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

Vol. V Washington, D. C., October 15, 1925 No. 10

A MONTHLY PERIODICAL TO PROMOTE THE BETTERMENT OF GOLF COURSES

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Published by the Green Committee of the United States Golf Association at Room 7213, Building F, 7th and B N. W., Washington, D. C.
Address all MAIL to P. O. Box 313, Pennsylvania Avenue Station, Washington, D. C.
Send TELEGRAMS to Room 7213, Building F, 7th and B N. W., 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.

Identifications of Strains of Creeping Bent

Specimens of creeping bent are frequently sent to us for identification. We must admit our inability to do this with any certainty, though we may say that a particular sample may look like Washington, Metropolitan or some other strain, as the case may be. Wild strains can not be identified at all. There are hundreds, perhaps thousands, of them. Of the numerous bents we have tested we now recommend but two, namely, Washington and Metropolitan. Under different conditions, these, as well as other bents, vary somewhat, so that identification is in large part guesswork. The only way to be sure is to grow a nursery from pedigreed material.

Even in the case of stocks handled by commercial dealers we can make no definite statement as to genuineness. Unfortunately, in some cases there has been error, and strains that are not Washington have been sold under that name. Even field inspection often leaves one in doubt as to the identity of the strain.

Washington and Metropolitan are decidedly the best of the creeping bents as regards brown-patch resistance, and both make turf of the highest quality.

Seed vs. fertilizer.—A dollar's worth of fertilizer will usually accomplish more than a dollar's worth of seed in thickening thin turf.

Checking the Growth of Algae on Greens

By John Monteith, Jr.

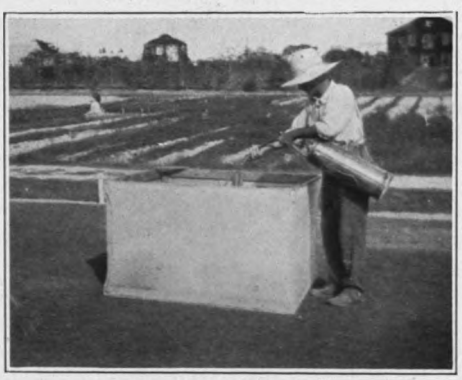
Where greens have been injured by brown-patch or by other conditions which leave bare spots in the turf, they are frequently coated with a green "scum" caused by a growth of algae. At times this may become serious and prevent the grass from growing over and becoming established on these bare spots. In testing different chemicals for the control of brown-patch it was noticed that a very light application of mercuric chlorid (corrosive sublimate) would immediately clear the turf of algae. In one case an application at the rate of ¼ pound of the chemical to 50 gallons of water when applied as a spray over 3,000 square feet of turf proved sufficient to eliminate the trouble. Other chemicals are also effective, but since mercuric chlorid is so commonly used as a means of ridding greens of earthworms it no doubt is to be preferred. When a green needs treatment to control algae the application can thus be combined to clean up the algae and worms at the same time, the treatment for the earthworms, of course, requiring a heavier application than the light treatment above referred to. At the same time this chemical will help check brown-patch, as shown in the article beginning on page 219 of this number of the BULLETIN. After treatment, the green should be top-dressed to stimulate the grass to cover the bare spots as quickly as possible.

The green layer of algae should not be confused with the heavier growth of moss which at time is found crowding in through turf. Moss in a sunny location, such as is found on most greens, generally indicates a "starved" soil or other soil conditions unfavorable to grass. As a rule, in such places it can be checked by feeding the grass with a fertilizer rich in nitrogen.

Control of Turf Diseases with Chemicals

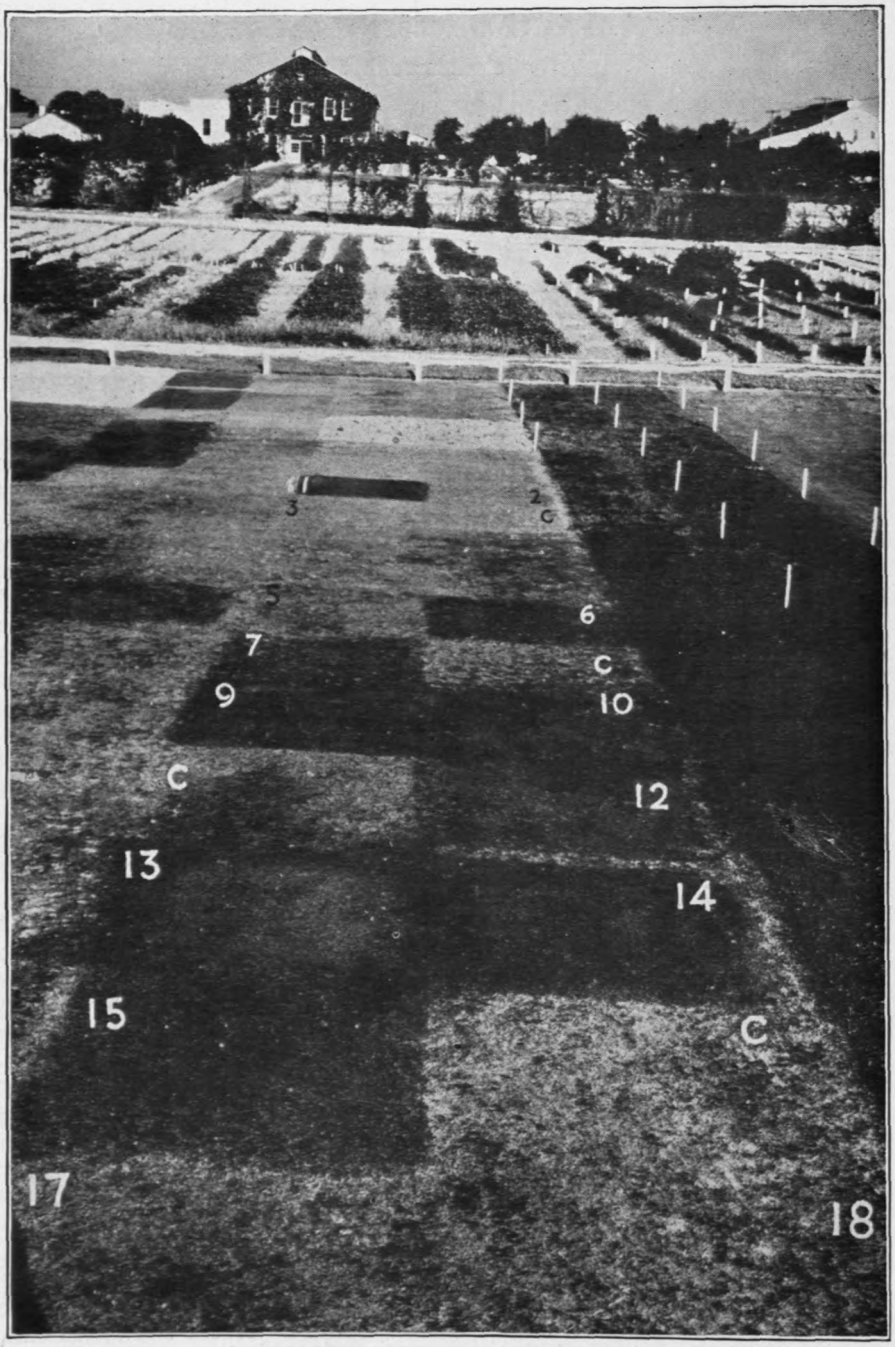
By John Monteith, Jr.

Various experiments have been conducted during the last few years at Arlington Turf Garden to determine the value of different chemicals in controlling brown-patch. It was soon learned that Bordeaux mixture would check large brown-patch but had little effect on small brown-patch. To protect turf it is necessary to have the Bordeaux on the grass leaves, for as soon as it is washed into the soil the disease may again develop. This necessitates frequent applications, which in many cases have resulted in injury to the plants due to accumulations of copper in the soil. Work was accordingly continued to try to find a fungicide which would maintain its protective qualities for a longer period even after frequent waterings or showers, one which would control both types of disease, and one which would result in no serious injury to the turf, either temporary or gradually cumulative. When the organic mercury compounds were found to be effective in controlling certain seed-borne diseases of cereals, they were tested in the Turf Garden. The preliminary trials showed considerable promise, but results were somewhat contradictory in many cases. A few isolated experiments which were claimed to demonstrate the superprotective qualities of these compounds were reported from other localities, but unfortunately were not supported with data showing control throughout a season under varying conditions. The experiments at Arlington showed that these compounds unquestionably would check brown-patch under certain conditions; and it was therefore planned to test them much more carefully this year to determine their effectiveness or limitations before making a general recommendation for their use. Part of the Arlington Turf Garden is divided into plots 8 feet square, each of which is planted with a single strain of grass. There is considerable variation in the amount of brown-patch on different grasses; so it is necessary to make comparisons of treated and of untreated areas in the same 8-foot plot. To do this accurately a frame 4 feet square with canvas sides was used in making the application, as shown in the accompanying illustration. By this means each plot could be divided into quarters, permitting three separate treatments on each plot and a 4-foot square of untreated grass for comparison. The canvas sides prevented any of the spray from falling outside the area treated. After the chemicals were applied the whole plot received the usual watering, cutting, or topdressing given the rest of the turf garden. The experiments reported in the August and September numbers of the BULLETIN were conducted by the above method.



Applying a spray treatment.

During the latter part of August and in early September small



Plots at Arlington Turf Garden, showing results of experiments in the control of small brown-patch.

brown-patch was very active at Arlington, giving a good opportunity to observe the effectiveness of the various fungicides when used against this disease. Some of the results are shown in the photo-

graph on the preceding page. In the case here illustrated several plots in a row were of the same strain of creeping bent, which is very susceptible to brown-patch. The several fungicides were applied on August 26, and all the plots were topdressed August 27. Since the disease appeared again in most of the treated sections the first week in September, the application of chemicals was repeated on September 8. The photograph was taken on September 19. For convenience in referring to the treated areas, they have been given numbers on the illustration, whereas in each case the untreated check has been designated with a letter C. It will be noticed that the check was alternated from right to left to indicate whether or not the disease was uniform on both sides of the strip and to make it possible to have every treated square directly compared with an untreated block. The dark strip on the right is Kentucky bluegrass, which is clipped at fairway length. The second plot behind numbers 1 and 2, as also the plot at the upper left, were being prepared for replanting and indicate how the bare soil photographed as compared with the diseased turf in the check.

The treatments applied to the plots shown in the photograph, converted into terms of pounds of the chemical in 50 gallons of water to areas of 1,000 square feet, were as follows:

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

The applications were made as a fine spray, except in the case of copper stearate, which was put on as a dust. The light, spotted appearance of the checks shows how much damage the disease caused as compared with the dark squares of healthy turf, where the fungus had been stopped by each of several of the chemicals. It is interesting to note the narrow diseased strip between plots 12 and 14, where the frame did not overlap for the two treatments, thus leaving the strip unprotected.

The copper compounds proved of no value, as will be seen by comparing them with the nearest checks. The organic copper (copper stearate, plot 18) was no better than the inorganic salt (copper sulfate, plot 5) nor the mixture of copper sulfate and lime (Bordeaux, plot 17). These copper applications are all effective in controlling the large brown-patch but have never shown any promise of checking the small brown-patch. Sulfur (plot 3) also proved practically useless. Formalin (plot 2) gave some indication of control in previous tests, but the protection it affords is for a much shorter period than is the case with the mercury compounds.

All the mercury treatments at this time showed very striking results. As shown in the illustration, they appeared to be equally ef-

fective at the rates used in this series. Of these, Semesan (plot 1), Uspulun (plots 7 and 15), Corona (plots 9, 10, 13, and 14), and Germisan (plot 12), are in general of a similar chemical composition—that is, made by combining mercury with cresol, formaldehyde, phenol, or similar materials. Throughout the summer they have given fairly comparable results. At times one would appear slightly more efficient than the others; but in other trials such differences would be reversed. For all practical purposes, therefore, they are to be regarded as equally effective in controlling both small brown-patch and large brown-path.

The effect of mercury in the inorganic form is shown in plot 6. On this plot mercuric chlorid (corrosive sublimate) was used at a rate of 1 pound to 3,000 square feet. The illustration shows that this treatment gave results equal to the treatments with any of the organic mercury compounds. Unfortunately the crab grass was not picked out of the plots containing treatments 5, 6, and 7 until a few days before the photograph was taken. The few spots which are evident in plots 6 and 7 are the holes left when the plots were weeded, as is seen also on the plot at their left in the next row. At the time the photograph was taken, and for at least two weeks thereafter, there was no development of brown-patch in plots 6 or 7. These results were similar to those obtained on other plots at different times during the summer. As a general rule, the application of 1 pound of mercuric chlorid to 3,000 square feet appeared about as effective as the treatments with 1 pound of the chlorophenol mercury compounds to 1,000 square feet. This is probably due to the fact that the latter products contain only 30 per cent of the active mercury ingredient, whereas the mercuric chlorid solution was made up from the pure chemical.

One of the most serious objections to the organic mercury treatments is their excessive cost when repeatedly applied throughout a season. Since mercuric chlorid may be bought for about one-half the cost of the chlorophenol mercury, it means that this lighter application could be made for approximately one-sixth the cost of using the chlorophenol mercury treatments. It will be recognized that murcuric chlorid is the old familiar "worm-killer" which is known as "corrosive sublimate" or "bichlorid." It should be possible therefore to work out a method of application which will utilize the chemical in both capacities at once. In another article in this number of the BULLETIN (page 218) it is pointed out that it will also check the growth of algae on greens.

The experiments this summer included a large number of chemicals and therefore the tests with mercuric chlorid were not as exhaustive as they might have been. The best method of application is still to be determined. There seems to be more danger of burning the grass with the bichlorid than with most of the organic mercury combinations. However, since this burning did not occur regularly, it may be assumed that when properly applied this injury may be avoided. The protection afforded by the bichlorid appears as lasting as in the case of the forms of organic mercury. It is very probable that the mercury in either form undergoes various chemical reactions in the soil and that the protective qualities are derived from the same source. At any rate, the important point is, that the mercuric chlorid protects the turf from brown-patch and at a much lower cost than

any of the organic mercury products now on the market. By this we do not mean to claim that it is the much-sought-for sure cure for brown-patch. We know that under certain conditions it will produce very remarkable results. We also know that under conditions extremely favorable for the development of brown-patch in midsummer it will not prevent brown-patch for more than a short period—nor indeed will any of the organic mercury compounds so far tested.

Converting Established Turf to Creeping Bent by Broadcasting Stolons and Topdressing

By O. B. Fitts

During the past two years a number of experiments have been conducted at the Arlington Experimental Turf Garden with creeping bent stolons scattered over old turf of various species of grasses and then topdressed, the purpose being to convert the old turf to creeping bent. Every attempt in this respect at Arlington so far has been very successful. Therefore it seems reasonable that such a method might be successfully practised in renovating old greens or converting the turf of other grasses to creeping bent. There are many clubs whose members are playing on poor putting greens simply because they are not willing to abandon the use of the greens long enough for the turf to be removed and new turf established. Others are playing on poor greens because they do not have the funds necessary for such a course of procedure in renovating the greens. It was in consideration of these problems that experimenting with creeping bent stolons planted on old turf was begun, the object being to find some practical method, if possible, of introducing creeping bent and establishing good turf on old putting greens without necessitating putting them out of play for any great length of time and at less expense than is usually involved in the customary method of renovating putting greens.

The first of these experiments was made at the Arlington Turf Garden during the year 1922, and the method employed was that of dibbling the stolons into the old turf; that is, the turf was slit with a knife at intervals of about four inches, and the stolons inserted in each slit, then the earth pressed down around them with the foot. This proved to be a very slow and tedious job. However, by the end of the summer of 1923 the plots so treated (which were originally redtop) were pure creeping bent. This method has been tried out on a few putting greens, but in some instances has not been very successful. In applying this method it is not necessary to put the greens out of play except during the time the work is being done; but it is a very slow method, and even when it is successful it requires from one to two years to get a good bent turf established.

In 1923 three plots at the Arlington Turf Garden were selected for trying out the method of broadcasting the stolons on the old turf and topdressing. One of these plots had fescue turf; one, South German mixed bent; and the other, a very poor strain of creeping bent. The fescue plot was planted to chopped-up stolons of Metropolitan creeping bent, and the other two were planted to Washington creeping bent. This planting was done in early September. The process

of planting was simply to chop up the stolons as though preparing them for planting a new green, and scattering them over the old turf without disturbing the turf at all, and then rolling and topdressing with about one cubic yard of compost to 2,000 square feet of green. This was then rolled again lightly and watered sufficiently to get the topdressing and stolons thoroughly moist. After that no special attention was given these plots. They were watered and mowed just as all the other plots in the garden, and by May, 1924, each of these plots showed a solid turf of the grass planted on it in this way, and hardly a blade of the old grass could be found. In this particular case the turf was in playable condition continuously except four or five days following the planting.

Since that time a number of plots of various grasses have been converted to bent turf in this way, except that in some instances the surface of the old plot was scarified by raking lightly with an iron-tooth garden rake before the stolons were applied, and in most cases the plots have been given more special care than the first plots were given; that is, they have been watered as frequently as was found necessary to keep the surface moist at all times until the stolons had become rooted and started growing. This usually requires about two weeks time, and during that time the turf is not in condition to be played on, owing to continuous watering. At the end of this period the greens should be topdressed lightly and after that they are ready for play.

There appears to be no reason why clubs should not use this method successfully in renovating turf on putting greens, and if it does prove to be successful in this way it means a great saving in time and money. It has actually been used with success by some clubs; but the greens were put out of play two weeks during the process.

A Machine for Spraying Liquid Solution

Hydraulic Sprayer

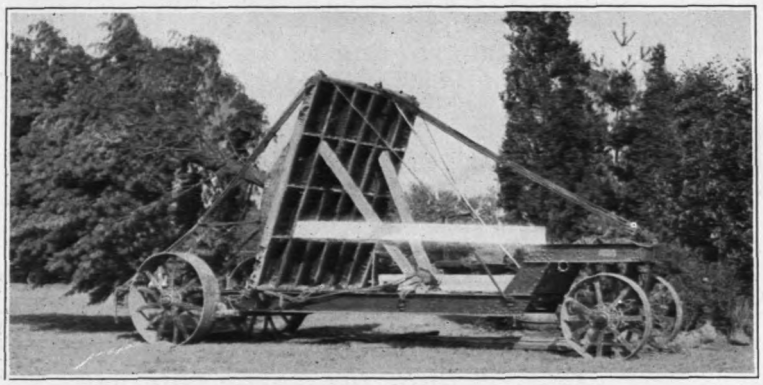
In the accompanying illustration is shown a machine designed for applying solutions to turf by means of a combined tank and sprayer. The sprayer runs with water pressure, effecting a uniform mixture of the solution in the water. It may be used for applying chemicals of any kind. The capacity of the tank is 15 gallons, this being sufficient ammonium sulfate for six or seven putting greens. The light wagon on which the machine is mounted makes it easy for two men to move it from green to green.

Native Trees, Shrubs, and Flowers for Golf Courses

Part I. Fall Plantings

By P. L. Ricker, President, National Wild Flower Preservation Society

Many golf clubs are well provided with larger or smaller groups of trees, and frequently with streams or ponds bordering some of the fairways and greens, furnishing shade and a landscape effect upon which it is difficult to improve. For clubs not so fortunate it is not difficult, in the late fall or early winter, after the deciduous leaves have fallen and the course requires less attention, to have the workmen move fair-sized trees, 20 or 25 feet tall, from the nearest wooded area, or perhaps from some real-estate improvement which is cutting down the bulk of the trees, to points of vantage along the fairways, greens, and tees. Maple, oak, elm, hickory, ash, tulip, poplar, walnut, beech, birch, wild crab, hawthorn, black cherry, yellow-wood, buckeye, gum, cedar, pine, spruce, or fir are usually available, and should be grouped with the trunks from 20 to 30 feet apart.



One method of moving trees. (The horizontal white strip results from eliminating the manufacturer's name.)

The usual method of moving such trees is to dig a trench about 2½ to 3 feet deep around the tree to be moved and at a distance of 3 to 5 feet from the trunk, depending on the size of the tree and the roots. The tree is then loosened by digging under it. Part or most of the soil may be removed from the roots with picks, when planks may be placed under the roots and the tree slid onto a drag; or a heavy rear axle with a long tongue and wheels as large as possible may be backed up to the tree and, after wrapping the trunk with several thicknesses of burlap to protect the bark, the trunk may be lashed to the tongue, the tree readily lifted from its hole, hauled to its new resting place, and planted by the reverse process.

By digging a square trench and boxing the soil around the roots, trees may be moved, with care, on a drag or skids, even during the growing season; but without experience the moving of deciduous trees when in leaf had better be left to the professional tree mover.

In moving evergreens, and deciduous-leaved trees with the leaves still on, the ground around the tree should first be thoroughly saturated with water, so that it will soak down to the roots, and then, after the ground is partially dried out so that it retains just sufficient

moisture to assist in holding the soil together, the excavating process is begun as described above. With smaller trees the ball of dirt on the roots should be wrapped with burlap to keep the soil from falling away from the roots. With larger trees the earth around the roots must be boxed. It is fatal to the life of a tree to allow the soil to fall away from the roots. When replanted, the roots must again be thoroughly watered. The larger trees are usually stayed with guy ropes from three directions, to prevent their being blown over, until the roots have reestablished themselves. Ropes around the trunk 6 to 8 feet from the ground may be used for this purpose, provided the bark is protected by burlap.

The Rose Mallow, blooming in July and August, is one of the most attractive flowers for low, wet meadows and banks of streams or ponds.

Large groups of trees should be planted somewhat farther apart, and small trees and shrubs, such as dogwood, redbud, holly, wild hydrangea, fringe-tree, elder, arrow-wood, spice bush, hackberry, mountain ash, shad-bush, wafer-ash, strawberry bush, bladder-nut, and pepperbush, may be planted between, or grouped by themselves.

In a well-established woods, particularly along streams, with acid soil indicated by a thick vegetable mould, mountain laurel may be introduced to advantage. Hedges of mountain laurel planted with plenty of wood loam and mulched every fall with oak leaves, pine needles, or sawdust that has been rotting for four or five years, for the purpose of supplying the necessary soil acidity, are very attractive, particularly when in flower. They should be planted in situations where they do not need to be trimmed in case they should eventually reach a height of 6 to 10 feet, a height which, except along streams, they are hardly likely to exceed in most localities.

When a wooded area has become established, a great variety of shade-loving wild flowers may be planted either from seed collected during the period from late spring to late fall or by moving the plants

with a good ball of earth from near-by woodlands or areas being cleared. Except in California and Oregon, wild flower seeds do not appear to be on the market, although many dealers throughout the country do offer rooted plants for sale. These are, however, often taken in considerable quantity from areas where they can not be spared, and there is danger of many localities being stripped of some of the rarer wild flowers by dealers. Few dealers attempt to propagate their own wild stock. In collecting seeds locally, care should be taken to leave plenty of the seed pods to maintain the usual supply of plants in their natural locations; this is particularly advisable in the case of annual plants. As nature's method is to drop the seed to the ground as soon as ripe or to have this done by birds, it is evident

The Rose Pink will make an attractive display in August on low meadows.

that all seed collected should be planted at once and not over one-half to 1 inch deep. In fact, scattering the seed is ordinarily effective, and this should always be done in as nearly the same soil, moisture, and shade conditions as those in which the parent plants were found growing. Some wild seed, such as that of wild rice and gentians, which normally grow in from wet to only damp conditions, will not grow at all if allowed to become thoroughly dry before planting. Many other seeds require to be frozen or to lay on or in the ground over winter before they will grow. This is to burst the outer, usually hard seed coat. Some seeds, like holly and dogwood, have such a hard seed coat and probably require so long a time for the seed to ripen that they have to remain in the ground over two winters before they will grow.

Wild herbaceous annuals and perennials suitable for situations which are not too densely shaded include golden ragwort, hepatica, bloodroot, anemone, phlox, trillium, bluebell, wild geranium, phacelia, larkspur, May apple, twin-leaf, spiderwort, stonecrop, toothwort,

The wild Aster makes one of the best subjects for dry, open ground, and blooms throughout August and September

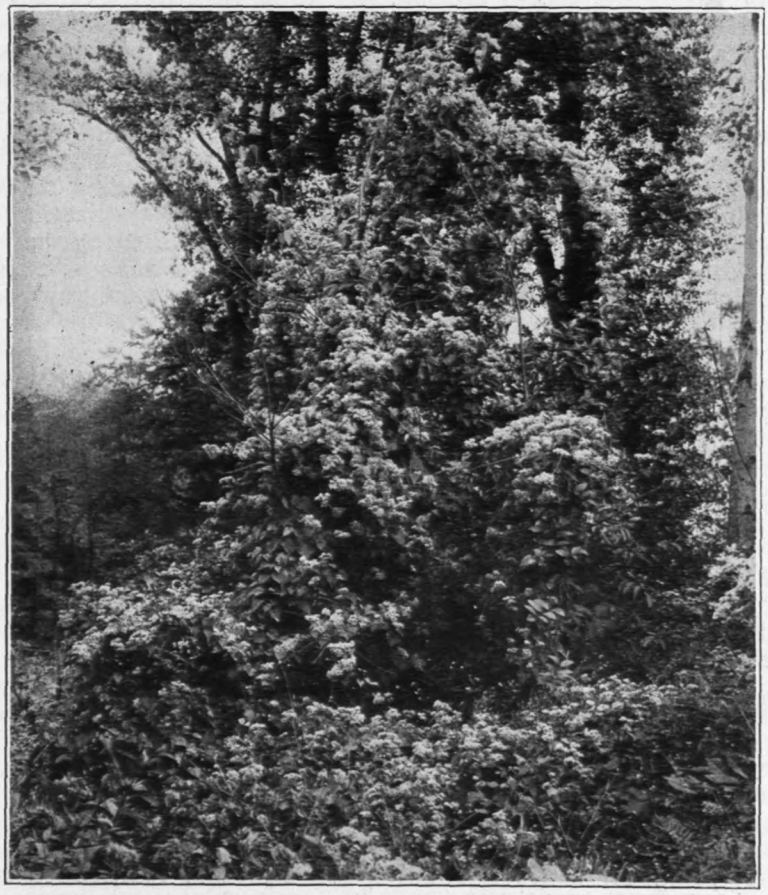
The Hairy Beard-tongue in this field covered several acres as dense as this during July and August

Dutchman's breeches, Virginia creeper, blue-eyed Mary, most ferns, and blue, white, and yellow violets. Some plants, such as lady's-slipper, trailing arbutus, violet wood-oxalis, partridge berry, bunch-

berry, wild ginger, and maidenhair fern, need acid soil, or leaf mould.

Along the edges of streams or ponds, sufficiently out of the fairway not to interfere with the play, may be planted blue flag, arrow leaf, pickerel weed, white and yellow water lilies, marsh marigold, lotus, and bulbous cress.

In slightly moist or low meadows adjoining water courses may be planted dog-toothed violet, cardinal flower, gentian, and rose pink. If the meadows are of acid reaction, or underlaid with peat, many orchids, such as pogonia, ladies'-tresses, and some of the fringed orchids, may be grown.



The climbing Hempweed makes a solid mass of pale pink to white flowers during July and August.

In dry, open fields violets, bluet, foxglove, milkwort, St. John's wort, steeple bush, lily, fritillary, California poppy, Mariposa lily, loosestrife, beard-tongue, farewell-to-spring, asters, evening primrose, butter-and-eggs, and lupine will grow in great profusion. Pokeberry, bayberry, hackleberry, buffaloberry, crowberry, huckleberry, blueberry, snowberry, blackberry, raspberry, juniper, madrone, manzanita, kinnikinnick, salal, and currant, added to the background, will attract many birds.

To rocky situations the moss pink, saxifrage, rockcress, and red columbine are adapted.

The beautifying of roadside approaches should not be overlooked. A judicious scattering of dogwood and redbud add much to the spring attractiveness of such situations. Arbor vitae and red cedar can be added, with an occasional tree from those first listed above, and in a more or less distant and not too formal arrangement. Either wild or rambler roses add a touch of color in season, and the latter have the advantage that they soon make a dense shaded thicket which helps to keep down some of the usual roadside weeds. Unsightly cuts, or banks subject to erosion, may best be covered in eastern United States with Japanese honeysuckle. This roots readily, spreads rapidly, and has attractive fragrant flowers, and is common as an introduced weed in many localities, where it may be obtained without other expense than that involved in collecting plants which are already rooted. Climbing hempweed will cover fences and in summer becomes a solid mass of white to pinkish blooms.

Many other plants may be added to the list, depending on one's knowledge of the local flora. With the advance of civilization and consequent destruction of woodlands and fields due to agricultural and building operations, few wild beauty spots will remain in another generation or two except such as are set aside for that purpose in the form of parks, town forest, and plant preserves. An opportunity is here presented for making the unoccupied parts of country-club grounds places of beauty and at the same time furnishing refuge for many of our disappearing birds and flowers.

Bird Houses

Birds appeal strongly to the interest and affection of mankind. Their natural attractiveness is enhanced by their great economic value, especially in the control of insect pests. For economic as well as for esthetic reasons, therefore, an effort should be made to attract and protect birds and to increase their numbers. The United States Department of Agriculture has a series of bulletins on harboring birds. These bulletins will be sent to anyone requesting them upon application to the Office of Publications, United States Department of Agriculture, Washington, D. C. The series consists of the following publications: Farmers' Bulletin 1456, "Homes for Birds"; Farmers' Bulletin 621, "Attracting Birds; Northeastern States"; Farmers' Bulletin 760, "Attracting Birds; Northwestern States"; Farmers' Bulletin 844, "Attracting Birds; Middle Atlantic States"; Farmers' Bulletin 912, "Attracting Birds; East Central States"; Farmers' Bulletin 1239, "Community Bird Refuges" (of general application).

New Member Clubs of Green Section.—Elmira Golf and Country Club, Elmira, N. Y.; New Zealand Golf Association, Wellington, New Zealand; Coldstream Country Club, Hempstead, N. Y.; Canadian National Railway's Course, Minaki, Ontario; Canadian National Railway's Course, Jasper, Alberta; St. Marys Country Club, St. Marys, Pa.; Lake Shore Country Club, Glencoe, Ill.; Prouts Neck Country Club, Prouts Neck, Me.; Antlers Country Club, Amsterdam, N. Y.

Fertilizing Fairways with Ammonium Sulfate

By Alan D. Wilson

One of our constant problems at Pine Valley Golf Club is to find the best way of nourishing the grass on the fairways. When the course was built the soil consisted of practically pure sea sand, which, of course, would not hold much moisture and contained little food for turf. This condition we have, however, greatly improved by light topdressings of clay and by constant feeding, and we now have fairways as good as even a very particular golfer would require; but these can be secured and maintained only by constant care and effort.

The first method of fertilizing tried was the use of composted cow manure applied with clay topdressing. This was effective, but after a number of years we had a severe visitation from the grubs of the southern green June beetle. It was thought that the use of organic fertilizer, such as manure, encouraged these grubs, or at least provided a perfect feeding ground for them. We therefore, to a large extent, abandoned the use of manure and resorted to the use of bone meal, as far as possible, as the fertilizer for our fairways. Bone meal was fairly efficacious, but did not give as good results as the manure, and we thought furthermore, that to a certain extent it encouraged the growth of crab grass. It is true that the invasion of crab grass may have resulted from agencies apart from the use of bone meal, such as the thinning of the turf. In any case the turf deteriorated and the crab grass increased. We then started to use mushroom soil, and found it extremely valuable. The growth of the grass was tremendously stimulated and a very marked difference could be noticed between the spots where mushroom soil had been used and where it had not been used. The only disadvantage encountered in this treatment was that we were again preparing a good feeding ground for the grubs, which had very largely disappeared, and the return of which we did not wish to encourage.

For some years we had been using ammonium sulfate with great success on the greens, and we thought it possible that if we could devise a satisfactory method of distributing the sulfate over the fairways we might get a fertilizer which would maintain them in first-class condition, which would decrease our crab grass through increasing the acidity of the soil, and which would not encourage the southern green June beetle to return to Pine Valley for the purposes of reproduction.

The first method we tried was that of applying the sulfate in solution by the use of a distributing apparatus consisting of cans in which the sulfate was placed and which were then connected up with the water system. This we found very tedious and expensive; it took two men eight hours to put the solution on two fairways, and the results were not entirely satisfactory, because the subsequent watering had not been sufficient thoroughly to wash the sulfate of ammonia into the soil, and as a consequence the fairways showed a number of burned spots.

Some weeks later we tried a second method. We waited until a rainy day arrived, a day when it looked as if we were in for an all-day downpour. We then hitched a fairway seeder behind a tractor and filled the seeder with ammonium sulfate in dry form, taking care

to cover the seed box with a rubber blanket to prevent the sulfate from becoming wet. This method proved wonderfully successful; two men in seven hours distributed the sulfate over fourteen fairways and eighteen tees. In all, we used four tons of ammonium sulfate, an average of about 500 pounds to each fairway, which works out roughly about 5 pounds to 1,000 square feet. By this method we were able to get a very even distribution. The rain fortunately continued for the rest of the day, the sulfate was thoroughly washed into the soil, and we did not notice a single burned spot at any place on the course. This was done in early August, a time of year when possibly the greatest care must be used in applying chemicals to turf, and while at this writing, a month afterwards, it is too early to give any definite and decided opinion on the value of this treatment, it can be stated that we think the Pine Valley fairways are in better condition now than we have ever seen them.

We believed this method might be of interest to others who desired to experiment, and are therefore setting forth the facts, but we would like to add this word of warning: Do not try this method unless you feel quite certain that you will have a long, steady rain, for if you should get your fairways covered with the sulfate in powdered form and just well moistened, and the rain should then stop, you would burn your grass in a way that would be heartbreaking.

(During the cooler part of the year, November to April, the sulfate can be applied safely at the rate of 2 to 5 pounds per 1,000 square feet, without any subsequent watering.—*Editors*)

Steam Sterilization as a Possible Means of Controlling Weeds on Putting Greens

By E. J. Kinney, Associate Agronomist, Kentucky Agricultural Experiment Station

Over a large area of the United States, particularly in the middle latitudes, the invasion of weed pests in putting greens presents throughout the summer one of the most difficult and expensive problems in greenkeeping. It is obvious that much of the labor of keeping greens free of weeds can be avoided if a good part of the weed seeds in the surface soil can be destroyed before the sowing of grass seed. One method of accomplishing this is preparing the soil for new greens or breaking up the soil of old greens in the spring, and stirring the soil at frequent intervals during the summer. Most of the weed seeds will germinate during that time, and the weeds will be killed by the frequent working of the soil. The only objection to this method of avoiding weeds is the length of time required. Players object to the use of temporary greens during an entire season, and for this reason the work is seldom started early enough in the spring to make it really effective.

It appears to the writer that steam sterilization of soil, as widely practised by tobacco growers in preparing tobacco plant beds for seeding, may be a practicable method of destroying weed seeds in the soil of putting greens. In the case of tobacco-plant beds it accomplishes this effectively, and presumably would be just as effective with putting greens. The cost would not be prohibitive, and the

greens could be seeded as soon as the soil was prepared and steamed, thus saving much time in getting a good playing turf. Another feature worthy of consideration is the marked increase in vigor of growth of plants on partially sterilized soil. The cause of this increased vigor has not been definitely determined, although it has been the subject of numerous investigations. It may be due in part to the destruction of disease organisms. That certain diseases of tobacco, such as root-rot, are controlled in the plant bed by steaming the soil is a well-known fact.

Steam-pan sterilization, as this method of partially sterilizing soil is called, was first advocated by Mr. A. D. Shamel, at one time in charge of tobacco investigations in the Bureau of Plant Industry, United States Department of Agriculture, as a means of controlling disease in tobacco-plant beds in the Connecticut Valley tobacco-growing section. It proved so valuable there that it was widely adopted, and in more recent years the practice has spread to other tobacco-growing sections. It is recognized as by far the most effective means of controlling weeds and disease in the plant bed.

The equipment required for steaming consists of a portable boiler, a shallow wooden or sheet-iron pan, and steam hose or iron pipe with connections for conveying the steam from the boiler to the pan. The pan is made about 4 inches deep, the other dimensions depending upon the capacity of the boiler available. A minimum steam pressure of 80 pounds must be maintained during the steaming operation, and 100 pounds is preferable. A steam tractor with forced draft rated at from 20 to 25 horsepower, such as is commonly used in custom threshing, will furnish steam for a pan 9 feet wide by 12 feet long. Most steam rollers have about the same capacity. The small boiler and pan are not practicable where much steaming is to be done.

In most tobacco-growing sections the steaming is done largely by contractors who own steam tractors, who go from place to place, carrying on the work whenever the condition of the soil permits. Steaming is not effective when the soil is very wet, and should not be then attempted. The ground to be steamed is prepared as for seeding. The pan is then inverted over a portion of the prepared bed and connected with the boiler. Steam is gradually admitted. Thirty minutes of steaming at a pressure of 80 to 100 pounds is sufficient. The pan is then moved and the steamed area covered with tarpaulin, sacks, or other covering, so that the heat may be retained in the soil as long as possible.

The temperatures reached after 30 minutes of steaming are about as follows, provided the soil is fairly dry:

208° to 212° F. in the upper 2 inches of soil; at 3 to 4 inches, 170° to 180°; and at 6 inches, about 150° F. A good way to measure the effectiveness of the operation is to bury a good-sized potato 4 inches beneath the surface of the soil. The potato should be well cooked when the pan is moved; if not, a little more time should be allowed. If the steamed area is protected after steaming, as suggested, the temperature at a depth of 6 inches should be about 170° F. two hours after the pan is removed. It is obvious that such temperature must destroy weed seeds very effectively.

The construction of the steam pan and the operation of steaming are so well described in United States Department of Agriculture Farmers' Bulletin 996 that it seems unnecessary to give details here.

This bulletin may be secured free on request to the United States Department of Agriculture.

The greens may be seeded the day after steaming the seed bed. The soil should not be stirred deeply after steaming. All preparation and leveling should be done previously, so that a light raking will put the green in condition for sowing the grass seed. The seed should be covered very lightly and the soil kept well watered.

Where custom steaming is practised, the charge varies from 75 cents to $1.25 per hundred square feet of plant bed. The contractor usually furnishes the pan and the necessary equipment, while the one having the work done furnishes the fuel and the labor necessary to move the pan. A ton of coal is required for steaming 2,000 to 3,000 square feet of bed. Three men in addition to the fireman are necessary for moving the pan. In steaming greens the men could be used for work near the green, subject to call when needed. The area of the standard putting green is about 6,000 square feet. The charges for steaming this area at the rates indicated above vary from $50 to $70. Coal would cost about $20, and help $10. The total cost would be $80 to $100 per green. Where the golf club has to do the work and supply the equipment it is difficult to figure the cost. The rent of a boiler would be the largest item. If several clubs would cooperate and purchase a second-hand tractor, the cost would eventually be less than if the boiler were hired. It is possible in most sections to hire a tractor or steam roller, including the man to operate it, for from $15 to $20 per day. A wooden pan costs about $25 and sufficient steam hose (about 50 feet), $30 to $40. If iron pipe were used the cost would be about $10. The pan should last indefinitely. About four days would be required for steaming a green. Figuring $15 per day for the boiler, $5 for coal, and $10 for help, the cost per green would be about $100. The labor cost of $10 is too low unless the men required for moving the steam pan can be utilized for other work nearby. The pan can be moved by two men, using a rack for lifting. The method of making this rack is described in Farmers' Bulletin 996, previously referred to.

The writer believes that annual weeds, and crab grass in particular, can be practically eradicated from a green by thorough steaming. White clover seeds will probably not be all destroyed, and deeply rooted perennials will persist. How long steam-sterilized greens would remain free of seeds is a question that can not be answered, because of lack of experience. It would, however, seem reasonable to suppose that if any weeds which do appear are promptly pulled and not allowed to seed, and if the greens are sufficiently elevated to keep weed seeds from washing or blowing onto them, little hand-weeding ought to be necessary for several years. Of course, it would be unwise for any golf club to spend much money on steaming until it has been determined how effective it may prove to be for putting greens; but the method appears to possess sufficient promise to warrant careful trials.

Compost mixing machines.—There are several of these machines which have proved very satisfactory. A machine of this kind should be a part of every club's equipment.

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

A and B both drove. About 200 yards from the tee a creek crosses the fairway. Both players thought that B's ball went into the creek. A stepped up and played B's ball. B went on to the creek and, not being able to find his ball in the creek, dropped another one and went into the creek again. He then dropped a third ball and shot over to the green. When both players arrived at the green B noticed that A shot B's ball. B therefore claimed that they should both go back, which they did, and A's ball was found in a trap at the right of the fairway. B dropped his ball as near as possible to where A had shot it from, and incidentally B got a four while A took a six.

Decision.—A had no right to assume without investigation that the ball found in the fairway was his ball. It does not appear that any misinformation was given A by his opponent in this case. Evidently A neglected to make certain that the ball belonged to him, and having played his opponent's ball he then and there lost the hole.

On several occasions arguments have arisen relative to grounding a club on the grass on the sloping side of a bunker. Some of our members contend that a club can not be grounded at any point below the level of the fairway and that it can not be grounded on the side of a bunker where grass is growing.

Decision.—The sloping sides of a bunker covered with grass are not considered within the confines of a hazard and therefore are not part of the hazard. Grass included within the boundaries of a hazard, however, must be considered part of the hazard. For this reason local committees should be very particular in defining the boundaries of their hazards.

A player was on the second green in 2 and had a 15-foot putt for his birdie 3. Just as he tapped the ball with his putter a small Scotch terrier which had been lying on the grass just off the carpet dashed onto the sward, skidded across the green, and seized the ball a short distance from the cup. The next instant the dog had dropped the gutta percha into the cup. There has been a great deal of argument since as to just how many strokes the player should have credited himself with for the hole.

Decision.—In this case the ball was moved by an agency outside the match. Under Rule 17 (2), therefore, the ball must be replaced as near as possible to the place at which the dog seized it.

Winter treatment of fairways.—Notwithstanding the fact that topdressings of manure or other humus materials encourage the spread of earthworms and grubs to some extent, a light covering of well-rotted manure on fairways over winter where they are kept out of play has a distinct advantage in stimulating the growth of the turf. All coarse material in the manure should be raked off promptly at the end of winter so as not to hinder the growth of the grass. If manure is not obtainable, a topdressing of good top soil alone is of great benefit, especially where the soil is naturally poor.

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. Fall, winter, and spring seeding of fairways.—The construction work on our new golf course has this fall progressed to such an extent that we shall probably wish to seed our fairways in the spring, as we expect to have water available for sprinkling them. Do you not think it advisable to seed in the spring rather than allow the ground to lie idle until next August? It appears to us that if we are ready it would be to our advantage to seed in the spring and then go over the job in August and reseed the thin spots that may not have taken hold. (Illinois.)

ANSWER.—The question you bring up is a very difficult one, and one on which we are frank to say we do not have a sufficient amount of experimental data. Unquestionably the end of August or the first of September is the best time to plant any of the perennial turf grasses. Under your conditions it is difficult for you to do anything but try seeding in the spring, unless you care to try winter seeding, which might possibly yield better results. The earlier you get the seeding done the better. Unfortunately, the ground is usually wet in the spring, with the result that considerable delay is encountered in getting the seeding done. For this reason we would advise you to try winter seeding, if the ground is in condition to seed. The soil should first be carefully harrowed, and after the seed is broadcast the area should be gone over with a weeder. If the seed is sown at any time during the winter it will be ready to germinate promptly in the spring and will easily get two or three weeks start over any spring seeding you could possibly do after the ground is ready to seed in the spring. From the data we have, your chances of success in winter seeding are very large. Even if the stand should be thin in spots you would lose nothing if those spots could be reseeded in the spring. Under ordinary conditions we recommend a mixture of 4 pounds of Kentucky bluegrass and 1 pound of redtop seed for fairways, sown at the rate of not to exceed 150 pounds per acre. For winter seeding, however, we would advise the use of a larger proportion of redtop, say 1 pound of redtop to 3 pounds of bluegrass, as the redtop seed germinates sooner and its seedlings are more vigorous than is the case with Kentucky bluegrass.

2. Controlling mole crickets and ground crickets.—We are having trouble with ground crickets under the turf on our greens. What is the best means for exterminating them? (Texas.)

ANSWER.—The following poison bait is recommended for controlling the ground cricket: 100 pounds ordinary wheat bran, 5 pounds white arsenic, and 1 small jar of beef extract. Sufficient

water to wet the bran will also be required, which is usually about 15 gallons. The beef extract should be dissolved in the water before being mixed with the bran. The bait should be scattered uniformly and rather plentifully where the crickets are feeding. As the crickets feed mostly at night and are attracted to the bran bait principally while it is in a damp condition, it would be better to scatter the bait during the early evening hours.

Thinking possibly what you have reference to may be the changa, or West Indian mole cricket, and not the common ground cricket, we are giving suggestions also for the control of the mole cricket. This insect was described and illustrated on pages 104 to 106 of the June, 1921, number of THE BULLETIN. In that article the following poison bait was recommended for the mole cricket: "Ordinary low-grade wheat flour, with which was mixed 3 percent of Paris green. This was distributed broadcast at the rate of 300 pounds per acre and resulted in a fairly satisfactory control. * * * White arsenic may be used in the place of Paris green where desirable, as it usually may be obtained much more cheaply. There is a bare possibility that the tender grasses of greens may be burned by the application of the arsenicals as recommended, and in this case hydrated lime may be added to the bait in sufficient quantities to overcome the trouble. * * * Since the burrows of the insects are often but a short distance beneath the surface of the soil, it may be found possible to reach them successfully with soil fumigants. The use of carbon disulfid may be attempted in cases where the infestation is of limited extent and injury is severe, in the following manner: Inject about 1 teaspoonful of the liquid into the soil at intervals of a foot or two over the surface, by means of a long-spouted oil can, and cover the same for an hour or two with large pieces of heavy canvas or burlap which have been previously wetted with water."

3. **Winterkilling.**—For several years we have noticed dead patches of turf on our greens at the end of winter, and the same condition has occurred during the past winter. In fact, we find from an examination this spring that they have been very badly attacked by this disease. Have you had any experience with this winter form of brown-patch? (Ontario.)

ANSWER.—We are certain that the trouble you refer to as brown-patch is not a disease. Brown-patch is notoriously a disease of hot weather, especially the large brown-patch, though the small brown-patch frequently occurs as late as October. We have never seen a case of brown-patch occurring during the winter. We suspect that what you call brown-patch is really winterkilling. This injury often occurs in the North, but in 99 cases out of 100 it is found only where the soil is waterlogged at the time of a freeze; that is, if there is a basin in a putting green which holds water, even temporarily, the grass will be killed when a freeze occurs. Even on the slope of a steep hill below a snowbank, where the soil has temporarily become waterlogged, winterkilling will occur. We can offer the following suggestions for preventing winterkilling. The most important consideration is to have better drainage, both subdrainage and surface drainage. Furthermore, it would be well to watch the putting greens during the winter to see that big snowbanks do not form which will keep the soil waterlogged just below the snowbanks during periods

of thawing. Where an entire green is covered with snow or ice no harm will ensue. It also helps to protect the greens with some sort of covering, such as branches or tobacco stems. Of course, there is this objection to such a covering, that as the wind blows the material about, bare spaces will be left. Nevertheless, it can not be expected that such a covering will materially overcome the effects of water-logging due to poor drainage. Some work of this last type has been done around Minneapolis, but its efficacy is still doubtful.

4. Kelp as a winter covering and compost ingredient.—One of our fairways is on clay soil evidently deficient in humus. It was planted two years ago with bent and redtop. Would an application of kelp to this fairway during the winter improve its quality? I have found in my pastures on soil of the same character that a topdressing of kelp during the winter is a decided benefit. In the spring we propose to topdress this fairway with a compost of manure, top soil, and seaweed. (Rhode Island.)

ANSWER.—We have never tried kelp as a topdressing for fairways but have had reports to the effect that unless properly used it is inclined to mat down on the turf and smother out the grass to some extent. If you decide to use kelp we would suggest that you distribute it in such a way that large amounts of it are not allowed to remain on any given area of the grass. Since you propose to topdress your fairways in the spring with a compost made of manure, topsoil, and seaweed, we are inclined to think that this will be all that will be necessary to bring about sufficient improvement. We are sure that kelp composted with manure and soil would be of appreciable value. On the other hand, we are equally certain that the potash contained in kelp is not needed to any considerable extent by your turf. You should bear in mind that potash added to clay soils is inclined to encourage the growth of goose grass and other weeds. On sandy soils we think it would have less of a tendency to do this.

5. Winter applications of manure.—Taking as a basis 10 feet square, or 100 square feet, please advise how much pure sheep manure can be safely used for winter topdressing of German bent greens. Should this manure be mixed with sand and soil? (Washington.)

ANSWER.—Although it is not necessary to protect bent turf from cold by a winter topdressing or otherwise, yet where the soil is poor it will be benefited by an application of fertilizer during the fall or winter. Where, however, the soil is in good condition our advice would be to avoid heavy fertilizing with manure of any kind, as certain troubles, particularly grubs, are apt to follow. If you think that manuring is necessary, we would suggest that you apply it very lightly, so lightly that if the material is ground fine it will not interfere with putting; that is, so that it will all brush into the grass. Broadly speaking, we would say that when it is necessary to use manure on a green the quantity of well-rotted barnyard manure or finely ground sheep manure used should not exceed one-half ton to 6,000 square feet. This material can be applied as often as it may seem necessary; but in any event we advise light applications at a time. If sand is required as a part of your topdressing it is all right to mix the manure with sand, though it is probably less expensive

to apply them separately. A discussion of the subject of fall and winter topdressing of putting greens will be found in THE BULLETIN, Vol. IV (1924), page 248.

6. Watering greens in fall when freezing is likely to occur.—I would like to have your opinion on watering greens in October. In this region the weather is generally very cold at nights in October, followed by warm days. Dew is on the grass almost all day. Heavy frosts occur at night, water freezing in buckets. The dry warm days make the greens hard. Some of our members think the greens should be watered to soften them so that a ball will lie where pitched. I have, however, always thought that water was not necessary for plant life during its dormant period. (Pennsylvania.)

ANSWER.—We have found it necessary to water our greens here at Washington frequently in October on account of the exceedingly dry weather. The grass in October is not completely in a dormant state, and therefore needs moisture. We believe you will find no bad effects from watering in October, but we would suggest that you water sufficiently long before evening so that the excess water may be absorbed by the soil and none is left on the grass to freeze during the night.

7. November planting of bent stolons.—Would creeping bent stolons sowed here in early November live through the winter and make growth early in the spring, or would you advise waiting until spring to plant? (Ontario.)

ANSWER.—We consider the first of November too late to plant stolons in Ontario. Plantings at Washington, D. C., made at that time have, however, been known to live through the winter. Bent will stand rather hard winters provided the soil is well drained.

8. Bent as a southern putting green grass.—Will creeping bent grow satisfactorily in Florida? Will it live there throughout the year? (Florida.)

ANSWER.—Creeping bent is useless in Florida except as a grass for making greens in winter, and for that purpose it is too expensive to use. Your best scheme for putting greens in Florida is to use the Atlanta strain of Bermuda grass as the base of your greens, and in the fall sow redtop or Italian rye grass on the Bermuda turf. The latter two grasses will give you good winter turf.

9. Temporary winter greens in the South.—What is your advice in regard to sowing rye grass or redtop on Bermuda greens for purposes of winter play? (North Carolina.)

ANSWER.—In your latitude it does not seem advisable, in the light of our present knowledge, to use any temporary winter grass on top of Bermuda grass. For winter play, separate temporary greens should be planted apart from the Bermuda greens, and for such temporary greens either rye grass or redtop is excellent.

Green Section Membership Now 880 Clubs! Boost It Higher!

Meditations of a Peripatetic Golfer

If your putting greens are good, keep them that way. It is astonishing how quickly they deteriorate with neglect.

If a golf architect recommends "commercial humus," shoot him at sunrise; if he advises lime, shoot him two hours earlier.

Old experiments showed that covering grass turf with straw, brush, or even wire stimulates the growth of the grass. Even now nobody knows why.

Ammonium sulfate is not only a fertilizer; it also discourages weeds and earthworms.

Brown-patch on greens is quite as trying as a red patch on the trousers.

If you want to encourage clover, use lime or phosphate. But who wants to encourage clover on a putting green?

Do not overlook drainage if your course is built during a droughty period. Otherwise look out when the rains descend and the floods come.

Cops and mounds bare, or covered with unsightly weeds! There is a suitable grass for every condition.

Grass will grow everywhere if you wait long enough. But it is foolish not to prepare the soil well.

It is not true that charcoal sweetens the soil. But even if it did, why sweeten the soil? Acidity is what you want.

An iconoclast is a sort of a "bull in a china shop." He is a destroyer of foolish ideas that have no substantial foundations. A lot of ancient ideas about turf culture need knocking.

There is not a bit of truth in the belief that deep roots necessarily make good turf.

It is expensive to test new materials for any purpose. Let them alone until the scientific fellows report.