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of the

UNITED STATES GOLF ASSOCIATION GREEN SECTION

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Contents

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Entered as second-class matter April 21, 1926, at the postoffice at Washington, D. C., under the Act of March 3, 1879.

Piedmont Green-Committeemen's Association.—Acting upon the suggestion so often made in THE BULLETIN that regional associations of green-committeemen be formed, representatives of several clubs in the piedmont section of Virginia and North Carolina met in Greensboro, N. C., on June 26, and organized the Piedmont Green-Committeemen's Association. Mr. J. L. Burgess, of the North Carolina Department of Agriculture, was present and read a paper on soil preparation and seeding, an extract from which appears in this issue of THE BULLETIN.

Conversion of Established Greens to Creeping Bent by Disking

Mr. O. K. Owen, chairman of the green committee of the Country Club of Terre Haute, Terre Haute, Ind., writes that he has had remarkable success in the conversion of greens to creeping bent by the following method.

The greens were moistened, after which an ordinary farm disk was pulled over the green by a tractor, the disks being set so that the turf was cut at an angle about ¾ inch in depth and ½ inch in width. The stolons were chopped and dropped into the grooves, and the turf pressed together over the stolons. The greens were immediately topdressed, and were not kept out of play.

This work was done last September and October, and the greens so converted are now practically solid creeping bent.

The club has 20 greens, and each Monday the greenkeeper topdresses 5 greens, with the result that all greens are topdressed once every four weeks, and the players are not annoyed by having the greens topdressed all at once.

Ammonium sulfate has been applied with each topdressing, the amount being reduced as the summer has advanced, and the greens for the first time in the history of the club have gotten this far along in the summer with any degree of perfection. The greens are also becoming practically free of clover, due to the continuous application of ammonium sulfate.

Earthworms and soil benefits.—Earthworms undoubtedly are extremely important on farm land. They do an enormous amount of tillage, bringing up the deeper soil to the surface and taking the surface soil down. On golf courses, however, they are often nuisances. Such subtillage as they do is not necessary for the growing of good turf. Especially where the soil is clayey in nature they do a lot of harm to putting greens and, when very abundant, to the fairways.

Carolina Clover and the Low Hop Clovers as Southern Fairway Plants

By A. J. Pieters

These little clovers need to be discussed together, as they occupy the same place among the plants on a fairway, flourish at the same time of year in the South, and when not in bloom are not readily distinguishable one from another, at least by the casual observer. The Augusta (Georgia) Country Club, on whose course these clovers have existed for several years, recently reported that "some time in January the clover appears and fills all cups and bare spots perfectly and also gives a greenish appearance to the entire course."

The Carolina clover (*Trifolium carolinianum*) (Fig. 1, left) is one of the four native North American clovers found east of the Mis-

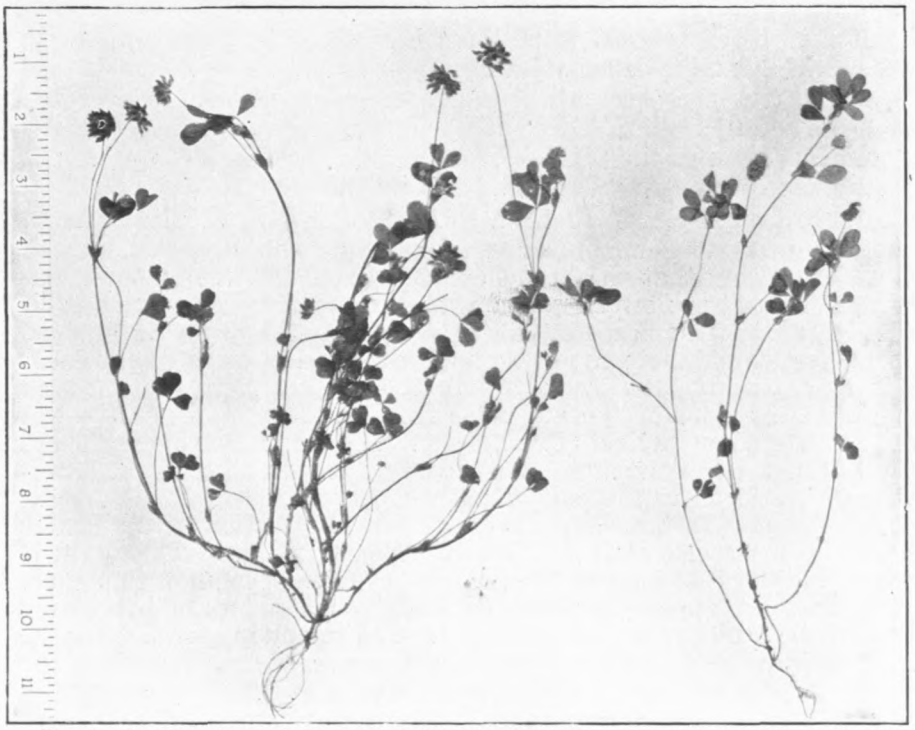

Fig. 1.—Carolina clover (left) and low hop clover (right). The upright habit of Carolina clover is well shown, but low hop clover is naturally prostrate. Least hop clover resembles low hop clover, but the flowerheads are smaller

sissippi River, and, as regards abundance, is by far the most important of the four. Its chief range is from North Carolina through the Gulf states to Arkansas and Texas, though it is occasionally found in Virginia and has been collected at the navy yard in Philadelphia. In this last case it was probably introduced.

The two hop clovers, so named from the resemblance of their flowerheads to the flowerheads of the hop plant, are the low hop clover (*Trifolium procumbens*) (Fig. 1, right), and the least hop

clover (*Trifolium dubium*). They range over practically the entire United States, except in the semi-arid region, and were both introduced from Europe. It is not known just when these hop clovers first came to America, but in a letter written to Arthur Young, of England, in 1786, George Washington asked him to ship 50 pounds of hop clover seed to his Virginia estate. From this source the plant probably spread south and west. The territory in which the hop clovers are most important coincides pretty well with that in which the Carolina clover is common, and frequently all three plants are found in the same field. In the North, the hop clovers are found in practically every state, but there are seldom more than a few plants in a locality. At present both hop clovers are abundant on the piedmont soils of western South Carolina and northern Georgia, and are common on all the better soils from Alabama to Arkansas, though they do not compete with the Carolina clover in the southern parts of these states.

It may be of interest to mention here that the least hop clover, which in England is called suckling clover or *Trifolium minus,* is said to be the true shamrock. Thousands of plants of white clover are sold every year as shamrock; but there is excellent authority for the statement that not the white clover, but the least hop clover, is the plant most commonly called shamrock by the Irish.

The Carolina clover varies a great deal in size of plant and in habit of growth. Commonly, few to many main branches arise from a stem so short that the branches are decumbent at first and then turn up so that at flowering time the branches are erect or nearly so (Fig. 1, left). The heads of pale cream or whitish flowers are borne on rather long stalks which terminate every main or lateral branch. The leaves, as in all clovers, are three-parted, and in the Carolina clover all divisions of the leaf arise from the same point on the end of the leafstalk or petiole (Fig. 2, left). This character distinguishes the Carolina clover from the hop clovers, with which it might otherwise be confused in the early stages of growth when none of them are in flower. In both hop clovers the middle section of the leaf is borne on a distinct stalk of its own (Fig. 2, right). This stalk is about one-third as long as the leaflet. Curiously enough, this character does not appear at first. On very young plants of hop clover the middle leaflet is without a stalk, but as the plant grows older the stalk appears and thereafter is present in every leaf.

In all of these clovers, each leaflet is wedge-shaped at the base, and broad at the apex, which is frequently notched. The margin of each leaflet is toothed except along the wedge-shaped base. The leaflets of Carolina clover are hairy. In the Carolina clover the leaf-veins are quite prominent and nearly always branch, while in the hop clovers the veins are not prominent and very rarely branched, but as a rule run straight from midrib to margin. This character can be used to distinguish very young plants before the middle leaflet in the hop clovers is stalked (Fig. 2, right). Both hop clovers have yellow blossoms, those of the low hop clover being sulfur-yellow, and of the least hop clover golden yellow. In the low hop clover each head contains many flowers, about 20 to 40, while there are usually 5 to 15 flowers in a head of the least hop clover. These two hop clovers are most easily distinguished by the flower color and the number of

flowers in a head. When not in flower they are almost indistinguishable, but the stems of the low hop are more hairy than those of the least hop clover.

In size, the Carolina clover varies from two to three inches high on poor dry land to nearly a foot in moist places or on rich land. The hop clovers vary in size even more than the Carolina clover. On poor soil they have been known to blossom when little more than an inch high, while when conditions are favorable the prostrate branches may be two feet long. The hop clovers are always prostrate in habit except when the stand is so thick that the plants support each other. In such cases, which the writer has seen in Louisiana and Arkansas, each plant consists of one threadlike stem 10 to 12 inches long, and

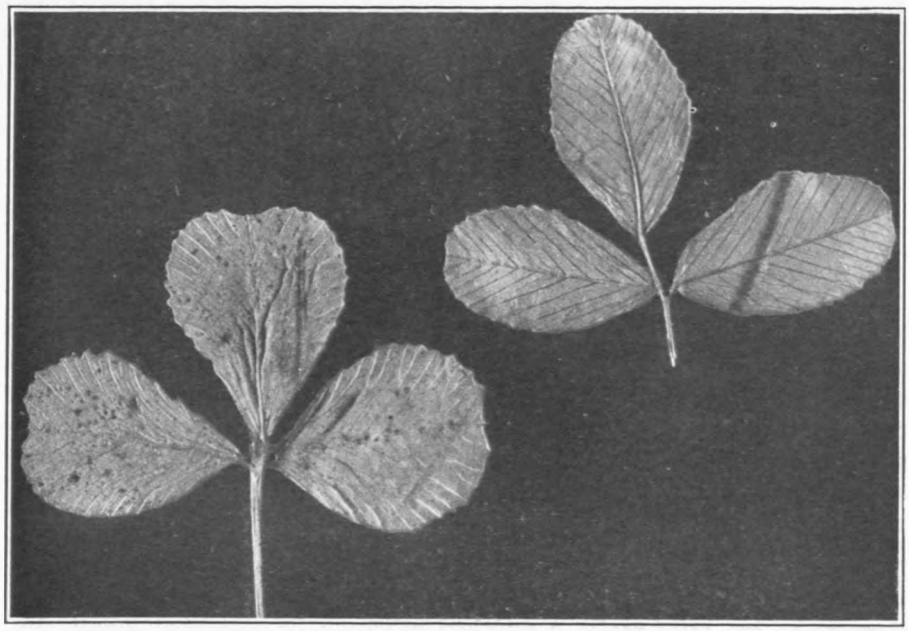

Fig. 2.—Leaf of Carolina clover (left) and of low hop clover (right), showing the stalk on the middle leaflet of low hop clover and the prominent branched veins in the leaf of Carolina clover. In the hop clovers the veins are unbranched. The shape of the leaflets is not always as distinctive as in these photographs

the field can be cut for hay. Both species mature early in June, after which the hop clovers disappear completely, while some of the Carolina clover plants may live over. The Carolina clover is said to be a perennial, but the writer has found little evidence to support this. However, his personal observations have been confined to May and June, and some observers have reported the Carolina clover as being green in November. The hop clovers seldom get much of a start before the middle of January, but after that they grow rapidly during any warm days.

The Carolina clover grows quite upright (Fig. 1, left), and mowing the fairway is quite certain to cut most of the blossoms and so interfere with reproduction. The hop clovers, on the other hand, are of a prostrate habit, and thus will bloom and mature seed in spite of moderate mowing.

No seed of the Carolina clover is available commercially; but where it is abundant, seedheads can readily be gathered and scattered where wanted. Seed of the low hop clover is not to be had in quantity, but that of the least hop clover can be bought in England under the name suckling clover or *Trifolium minus*. It can also be had from certain seed dealers in Oregon, who clean it out of alsike clover seed; but the Oregon seed is usually quite foul with weed seeds and there is at present no information as to how these weeds will behave in the East. Seeding of all of these clovers should be done in early fall or late summer. Much of the seed of the Carolina clover is hard, so that if a quick stand is wanted a rather heavy seeding must be made. No experiments have been made with these plants, but in view of the small size of the seed it seems as though five pounds per acre of the hop clovers and eight pounds of Carolina clover should be enough. To insure even distribution it is well to mix the seed with sifted loam or sand.

Humus-Producing Materials and the Making and Use of Compost

By R. A. Oakley and H. L. Westover

Organic matter, or humus, as a constituent of soil, bears a very important relation to the growth of plants. This is a fact that was discovered by man early in his agricultural efforts. Just as he had a knowledge of the plants that were worth his while to grow, it is reasonable to suppose he early learned the difference between poor and productive soils, and what common substances he could add to them to increase their productivity. That he knew little of the reasons for the results he obtained is not particularly to his discredit. Even in our enlightened generation we have failed to work out the complete story. But we have added to it and today we know more of the role of organic matter in the soil than we knew yesterday. Tomorrow we may make a further advance in our knowledge, for investigators are attacking the subject along some very promising lines.

The modern conception of fertilizers attaches even more importance to humus than was ever before accorded it, and this regardless of the efforts of Liebig and other apostles to argue the all-sufficiency of inorganic forms of nitrogen, phosphorus, and potassium. Good barnyard manure heads the list of fertilizers today, as it has headed it for generations, and will probably continue to head it for some time to come. Other fertilizers are highly important, but they can not fully replace this humus-supplying material.

Humus Defined

In the sense that it is now used, the word humus applies to decaying organic matter, or more strictly to decaying organic matter in the soil. In its adjective form the same word is used to designate organic materials that make humus when added to the soil. Common practice has made this usage acceptable.

Functions of Humus

One of the outstanding functions of humus is to improve the texture of soils. This is a physical function involving better aeration, water-holding capacity, and drainage, and incidentally the lessening of heaving due to alternate freezing and thawing in the winter and spring. By the proper use of humus, stiff, impermeable soils may be made friable, which, in addition to providing better water-absorbing capacity and drainage, also permits of better penetration by the roots of plants. Humus added to the soil gives it springiness and prevents the formation of a hard, unyielding surface. This is especially important in the construction of golf courses. While clay soils may be loosened by the incorporation of organic matter, sandy soils may be made more cohesive, thus giving them better water-holding capacity and making them less subject to blowing. In addition to changing the texture of the soil, humus modifies its temperature relations. Organic matter incorporated with the soil darkens it, thereby giving it a greater heat-absorbing capacity, and when it is applied as a topdressing it acts somewhat in the nature of an insulation.

An important physiological function of humus is to furnish suitable food for beneficial soil organisms, which in turn, among other things, supply nitrogen in a form available to growing plants. In fact, it is only through the action of certain soil organisms—notably the azotobacter group of bacteria—that humus can be made to yield nitrogen for the use of higher plants. Whether it is the nitrogen that organic matter yields or whether it is something else that is most responsible for its beneficial physiological action on plants, is not known. Recent investigations, however, indicate that green plants will not thrive in a medium totally destitute of decaying organic matter. Why this is true has not been ascertained; but certainly it is not for lack of nitrogen.

Some time, more will be known of the functions of humus in the soil, but it may be said with considerable certainly that future discoveries—no matter how valuable they may be—will only tend to emphasize the importance of decaying organic matter to plant growth.

Sources of Humus-Making Materials

While humus may be produced from decaying animal matter, very little is added to the soil from this source. Most of it is supplied by animal-made manures and by partly decayed vegetable debris, such as peat, sod, and leaf mold. It is a common practice to mix one or more of these materials with soil or sand, or both, thus making what is called compost. A little good barnyard manure may be made to go a long way by composting it with other decaying organic materials. Compost is a highly satisfactory source of humus and has proved the salvation of many golf courses.

Barnyard Manure

The only serious objection to barnyard manure as a humous material is that the supply is too limited. If it were not for this, there would be little interest taken in other kinds. The others at best are but substitutes. Good barnyard manure properly rotted and com-

minuted comes more nearly filling the requirements of a humus-producing material than any other form of organic matter that is commonly available. In the form of spent mushroom soil it is nearly ideal. In this condition it is well decomposed, of good texture, easily broken up, free from viable weed seeds and disagreeable odors, and usually all it needs is to be put through a screen to make it ready for mixing with the other constituents of compost. Spent mushroom soil is what remains of a good quality of horse manure after it has been in a mushroom cellar for a year. It has lost little of its fertilizer value and is highly desirable for the golf course.

It is not a difficult matter to convert barnyard manure into a form suitable for topdressing turf. All that is necessary is to pile it in ricks and give it time to decompose. Surplus straw should be removed with a fork or screen. For incorporating with the soil of fairways, manure should be used alone unless the soil is very sandy, and little attention is necessary in preparing it for this purpose. For topdressing fairways, it should also be used alone, except on very sandy soils, where clay should be mixed with it. But as a topdressing it should be free from undecomposed straw and from large lumps. As a topdressing for putting greens, loam and sand may be mixed with manure to advantage. The charge that manure is unsafe to use on turf because of the weed seeds it contains is not well founded; and besides, it is entirely possible to determine whether or not it contains viable weed seeds, by putting a representative sample in a box and giving it conditions of heat and moisture favorable for the germination of seeds. No conjecture on this point is necessary. If seedlings appear, weed seeds are present; if seedlings do not appear, weed seeds need not be feared. Seeds of the most troublesome weeds are soon killed by composting.

The fertilizer value of barnyard manure can not be reckoned from its nitrogen, phosphorus, and potash content, nor from the organic matter it contains. In addition to available nitrogen, phosphorus, potash, and organic matter, it carries numerous beneficial organisms and their products. Very probably there are also other beneficial agents in it, all of which are valuable; but their importance can not be directly measured.

The duty of a limited quantity of barnyard manure can be greatly increased by composting it with peat, sod, or other decaying plant material. A little manure will inoculate a large compost heap.

Peat or Muck

The terms peat and muck are very often used interchangeably. Peat, however, is the more comprehensive of the two, and is applied to the remains of plants decomposed or partly decomposed in the presence of water. In consistency, it varies from scum to a solid substance in which the texture of the plants has almost if not entirely disappeared. All muck soils are of peat origin. Peat deposits are numerous, especially along the seacoast and in the vicinity of large lakes. The color and texture of peat and its availability have suggested its use as a material to add to soils to increase their productivity, but results from its use have been far from consistently good.

There is a wide diversity in the texture and chemical composition of peat deposits in the United States, as they represent hundreds of years of plant accumulations, often of different kinds, and it is only

to be expected that there should be considerable variation not only between peat deposits but also between different portions of the same deposit. It is said that deposits vary widely in percentage of nitrogen, and it is often claimed that those with a high percentage are much more valuable than those with a small amount of nitrogen.

As it occurs naturally, peat is very frequently toxic to plant growth, and some of it is highly acid in its reaction. It is also practically free from nitrifying bacteria and other beneficial organisms. Because of its probable toxicity and freedom from organisms, peat should be thoroughly weathered and composted with manure and probably lime before it is used for topdressing. Lime has a tendency to correct the toxicity, and manure inoculates it with proper organisms for nitrification.

As a fertilizer or a topdressing on grass or other crops, the value of any peat is very slight. The nitrogen or other elements found by chemical analysis in peat are in a very inert condition. Indeed, as compared with manure or commercial fertilizer, the elements in peat are practically unavailable to plants. During the past few years peat has frequently been advertised for sale as "humus" to be used as fertilizer or in place of fertilizer or manure. Special processes, such as the bacterization of peat, occasionally are alleged to give to it unusual power to improve soil conditions and to aid plant growth. In general, extensive investigations show that peat as well as muck and similar materials, whether bacterized or not, are distinctly inferior to stable manure or mineral fertilizers for increasing crop production. The use of some kinds of peat, like straw or other low-grade or surplus material, may often be desirable in stable manure or in compost. Composting a suitable peat with stable manure increases the quantity without very materially lowering the manure value.

Where peat can be procured cheaply and where good barnyard manure is not abundantly available, it may be used advantageously on greens and fairways if it is composted with manure and lime to correct the toxicity. Golf clubs can not afford to pay good manure or mushroom soil prices for raw peat even if it has a low moisture content and is non-toxic. Compost containing peat should not be used as a topdressing for putting greens without first being tested by putting a sample in a box or tray and sowing grass seed in it. If the young seedlings thrive, it is safe to assume that the peat is not toxic.

Sod, Leaves, and Leaf Mold

In making compost, sod is very useful. It is composed of the dead leaves and roots of grass, and the soil in it is usually of very good texture and quality. Some soil is needed in compost, and almost an ideal combination can be made by mixing sod and manure. Equal parts by volume of sod and manure are about the right proportion for compost; but the matter of proportion is indeed very flexible. Six months to a year in a compost pile is necessary for sod to rot properly. The pile should be worked over and screened considerably in advance of the time the compost is needed, and the coarse material put aside for further composting.

The term leaf mold is applied in a very general sense to leaves, twigs, roots, and similar vegetable matter in various stages of decay. Much of the leaf mold that is used is made up largely of leaves only

partly decomposed. Such material is useful for supplying humus if it is well composted with manure, but alone it does not make a suitable topdressing for turf. Darwin says earthworms play a very important part in the making of leaf mold—much greater, in fact, than is ordinarily supposed. Leaf mold commonly gives a relatively high acid reaction, the degree of acidity depending somewhat on the stage of decomposition, the kind of leaves, and the kind of soil underlying them. Well-decayed leaves often give a neutral or even an alkaline reaction, because of the lime they contain. Red oak leaves have higher acidity than maple leaves, and leaves that have fallen upon acid soil produce leaf mold that is more highly acid than that produced from leaves decomposing on an alkaline soil. Like sod, leaf mold contains an appreciable proportion of soil, which is useful in making compost. Equal parts by weight of leaf mold with the soil that usually goes with it, and manure, make a desirable combination.

Street Sweepings

At one time street sweepings were quite extensively used as a fertilizer. Now they are not so much in demand. With the advent of the modern asphalt pavement and the automobile, street sweepings are not what they once were; in fact, sweepings from an asphalt-covered street are very likely to be toxic to grass and other plants, because of the asphalt and oil that are collected with them. It seems advisable, therefore, to issue a warning against their use, especially for topdressing turf. Where they have been used and injury to the grass has resulted, it is suggested that a light application of pulverized limestone be added. Calcium is known to unite with asphalt, and it is believed that it will neutralize the harmful effects of the latter on vegetation.

Pulverized Sheep Manure

As a source of humus, sheep manure as it is put on the market is an expensive product and is not considered very satisfactory. While it is in a very convenient form to use and is free from viable weed seeds, it falls far short of producing the results that are necessary to justify the price that is asked for it.

Barnyard Manure Made Artificially

The Rothamsted Experiment Station, in England, has found that straw may be converted into a good quality of manure by treating it with a soluble nitrogen compound, such as ammonium sulfate or nitrate of soda. The former has been used at Rothamsted and is preferable where golf courses are concerned. The method involves the composting of fresh straw with ammonium sulfate at the rate of 100 pounds of ammonium sulfate to one ton of dry straw. As straw takes up moisture slowly, it should be moistened thoroughly two or three days before adding the ammonium sulfate. Where the sulfate is put on dry straw and then watered, there is danger of considerable loss through leaching unless extreme care is used. After applying the ammonium sulfate, the straw should be kept well moistened until fermentation or decay is well under way, and then mixed with loam or clay loam, as in making compost with manure. The Rothamsted investigators advise the addition of lime to the ammo-

nium sulfate and straw, since straw breaks down more rapidly in a neutral or alkaline solution of nitrogen, but experiments conducted here in a crude way indicate that lime is not necessary, and where compost is to be used on putting greens it is not desirable. At least one concern is attempting to commercialize the process, but doubtless the method used by this concern involves some modification of the simple one here described.

COMPOST

Barnyard manure, sod, leaf mold, and peat—in fact, almost any vegetable matter that will decay readily—may be used in making compost. Clay, loam, and sand may also be included, and probably some lime, where peat is used, to obviate any possible toxic effect; likewise organic and inorganic commercial fertilizers—the fertilizers especially if the compost is not rich. Composting is an old practice of gardeners and florists. It brings about changes in the materials involved—some well known, others only slightly if at all understood. The final result, however, is a product very beneficial to plant growth.

Mixen was the name by which compost was known several generations ago, but it is obsolete now. Nevertheless, the term has good features. It is simple, euphonious, and descriptive. However, it smacks of common origin and lacks the pedigree of its successor, "compost." This is probably responsible for its demise.

There are no very hard and fast rules to lay down for the making of compost. The materials to be used necessarily depend to a considerable extent on what is available. Barnyard manure, however, should always be a conspicuous constituent of every compost pile. No commonly available material will take its place, especially in supplying the various organisms that are highly important in bringing about proper decay.

In addition to organic matter, soil of some kind should be added. Whether clay, loam, or sand, depends largely on the kind of soil with which the compost is to be incorporated or upon which it is to be applied. The common range of soil to organic matter is from one-fourth of the former to three-fourths of the latter, to equal parts of each. However, local conditions may call for proportions outside this range.

Two common and very satisfactory methods of constructing compost piles are illustrated by the following diagrams:

1

Sod
Manure
Sod or leaf mold
Manure
Sod or leaf mold
Manure

2

Sod
Manure
Peat mixed with lime
Soil
Manure
Peat mixed with lime

The piles may be built as high as desired. Six to eight feet is suitable for convenience. In diagram No. 2 the lime should be mixed with the peat at the rate of about 25 pounds to the ton; but it should not be mixed with the manure or allowed to come in direct contact with it until the compost pile is cut down and worked over for use. By varying the depth of the layers, it is easily possible to make compost of the desired consistency. However, layers exceeding 8 inches are usually too deep for the best disintegration.

If compost piles are built in sheds or are otherwise similarly covered, there will be less loss from weathering than if they are built in the open, but sufficient moisture must be provided to bring about the necessary decomposition and other changes.

It is said to be possible to inoculate peat with nitrifying organisms by composting it with bone meal, fish scrap, tankage, and similar fertilizers composed of animal products. However, the evidence indicates that they are not as satisfactory as manure for this purpose. If manure can not be had or is not sufficiently abundant, it is suggested that they be tried as a partial substitute for it. Five pounds of these fertilizers to a cubic yard is the approximate quantity which should be used. But, it should be distinctly understood that there is as yet no thoroughly satisfactory substitute for manure.

In making compost there are some important points to be borne in mind:

1. The compost pile should be so constructed as to bring about the proper decay of vegetable matter. This means that the materials should be laid down in layers about 6 inches thick or otherwise reasonably well mixed. This aids in decomposition and in the production of a uniform final product.

2. Covering compost piles protects them from loss by weathering; but considerable moisture must be present in the materials to promote proper decay and other beneficial changes.

3. Barnyard manure carries beneficial inoculating organisms and should be present in every compost pile, especially where peat is used. Bone meal and tankage and similar animal products are said to aid in the introduction of nitrifying organisms.

4. Soil of some kind improves the quality of compost, chiefly by giving it better texture, which involves, among other qualities, cohesiveness and water-holding capacity. It helps to unite the organic matter with the surface of the soil upon which it is applied.

Compost for Topdressing Turf

A rational system of greenkeeping involves the use of good compost as a topdressing. It should be followed in most cases as a matter of routine about once a month during the growing season. For topdressing sandy-soil fairways, compost should have a large proportion of clay. Even three parts of clay to one of organic matter is not excessive where the soil is nearly pure sand. For putting greens, such a large proportion of clay is not desirable, even where the soil is very sandy, and on clay-soil fairways it is questionable whether even a small percentage of clay or soil of any kind adds materially to the value of the compost. For putting greens on clay soil, compost should contain loam and sand rather than clay. A liberal proportion of sand will do no harm.

For best results ammonium sulfate should be mixed with the compost at the rate of 15 pounds of the sulfate to a cubic yard of compost at the time of topdressing. As is well known, care must be taken in applying ammonium sulfate alone, or otherwise burning of the turf will result. Even when mixed with compost the necessity of careful handling is not obviated. Applications of compost should ordinarilly be made at the rate of 1 cubic yard to 5,000 square feet, monthly, during the growing season. The compost should be worked thoroughly into the turf with a switch broom, a street broom, or any suitable implement. Flexible wire door-mats tied together lengthwise make an excellent device for this purpose.

Stink-Grass; A Putting Green Weed

Stink-grass (Eragrostis cilianensis), about two-thirds natural size; "a," single spikelet of seed-head, enlarged.

Stink - grass (*Eragrostis cilianensis*) is a slender, tufted, often decumbent grass with compact panicles of large spikelets, as shown in the accompanying illustration. The grass gives off a disagreeable odor, which is thought to be due to the glands found on the pedicles and spikelets. Being an annual, stink-grass starts from seed each year and dies in the fall. It occurs as a weed throughout much of the United States and at times invades putting greens in the eastern states. In the summer of 1925 it was reported as forming a solid patch on a putting green in eastern Pennsylvania. It was also reported on the course of an Ohio country club. Stink-grass is not likely to invade a heavy vigorous turf but may become a pest in thin turf. In such cases it should be weeded out by hand before it has a chance to produce seed. Heavily infested areas should be cut out and removed from the course.

Another species (*Eragrostis carolinia*), with open panicles of smaller spikelets, is also a common annual weed that is widely distributed in the United States.

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

Is it permissible, in match and medal play, to remove mud adhering to a golf ball on the putting green?

Decision.—According to the Rules of Golf, mud adhering to a golf ball may not be removed. However, where conditions warrant, the committee in charge may make a local rule which makes removing the mud permissible.

In a tournament, after the qualifying round has been played and the play-off of the tournament is under match play, have the players a right to play on the course up to the greens or on the greens the same day that they are to play in the tournament?

Decision.—Under the Rules of Golf, players have the right to play on the course and putt on the greens before the match play rounds, after the qualifying round has been played.

In match play, A is on the green within 20 yards of the flag. There is no person at the flag. He putts, his ball hits the flag, and is deflected by the pole. What is the penalty for a ball hitting a pole?

Decision.—In match play, there is no penalty for hitting the flag from any distance when there is no person holding it. See Rule 32, paragraph 1.

Among the new additions to the Rules of Golf, I notice that the United States Golf Association has inserted a decision under "Lost Ball" to the effect that a player must play a provisional ball before he leaves the spot at which his last shot was played. Suppose he plays a ball straight down the fairway and has every reason to believe the ball can be found, does not play a provisional ball, but is unable to find his drive. What would he have to do then?

Decision.—If the player is unable to find his ball within the prescribed time under Rule 22, he returns to the spot and plays again as provided under the same rule. A provisional ball is played when doubt exists as to whether it may be lost or unplayable. A player must play a provisional ball before he leaves the spot from which he has played a ball which leaves the player in doubt. Once having left the spot the player must look for his ball and then play as provided under the rules.

Applying ammonium sulfate in hot weather.—Burning is likely to result if ammonium sulfate is applied in hot weather at a rate to exceed 2 pounds per 1,000 square feet. The application, whether in the form or a solution or mixed with sand or compost, should be followed at once with watering. If no water is available, it should be applied only during showers.

Don't let weed seeds from fairways wash onto your greens.—It is often the case that a portion of a fairway near a green is higher than the surface of the green. As a result of this, many weed seeds are certain to be washed onto the putting green from the fairway unless steps are taken to divert the rain falling upon the fairway from run-

ning onto the green. This may be effectively done by the construction of ditches. In many cases the abundance in a green of crab grass, chickweed, pearlwort, white clover, yellow foxtail, and other weeds may be traced to the higher ground of a near-by fairway.

Seeding Golf Courses in the Piedmont Section of the South

By J. L. Burgess, North Carolina Department of Agriculture

The Problem

The factors which enter into the solution of the problem of securing good year-round golf greens in the piedmont section of the South are soil and climate.

The more elevated parts of Virginia and the Carolinas constitute the northern limit of the best southern grasses and the southern limit of the best northern grasses for golf course purposes and this fact renders rather difficult the selection of the proper combinations for any given area. Here, also, we find every conceivable variety of soil, from the sandy loams to the stiffest of red and white clays.

Nothing is more conducive to rapidity of growth and permanency of a stand of grass than a granulated subsoil that will readily absorb and hold the winter and spring rains. Such a condition of subsoil is found, generally, throughout that section lying north of latitude 40, where winter freezes reach a depth of 6 to 10 inches, or more. Nothing so effectively granulates clay subsoils and promotes their water-holding capacity as deep freezing. Since no such climatic condition obtains in the piedmont section of the South, other means of pulverizing and opening up the subsoils must be resorted to if we are to secure permanent and drought-resisting stands of grass on our golf links.

Again, a cool climate is always a moist climate, and a moist climate is most favorable to the maximum growth of grass. This favorable climatic condition obtains in the North, but the hot sun of the South is killing in its effect on grasses that have an insufficient supply of subsoil water to withstand the onslaughts of our annual midsummer droughts. These facts make it all-important that the initial preparations of the soil for the reception of the seed be as deep and thorough as possible.

Land Preparation

Whenever possible, land should be plowed at least eight inches deep and seeded thickly to cowpeas or soybeans, with heavy fertilization any time from May to July. Just before frost this crop should be plowed into the ground as deeply as the soil was originally broken, being careful not to invert the furrow slice, but to turn the furrow at an angle of about 45 degrees, thus distributing the organic matter from the top to the bottom of the furrow. This will give uniform distribution of humus throughout the entire soil stratum—a necessary condition to promote the water-holding capacity of the soil and to attract the grass root into its lower depths. This done, the land should be thoroughly double-disked in a direction at right angles to the last plowing, so as thoroughly to pulverize and mix the organic matter with the first five or six inches of the surface soil.

Now let the land lie and take the fall and winter rains. About

March 1 repeat this operation of disking at right angles to the previous disking, and follow this last disking with a smoothing harrow, letting it run in a direction across the last disking. These operations of plowing, disking, and harrowing are necessary in the piedmont section in order to get a thoroughly pulverized and compacted seed bed for grasses.

Any time from the middle of March to the middle of April, but not later than the middle of April, the course should be seeded. Just before seeding, put on an application of at least 500 pounds to the acre of a mixture composed of 250 pounds of an 8-4-4 fertilizer and 250 pounds of hardwood ashes. Apply this fertilizer mixture with an ordinary fertilizer drill, being careful to get an even and uniform distribution of the material in the soil.

In case fall seeding is desired, keep the land harrowed and disked throughout the summer to conserve the moisture and kill the weeds, and sow seed about September 20.

Selection of Suitable Grasses

As stated above, this is the common meeting-grounds of the best northern and southern grasses for greens purposes, and neither class should be expected to exhibit its best performance in this latitude.

With the exception of the putting greens, the texture of the soil of which is likely to be rendered uniform by frequent topdressings, practically all golf links, in the section under consideration, will present a medley of soils ranging from clays through loams, sandy loams, gravelly loams, and silts, each being just a little better suited to some varieties of grass than to others.

Of the southern grasses, Bermuda grass and carpet grass are especially adapted to the sandier soils, though they are by no means a failure on the heavier types. Of the northern grasses, red fescue and Canada bluegrass are well suited to the lighter soils and also do well on the heavier soils. Kentucky bluegrass remains a standard of comparison for lawn and greens purposes. Though its ideal growing conditions are found on the limestone soils throughout the northern and middle states, it is found growing in all parts of Virginia and the Carolinas and as far south as Louisiana. Rhode Island bent and creeping bent are other grasses on their way south and are gradually becoming acclimated to southern conditions.

Most of the above-named grasses are stoloniferous in their habits of growth, and this gives them first place as grasses for both putting greens and fairways. Bermuda grass and carpet grass are both summer grasses, turning brown after severe frosts have set in. They should therefore be mixed with evergreen grasses in order to maintain a beautiful green sward on the course throughout the winter months.

In a few cases I have seen accidental or volunteer seedings of white clover, another plant of stoloniferous and mat-forming habit, on putting greens, working its way into the confidence and approval of greens managers and seasoned golf players. It would seem that where putting greens are seeded thickly to desirable grasses, a small sprinkling of white clover is a positive aid in promoting the resilience of the putting surface. The presence of the white clover is an aid in maintaining the fertility of the soil and in adding a vivid green to the course throughout the winter.

QUESTIONS AND ANSWERS

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

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

1. Controlling ants and eradicating plantain.—We have been greatly bothered lately with ants appearing on the greens and do not know the best method to pursue to exterminate them. We should therefore be pleased to have your recommendations in the matter. We should also like to know what you would recommend to get rid of plantain weeds which are growing in one or two of the fairways and seem to be gaining on us very much. (Pennsylvania.)

ANSWER.—We have been unsuccessful in finding anything which could be relied upon to rid putting greens of ants on a wholesale scale. In fact, the only means of getting rid of them that we have observed up to this year is to treat each individual nest with some substance such as carbon disulfid or paradichlorbenzine. This material should be injected into the nest and then the hole stopped up. We have this year however noticed on our brown-patch experimental plots at the Arlington Turf Garden that where we apply corrosive sublimate the ants are either killed or driven away, and while this is not sufficient evidence of the efficacy of bichlorid in this respect to justify a positive recommendation we feel that it is worth experimenting with further. We would suggest that you mix 2 pounds of corrosive sublimate with a cubic yard of compost, topdress 5,000 square feet of your green most seriously infested with these pests, and follow the topdressing immediately with a thorough watering. Corrosive sublimate has shown indication of being a very effective remedy for the brown-patch disease and is also one of the best known remedies for earthworms.

With regard to the plantain in your fairways, we know of no means of getting rid of it other than digging it out or treating it with chemical weed-killers, which are likely to burn your grass to a considerable extent. Of course, in case of there being only a few plants scattered sparsely over the fairway, it might be found practicable to take a can of sulfuric acid and use some instrument similar to an ice pick, dipping this into the acid and piercing the crown of each plant. If the plants occur thickly in small areas, probably the best method would be either to plow the areas up or spray them with an iron sulfate solution consisting of 1½ pounds to 1 gallon of water. This treatment may have to be repeated three or four times during the season to get the desired results.

2. Preparing compost in the open.—We are considering the old method of putting humus and manure on the ground and turning it over with a plow possibly two or three times and then using it when

it is two years old, and not incorporating ammonium sulfate in the compost but applying it to the greens at the time they are topdressed. Do you think this would be an improvement over the method of putting the ammonium sulfate in the compost pile when it is first made? (Kentucky.)

ANSWER.—The method you propose should be entirely satisfactory. There are some objections to preparing compost in the open, and there are some advantages in the practice. The objections are that the natural fertilizing elements in the manure leach to some extent into the underlying soil through the action of rains, work on the compost can not be performed during rainy spells when as a rule the men on the course can not be employed in their customary duties, and additional labor is required in applying ammonium sulfate to the greens when the chemical is not worked into the compost at the time the compost is worked over. The advantages are that the expense of the erection of a compost shed is avoided, the compost can be turned more economically with a plow when it is spread out and not piled up, and decomposition is hastened in the compost through the heat of the sun and the moisture from rains and dew. We note you speak of using "humus" in your compost. If by this you mean "commercial humus," which is in the form of peat, we would advise you not to use it, as it is a form of humus not available for grass food. If however by "humus" you mean fresh vegetable matter, such as leaves or grass clippings, it will be excellent material to use, with manure, in your compost.

3. Treatment of land for coastal fairways at sea level; grass for locations where salty water collects.—Our fairways on made land slightly above sea level are giving us trouble, while those on natural land are satisfactory. On the former fairways the grass is either very cuppy or thin. Some of this land appears to be too heavy, and some is sandy and does not retain moisture. This land was made largely by sucking in mud and sand from the harbor. In low spots where salty water collects it seems impossible to grow any grass. Can you offer any helpful suggestions for correcting these conditions? (Connecticut.)

ANSWER.—From the conditions as you state them we are much inclined to the opinion that your principal trouble is insufficient drainage. We realize that it is very hard properly to drain flat land which is scarcely above water level. We would suggest that if possible you have your land diked against high water and have the water drained into a basin from which it can be pumped either continuously or whenever necessary. This method of drainage has been much used for agricultural land not above sea level. The heavy and light condition of the soil of your fairways can be much helped by frequently topdressing the heavy portions with sand and the sandy portions with clay. As for a grass to grow in locations where salty water collects, the only grass we know of suitable for the purpose is the common salt-grass, which occurs frequently along the seashore and which possibly may be near your own course. It has an abundance of underground creeping stems; and it is necessary only to take up the sod of this grass, chop it up, scatter the chopped stolons on the ground, and roll them in or cover them lightly. This grass will make splendid turf even where it is covered by salty water or high tide.

4. Fescue and Poa trivialis in seed mixture for putting greens.—A seed mixture of 60 percent fescue and 40 percent German mixed bent and *Poa trivialis* has been strongly recommended to us for our putting greens. Previously we had a very unfavorable experience with a mixture containing 80 percent fescue. The grass germinated luxuriantly, but failed to stand up under close cutting. Could it be that the fescue is included in the mixture as a protective growth to shield the other grasses, which are intended to be permanent? (Nebraska.)

ANSWER.—Fescue has not proved to be a satisfactory grass in the Middle West, and *Poa trivialis* would certainly not survive except in shady spots. There are very few places in the United States where fescue gives any satisfaction at all. We would advise you to use either straight German mixed bent for your greens, or else bluegrass and white clover. With the bent you must expect considerable trouble from brown-patch from the middle of July until the middle of September, whereas bluegrass and white clover are not attacked by this disease and furnish a passable putting green turf, though not of the highest type.

5. Fertilizing value of furnace dust and soot.—I am sending you a sample of dust that collects back of the combustion chamber under the boilers of a local steam plant which burns sawdust. What value has it as a fertilizer? I would also like to know the value of soot and the method of applying it. (Oregon.)

ANSWER.—Furnace dust and soot have very little fertilizing value. Indeed, the fertilizing value of each is so low that we do not believe one is justified in using it even if the material costs nothing, as it is not considered that it will pay for the labor necessary to apply it.

6. Moss or green scum on fairways.—Can you advise what the cause may be and what remedy is suggested for the occurrence of moss or a green scum on fairway soil? (New York.)

ANSWER.—Two common causes for this condition are, insufficient drainage and poverty of soil. At times also when manure is used to excess, a green scum will appear. We would suggest that you improve the drainage in case you find it defective, or else fertilize these spots with a chemical fertilizer, such as nitrate of soda or ammonium sulfate.

7. Underground watering systems.—We are building two new greens and wish to know if it is practicable to install an underground watering system to render it unnecessary to make use of sprinklers. (New York.)

ANSWER.—The experience has been that surface sprinkling is more desirable. With greens properly constructed as to drainage, it is a simple matter to regulate the amount of water needed to keep the turf in good condition, by the use of surface sprinklers, while with underground irrigation it is difficult to control the applications of water in such a way as to insure good results at all times.

MR. GREEN-COMMITTEE CHAIRMAN:

Much of the progress the Green Section has made has been due to cooperative efforts on the part of green-committeemen. Further progress will depend largely on the loyalty and enthusiasm of these men.

As announced in the July issue of The Bulletin, the Executive Committee of the Green Section has recently sent a letter to the president of every golf club in the United States outlining plans for raising an endowment fund to put the Green Section on a sure foundation.

An appeal is now made to you to aid your club president in this work.

If every golfer in the United States contributes one dollar to this fund the Green Section can not only carry on as heretofore but can widen its field of usefulness.

Many calls for personal service have to be refused because of a lack of trained men.

Much needed experimental work in the North, South, East, and West can not be undertaken because of a lack of funds.

Your earnest efforts will help to remedy this situation.

That the Green Section is of real value to golf is proved by its growth in five and a half years to a membership of 925 clubs.

Great Britain and Canada have followed the lead of the United States Golf Association and now have well organized Green Sections of their own. Their problems are more localized than ours.

A house is no more stable than its foundation. Shall the United States Golf Association Green Section have a firm one?

THE GREEN SECTION.