to seed before fall we would advise your using the salt in heavy applications so as to exterminate the canebreak completely, as it is generally a troublesome plant to handle.

9. PATCHING GREENS PLANTED FROM CREEPING BENT RUNNERS.—Our No. 1 green, which was reconstructed and planted vegetatively last fall, is coming along nicely, but the lower part, which slopes a little more and naturally gets more wash, shows a few bare spots about the size of a plate. We are considering planting bent seed in these spots. Would you consider such a method practicable for patching the green? (Indiana.)

Answer.—The use of bent seed for this purpose would tend to mar the uniformity of your turf. We would advise you to plant these bare spaces with plugs or runners taken from the edge of your green, as in this manner you would preserve its uniformity.

10. RIDDING TURF OF DANDELIONS.—Our turf is beginning to show dandelions and we should like to have your recommendations for getting rid of them. (California.)

Answer.—If you have only a few dandelions and they are sparsely distributed over a large area we would suggest the sulfuric acid treatment, but if you have numerous plants on your course and they appear in colony-like patches, the iron sulfate treatment would probably be better. If sulfuric acid is used, extreme caution should be exercised not to let the acid come in contact with the grass, the clothing, or the person, as it is very corrosive and will readily kill any vegetation with which it comes in contact, eat holes in clothing, and injure the skin. The acid should be applied with a sharp-pointed instrument, such as an ice-pick, which should be dipped in the acid and inserted into the crown of the plant. If iron sulfate is used, it should be employed in the form of a solution of $1\frac{1}{2}$ to 2 pounds to 1 gallon water and applied as a spray over the infested area. This treatment should be made on a bright, sunny day, when there are no indications of rain and when the conditions are such that the area which is treated requires watering. It should be watered thoroughly just before making the treatment in order that it will not be necessary to water for two or three days following. It may require two or three of these treatments during the season to keep the dandelions in check; but at that, it is more economical than hand-weeding.

11. METHOD AND RATE OF APPLYING AMMONIUM SULFATE.—Kindly tell me what is the proper method of applying ammonium sulfate as a fertilizer. (Connecticut.)

Answer.—We prefer mixing it with sand or good loam compost and applying it at the rate of approximately 3 pounds to the 1,000 square feet. Three applications may be made, one early in spring and one late in spring; and a third application in the fall if the grass needs stimulating then. Occasionally it seems desirable to apply a little in midsummer, especially on grass that has been attacked by brown-patch. One-half pound, or certainly not more than 1 pound, to 1,000 square feet, is all that should be applied in hot weather or in midsummer. Exceeding care is necessary to prevent burning the grass at that time, and therefore it is advisable to be in a position to water the grass thoroughly after the ammonium sulfate has been applied.

12. ERADICATING CHICKWEED AND WHITE CLOVER WITH AMMONIUM SULFATE.—What is the best method of getting rid of chickweed and white clover? (Ohio.)

Answer.—Fertilizing the grass with ammonium sulfate tends to eradicate both of these plants. Chickweed is sometimes gotten rid of by using ammonium sulfate up to the point where it begins to burn the grass. Grass will stand a little more ammonium sulfate than will chickweed. You will have to experiment in order to find the right amount to use, else you will incur the danger of injuring your greens.

13. USE OF SEED FROM HAY LITTER FOR FAIRWAYS.—We plan to reseed our fairways lightly this spring in order to thicken the turf, which is redtop. A member of our club who owns a large farm suggests that after he uses the hay in his barn he could pick up a large amount of seed from the floor. Do you think such seed would be suitable? (Maine.)

Answer.—That depends on the kinds of grasses that make up the hay. If the grass is a small native sort commonly called burden, it would be first-class for your fairways, but if it is timothy or dog grass we would not recommend its use. If you purchase any seed for this reseeding we would recommend bent.

Meditations of a Peripatetic Golfer

One of the best ways to combat weeds in the putting green is to keep the turf dense and vigorous.

Before the craze for having the longest hole in golfdom leads to further insanity, we propose a prize for the shortest hole. There are no limits as to length prescribed in the Rules of Golf. For the shortest hole, however, it is suggested that the only club to be used on the tee be a wooden toothpick.

Any good thing, including both materials and methods, may be used to excess, with resultant harm. "Temperance in all things" is a maxim which applies to greenkeeping.

A famous architect says, "The attempt to reproduce a well-known hole with hopelessly different materials is the most futile nonsense in golf architecture." It is hard to make a replica of a water hole where there is no water. The principle of any type of hole can, however, be applied in many different ways to details.

The type of golf course construction has much to do with the cost of its upkeep. Construction which calls for much hand-labor in mowing always adds to the expense.

Because certain fertilizers give the highest hay yields, it does not at all follow that the same fertilizers are best for growing turf.

The trade still harps on the value of "commercial humus" for golf courses. We repeat that one ton of well-rotted manure or mushroom soil is easily worth five tons of commercial humus for growing turf. Frequently the discrepancy is far greater, as commercial humus is often positively harmful.

Any poor or mediocre hole is too long or too short as you may please. Length has little to do with the playing qualities of a hole.

In your compost, the humus materials should probably never exceed 25 per cent of the total mass.

How to beat the Hole-in-One Club. Build short holes, say six inches to six feet in length. There is nothing in the Rules to the contrary.

Good humus and "commercial humus" are very different things.

What do you think of a club which fired its manager because he sought and followed the advice of the Green Section? Incredible, but true.