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

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A MONTHLY PERIODICAL TO PROMOTE THE BETTERMENT OF GOLF COURSES

ISSUED BY THE GREEN COMMITTEE OF THE UNITED STATES GOLF ASSOCIATION

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MEETING OF THE GREEN SECTION AT THE ST. LOUIS COUNTRY CLUB, SEPTEMBER 20, 1921.

In connection with the Amateur Golf Championship Tournament of the United States, a meeting of the Green Section was held at the clubhouse of the St. Louis Country Club on the evening of September 20. About 200 people were in attendance. Mr. E. J. Marshall acted as chairman. Mr. Sterling E. Edmunds, of St. Louis, in a few well-chosen words, welcomed the visitors to St. Louis. President Howard F. Whitney, of the U. S. Golf Association, spoke briefly of the history of the Green Section and complimented its activity and efficiency. The main address of the evening was by Prof. Lyman Carrier, on "Identifying the Common Grasses of Golf Courses by their Vegetative Characters." His address created much interest and brought forth numerous questions from the audience. Mr. E. J. Marshall explained the importance of district green sections, relating in detail the beneficial results accomplished by the Detroit District Green Section. He earnestly advised the organization of a similar district green section at St. Louis. Mr. Alan D. Wilson spoke of the splendid service being rendered by the Philadelphia District Green Section. Prof. C. V. Piper, chairman of the Green Committee of the U. S. Golf Association, spoke of the scope of the work of the Green Section, the problems it has to meet, and the results it has secured and the things it hopes to accomplish. The enthusiastic support of its members makes it certain that it will be a great factor in the progress of golf. The remainder of the evening was devoted to answering numerous questions covering nearly the entire field of green-keeping. Particularly interesting local problems were discussed by several St. Louis men.

Mr. E. B. Fay spoke at length of experience with sub-irrigated greens, the present conclusion being that they are still in the experimental stage. Mr. Robert Foulis, of the Bellerive Country Club; Mr. W. M. Warren, of the Algonquin Golf Club; Mr. Jack Baxter, of the Glen Echo Country Club, and Mr. Alex. Smith, of the Westwood Country Club, all discussed different problems of interest in connection with the maintenance of turf. During the season the brown-patch fungus disease was very severe, and this is the most serious factor to contend with. Mr. J. S. Clapper, of Minneapolis, exhibited photographs and models of a new spiked roller, a heavy one for fairways and a lighter one for greens. The use of the former for a year at Minneapolis indicates that it greatly helps the grass turf on fairways. Experiments on putting-greens are under way.

The interest and enthusiasm shown at the meeting make it certain that the St. Louis District Green Section will be formed at once.

MEETING OF THE GREEN SECTION OF THE PHILADELPHIA GOLF ASSOCIATION AT THE MERION CRICKET CLUB, SEPTEMBER 14, 1921.

The Green Section of the Philadelphia Golf Association was formed last July after a preliminary meeting at the Huntingdon Valley Golf Club, when the chairmen of the various green committees were the guests of Mr. George W. Elkins. This Green Section is composed of five members of the green committees from each of 28 clubs in the Philadelphia district. It has the customary officers, and standing committees on purchasing, machinery, golf-course construction, publicity, and membership.

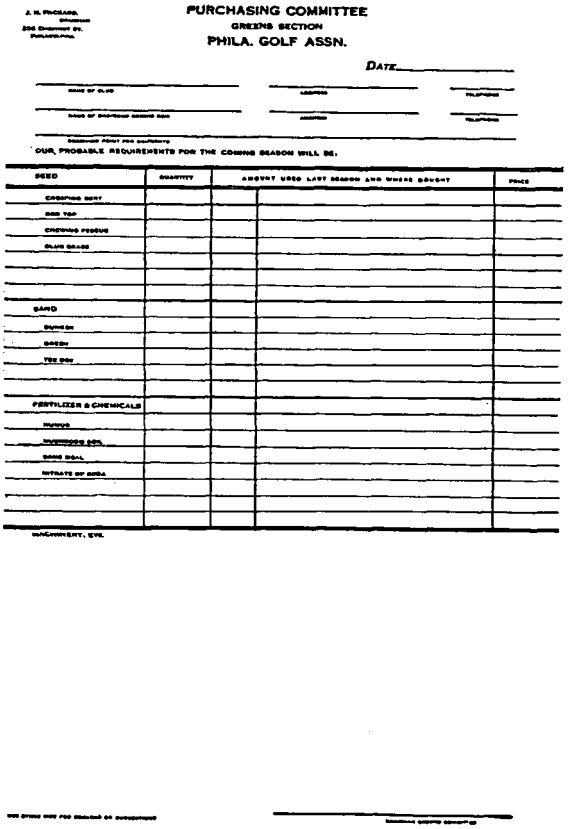
The chairmen of these committees, together with the officers, form an executive committee.

The first meeting was held at the Merion Cricket Club on September 14, with about 150 men in attendance. A handicap tournament was held during the day, and afterwards there was an exhibition of mowers, tractors, and other power-driven machinery for mowing fairways. Six of these devices were demonstrated in actual operation, as follows: Toro, Roseman, Worthington, Utilitor, Ideal, and Traynor. A report on them will be made to the Association by the Machinery Committee, which is composed of engineers and automobile experts. After dinner, Professor C. V. Piper gave a short talk, and then, for an hour and a half, answered questions on caring for golf courses, covering the following subjects: seeds; best grasses for fairways, putting-greens, and rough; fertilizers; brown-spot disease; and grubs. The trouble from grubs was taken up rather thoroughly, because Merion has a great many just now, and a gang of men was at work staking off the fairways in sections and spraying each section with the proper amount of sodium cyanide solution to kill the grubs.

A District Green Section's Purchasing Committee's Good Work

John H. Packard

The Purchasing Committee of the Green Section of the Philadelphia Golf Association, when first organized, was naturally at a loss to know where and how to begin, having had no previous experience, and at that time no neighbors to copy. It was therefore first necessary to collect information regarding the requirements of the member-clubs, if for no other reason than to ascertain our potential buying power. The accompanying questionnaire was therefore prepared and distributed to all of the clubs. Information is coming in very satisfactorily, and it is hoped that its value will be felt during the coming season, as the figures are quite impressive both to ourselves and to the various dealers



PURCHASING COMMITTEE
GREENS SECTION
PHILA. GOLF ASSN.

DATE_____

OUR PROBABLE REQUIREMENTS FOR THE COMING SEASON WILL BE.

SEED	QUANTITY	AMOUNT USED LAST SEASON AND WHERE BOUGHT	PRICE
CREEPING BENT			
RED TOP			
CHEWINGS FESCUE			
BLUE GRASS			
SAND			
FERTILIZER & CHEMICALS			
MACHINERY, ETC.			

in golf-course materials. Some of the bids already received indicate that all of the clubs will save considerable money by cooperative purchasing.

Reflections on Bunkers

Some "golfomaniac" has said that a really good bunker is both a guide and a chastener. Unfortunately a lot of golf architects have not yet learned of its first-named function. Most golf courses are still afflicted with hidden holes and deep pits which in no sense deserve to be called by the honorable term *bunker*.

Less objectionable than the concealed or "blind" bunkers are those half hidden. It is not uncommon to see a series of bunkers so built that each conceals in part those beyond. Such construction is not commendable and is practically always avoidable. Not rarely bunkers near the green are so built as to mask part of the green itself. In not a few instances bunkers guarding a green are built up too much in the form of mounds and ridges. Every one has seen a ball hit such an elevation and be deflected toward the hole. A good bunker should catch a poor shot and not convert it into the semblance of a good one. There are flukes enough possible in the game without building courses that increase the number.

Well-designed and well-built bunkers may add to the attractiveness of a view. One or two bunkers to a hole look, as a rule, artificial; but increase the number to six, eight, or more, and they really give character to the landscape. But made too formal or too artificial they offend the eye and ruin the vista. One architect says he finds the best model for his ridges the rounded peaks of the sky-line of a distant mountain range. He even contends that some of his bunkers are so alluring that the players like to get into them. Another uses the sky-line of a forest border.

Still another role of a bunker is to induce awe in the mind of the player—the effect so well called "mental hazard." As the wobbler on the bicycle runs the thing he tries to avoid, so the golfer is apt to drive toward the object he tries hardest to evade. Particularly is this true of a mashie-shot hole heroically guarded. Such a hole, if not well-bunkered, lacks all character. It recalls the story of the handsome old gentleman with flowing white whiskers who looked very learned and impressive, but a shrewd judge of men divined the real situation when he remarked: "Take away the whiskers and what is there left?" So with the mashie-shot hole—take away its artificial or natural terrors and there is nothing left.

It is one of the curious anomalies of golf that a course without bunkers is less easy to play well than one well bunkered. Good bunkers not only indicate clearly the line of play but they serve as landmarks by which the distance can be more closely estimated. Most American courses need more bunkers—but they should be attractive and fair, and above all things visible. Much of the protest by players against more bunkers is because they are too often unfair. Good bunkers, more than anything else, tend to make good players.

The Green Committee of the U. S. Golf Association is always pleased to publish items showing how work around courses can best be done.

Commercial Fertilizer

LYMAN CARRIER

The commercial fertilizer industry has been built on the Liebig theory of manures. Briefly stated, that theory is essentially as follows: Given chemical analyses of both the soil and the crop to be grown, all the fertilization necessary is to add to the soil the constituents shown to be lacking; or, in other words, to supply the soil with the mineral elements which the difference between the two analyses indicates are needed. This theory has been exploded time after time. A chemical analysis, except in extreme and very rare cases, does not show which fertilizers will give the best crop production. But while this theory was in vogue (and it still holds sway in certain quarters, especially among city agriculturists), farmers learned by experience that chemical fertilizers are an efficient aid to increase production. The practice of using them has persisted and the commercial fertilizer business has grown to enormous proportions.

CUT AND TRY WITH FERTILIZERS

There is still much of the haphazard in connection with the use of fertilizers. Chemists have never been able to approximate or measure the reactions which under natural conditions take place in the soil. Perhaps they never will. These reactions are complex owing to the large number of factors involved, and they differ with each individual soil. The only way to find out what fertilizer is needed is to try them out, leaving an untreated area as a check for comparison. Literally thousands of such tests have been conducted, and from the mass of data collected some fairly definite and other less definite conclusions may be drawn. Unfortunately for the subject at hand—that is, growing fine turf—we have very few definite data. Most of the fertilizer tests with grass have been conducted on seedings of the coarse forage types used for hay. It has not been shown that fine turf grasses require the same kind of fertilizer, for best results, as would be used for a hay crop. We know now that different grasses vary widely in the way they respond to applications of fertilizers. There is great need for many more definite tests of fertilizers on fine turf. It will be to the interests of golf in general, and a money-saving expedient to the clubs conducting such experiments, if tests, well planned and carefully carried out, are made of the standard fertilizing materials to be found on the market. In most putting-green construction there are so many things done that it is often impossible to know what causes the results, good or bad, as the case may be. So it is unwise to attribute too much value to a certain fertilizer unless there is an untreated piece of turf under the same conditions to be used as a check for comparison.

NO MYSTERY ABOUT FERTILIZERS

In the early days of the fertilizer industry manufacturers endeavored to cover their business with a fog of mystery. Farmers, not being chemists, were supposed to be incapable of understanding the technique of fertilizer composition. Most outrageous frauds were perpetrated. Scores of brands with high-sounding names and for which most extravagant claims were made were offered for sale. Many of these different brands were of the same identical composition and frequently were taken from the same bulk lot.

Low-grade stuff, sometimes almost devoid of plant food, was sold in direct competition and not uncommonly at a higher price than first-class, honest goods. The chemists of the agricultural experiment stations exposed these frauds and are responsible for the various State laws which now govern the sale of fertilizing materials. They punctured the veil of mystery so full of holes that any man of ordinary intelligence can readily understand all the known facts in regard to the manufacture and use of fertilizers.

Plant Food

Chemists have found that most plants are made up of thirteen elements, an element being a substance, as iron or sulfur, which has never been divided into two or more other substances. Of these thirteen elements, three—sodium, chlorine, and silicon—are not essential to normal growth of most plants, though they are often present in the plant and probably under certain conditions perform some service. The remaining ten elements are absolutely essential. In the absence of any one of the ten the plant does not make a normal growth. Four of the ten essential elements are derived either directly or indirectly from air and water; these are carbon, hydrogen, oxygen, and nitrogen. These four elements constitute from 90 to 99 per cent by weight of all ordinary plant material. Young grass, with which the golfer is concerned, is about 98 per cent of carbon, hydrogen and oxygen, derived from air and water. Of course, these do not exist in plant tissues as free carbon, free hydrogen, etc., but are chemically combined with each other, or with some of the other elements, into various compounds. Of these three elements, carbon is always present in abundance in the air in the form of carbonic acid gas. The chemist refers to this gas as carbon dioxide, or more easily by the symbol CO_2. This is given off from the lungs of animals, and is produced by the burning of wood or other vegetable material. In plant growth it is absorbed by the leaves from the air.

Hydrogen and oxygen, in the proportion of two parts hydrogen to one of oxygen, when chemically combined, constitute water. Plants demand a great deal more water than what is needed to supply the hydrogen and oxygen required in building up their tissues. In order to transport the material, for every pound of dry matter produced in plant growth around 500 to 600 pounds of water has to enter the plant roots, pass up to the leaves, and be evaporated. Water is also the carrying agent for moving the starch, sugar, and fiber elaborated in the leaves, to the stems and roots.

Nitrogen

Nitrogen, which costs the golf clubs a liberal-sized fortune every year, constitutes four-fifths of the air we breathe. There are approximately 37,000 tons of nitrogen over every acre of the earth's surface. When free, as it is in the air, nitrogen is one of the most inert materials known. Unless it is stirred up and goes on a rampage in the form of a tornado it is entirely harmless. But get it chemically combined with some other elements and it quickly loses its pacific tendencies. Nitrogen enters into the composition of the most violent explosives, as guncotton, T. N. T., dynamite, etc., it is a constituent of the most deadly poisons, as hydrocyanic gas; and nitricacid is a powerful solvent. Nitrogen is also essential to the growth of animals, and is present in large

amounts in lean meat, eggs, and milk. What makes nitrogen expensive is the energy that it takes to get it combined with other elements, especially oxygen. The lightning flash accomplishes this combination, and it has been done commercially where powerful electric currents are available. The Muscle Shoals plant in Alabama was projjected for the purpose of making combined nitrogen.

The cheapest way to combine nitrogen with oxygen is performed in nature by a species of bacteria which live in the live root-tissues of the legume family of plants, such as clovers, beans, peas, vetch, alfalfa, etc. Unfortunately none of the legumes so far tried make fine turf suitable to golfing purposes, so the green-keeper is dependent on manure and commercial forms of this material to keep up the supply of combined nitrogen for his grass.

A Warning.—For the reason given above none of the commercial cultures for inoculating legumes are of any value for use on a golf course. Some companies are now advertising inoculating cultures, and making claims not warranted by experience, in order to sell their dope. It should be clearly understood that these cultures have no effect whatever on the true grasses.

Purpose Served by Nitrogen

Nitrogen aids greatly in the formation of leaves. A deficiency of this element results in a stunted, yellow, sickly growth of grass. As the nitrates are quickly washed out of the soil if not taken up by growing plants, they should be applied as a top-dressing to growing grass rather than before seeding. Nitrogen is usually reported in fertilizer analysis as the number of pounds of the pure element in one hundred pounds of the fertilizer. Sometimes it is reported as ammonia. Of course this element does not occur in fertilizer either as free nitrogen or free ammonia, so it does not matter which form is used so long as it is understood that ammounia is only 14-17 nitrogen—that is, 14 pounds of nitrogen is equivalent to 17 pounds of ammonia. Many manufacturers prefer to use the term ammonia instead of nitrogen, as they can accompany it with a larger number, which gives a better appearance on the bag. The chemical symbol for nitrogen is N, and for ammonia NH_3.

Nitrogenous Fertilizers

Ammonium sulfate.—This is a bi-product in the distillation of coal in the manufacture of coke and illuminating gas. The usual commercial grades have about 20 per cent nitrogen; but as some of this nitrogen does not become available to plants, ammonium sulfate is generally considered of equal value, weight for weight, with nitrate of soda. Ammonium sulfate is highly soluble and quickly available to plants. Its continued use tends to sour land, and is detrimental to the growth of clover and many weeds, such as buttercups, dandelions, plantains, and crabgrass. There is no evidence of injury to the bents and fescues even after many years of use. Ammonium sulfate should never be mixed with strong alkalies, such as lime, ashes, potash, etc., as the ammonia is easily driven off in the air by these substances.*

Nitrate of soda.—This is mined in Chile, South America, and is sometimes called Chile saltpeter. The commercial grades carry about 16 per

* See "Ammonium Sulphate," in No. 3 (p. 31) of this Bulletin.

cent nitrogen. It is soluble in water and readily available to plants. It tends to form an alkaline condition of the soil, due to the absorption of the nitrogen by plants, leaving sodium, a strong alkali, in the soil. The effects from nitrate of soda on grass in good growing weather are remarkable. The grass turns to a deep green and grows rapidly.

Fish-scrap.—The refuse, heads, offal, etc., from fish canneries is dried and sold on the market for fertilizers. Many unedible fish are also caught and used in the same way. Fish fertilizers vary greatly in their chemical composition, but frequently carry about 8 per cent nitrogen and 8 per cent phosphoric acid. Fish decay quickly in the soil and the plant food which they contain is soon available. As might be expected, they have a very disagreeable odor; otherwise there is no objection to their use on fine turf. The use of fish-scrap is confined quite largely to the coast country, where its merit is fully recognized.

Cotton-seed meal.—There are several concentrated vegetable substances which are highly valuable as fertilizers; among these, cotton-seed meal is the most widely used. This material becomes available quickly, and its effects on growing grass are almost as quickly noticeable as are those from such soluble salts as nitrate of soda. Cotton-seed meal contains from 6 to 7 per cent nitrogen, about 2 per cent of phosphoric acid, and 2 per cent potash. From a theoretical standpoint, backed up by considerable experience, cotton-seed meal is an ideal complete fertilizer for growing fine turf. It is best applied mixed with a top-dressing of sand, compost, etc., but can be spread alone. Soy-bean meal, of which there has been a little offered for sale, is still richer than cotton-seed meal in fertilizing ingredients and may be used whenever it can be obtained. Both cotton-seed meal and soy-bean meal are valuable stock feeds, which keeps the price above their relative values for fertilizers.

Dried blood.—This by-product from slaughter-houses is a quick-acting fertilizer. If pure it has from 12 to 14 per cent nitrogen, but if other refuse is mixed with the blood it may analyze as low as 10 per cent nitrogen, but usually in that case will have also 3 or 4 per cent phosphoric acid. The limited supply and demand for dried blood for feeding poultry usually makes the price high in comparison with nitrate of soda or ammonium sulphate.

Calcium cyanamid.—This compound is manufactured by passing nitrogen into a closed retort over superheated calcium carbide. The composition of the calcium cyanamid on the market varies considerably. The nitrogen content varies from 15 to 23 per cent. This fertilizer is so new and its effects on plants under some conditions so peculiar that its general use can not be recommended at this time; but it offers a fine opportunity for experimental work on turf grasses in order to find the reaction of insect pests, weeds, diseases, etc., to its use.

Elements from the Soil

The six other essential elements—calcium, magnesium, potassium, phosphorus, iron, and sulfur—are derived from the solid material of the soil. These are sometimes spoken of as the mineral elements of a plant. They constitute the ash when vegetable substances are completely burned. While these materials are present in very small quantities in plant tissue, they are absolutely necessary. As stated before, normal growth can not take place if any one of them is entirely lacking. Of these six elements,

magnesium, iron, and unsually sulfur, are present in every soil in sufficient quantities to answer all requirements for plant food. In a few tests recently conducted, sulfur has been beneficial on some crops, as alfalfa in certain locations, but for all practical purposes the green-keeper need not worry at all about magnesium, iron, or sulfur; his soil will have all of these in ample quantities for growing grass.

Calcium.—This is the basic substance in the various lime materials. The use and abuse of lime was thoroughly discussed in No. 3, page 43, of this current volume of THE BULLETIN, so that part of the subject need not be repeated here.

There are three grades of lime (burned lime, hydrated lime, and ground limestone) on the market. While the results of lime experiments are not all in harmony, the weight of the evidence indicates that it does not make any difference which one of these three forms is used provided the same amount of calcium is added to the soil in each case.

Ground limestone is just what its name implies. In most cases only a high grade of calcium carbonate is used for grinding. There is much ground limestone on the market which analyzes above 93 per cent calcium carbonate. Some forms of limestone carry magnesium as well as calcium. If the magnesium is not present in excessive amounts it does no harm. Marble and oyster shells are also composed of calcium carbonate and are frequently ground for agricultural purposes and are of equal value for the same degree of purity as ground limestone.

When calcium carbonate is burned at a high temperature it gives off carbonic acid gas and water, leaving calcium oxide, or, as it is known commercially, quicklime or burned lime. One hundred pounds of pure limestone, when thoroughly burned, gives 56 pounds of quicklime.

If to the 56 pounds of quicklime just 18 pounds of water are added, the lime slakes to a fine, dry powder; this is known on the market as hydrated lime. If this 74 pounds of hydrated lime is exposed to the air for a few weeks it will take up carbonic acid gas, increasing in volume, and will return to its original weight of 100 pounds; this is known as air-slaked lime. These figures give the relative value of the three grades of lime; that is, 56 pounds of burned lime equals 74 pounds of hydrated lime or 100 pounds of air-slaked lime or ground limestone. Approximately one ton of quicklime is equivalent to two tons of limestone.

Quicklime should be thoroughly slaked before being applied to living grass or when seeding. The caustic nature of quicklime, especially in the ground form, is very irritating to the skin and disagreeable to handle. Horses hauling it should be protected with blankets. In the hydrate form, much of the caustic property is gone, and the ground limestone is free from it entirely.

There is still one other form of lime used agriculturally; that is, calcium sulfate, known variously as gypsum, land-plaster, and plaster of Paris. It has a remarkably stimulating effect on the growth of clover when applied to fairly fertile land. The use of land-plaster has greatly declined in late years. It is doubtful if it has any value in growing fine turf.

Phosphorus.—There is much variation in the phosphorus requirements of different plants. Plants which produce seeds, as wheat or other grain, require relatively a large amount of this element. It is also highly important in the growing of tobacco, potatoes, and many vegetables. For

grass growing it takes a secondary position to nitrogen; but it must be remembered that phosphorus is an essential element and nature has no way of restoring it to the soil once the supply becomes exhausted. The tendency has been of late years to forego the use of phosphates on fine turf, and depend almost entirely on the use of nitrates in order to keep up the growth of the grasses. This in some instances has been undoubtedly carried too far, and on some putting-greens an application of phosphatic fertilizers would likely be beneficial. Unlike nitrates, which are quickly leached out of the soil, phosphates become fixed until used by plants. Phosphates have markedly beneficial effect on bluegrass, and the famous bluegrass regions are all righ in this element. One characteristic result from phosphorus should be noted: it hastens the maturity of plants to which it is applied. This is especially noticeable in leafy plants, such as tobacco, as well as those grown for seed. For this reason it should, when applied to turf grass, be used in moderate amounts, as the desire in the latter case is to postpone maturity as much as possible.

Phosphorus is usually reported in fertilizer analysis as phosphoric acid, a compound of two parts of phosphorus and five of oxygen. In some states the manufacturers are required to give the composition as phosphorus alone; less than half of the phosphoric acid is phosphorus. To be exact, 31 pounds of phosphorus is equivalent to 71 pounds of phosphoric acid. The chemical symbol for phosphorus is P, and for phosphoric acid P_2O_5.

Phosphatic Fertilizers

Acid-phosphate.—When a ton of ground phosphate rock (mined in Tennessee, South Carolina, and Florida) is treated with an equal weight of sulphuric acid, the resulting product is two tons of acid phosphate. If the original rock has 32 per cent phosphoric acid, the acid-phosphate will have just half as much, or 16 per cent. The reason for this acid treatment is to change the chemical form of the phosphate from an insoluble to a soluble form. At the same time quite a large amount of land-plaster or calcium sulfate is produced. Each ton of acid-phosphate has from 1,000 to 1,200 pounds of sulfate of lime. As previously stated, sulfate of lime promotes the growth of clover, and top-dressings with acid-phosphate on bluegrass pastures have greatly increased the stand of white clover. For that reason acid-phosphate should be used moderately on putting-greens. Much of the white clover trouble may be attributed to the use of too much of this fertilizer.

Bone-meal.—Long before plant food was called "pabulum," farmers learned that bones and other animal refuse nourished and increased the size of plants. This class of materials is still one of the most popular forms of fertilizers. It has proved especially efficient in increasing the production of meadows and pastures. Three of the characteristics of bone-meal which appeal to farmers are (1) that there are no deleterious effects, no matter how abundantly or carelessly applied; (2) that the action is slower than some other phosphates; and (3) that the effects are noticeable for several years after using.

While bone-meal is generally classed as a phosphatic fertilizer, raw bones contain about 4 per cent of nitrogen in addition to 22 per cent of phosphoric acid. The form most generally used for fertilizer is steamed bone-meal—that is, bones which have been heated in live steam to extract the fat and gelatinous matter. In steamed bones the nitrogen content is

reduced to about 1½ per cent, and the phosphoric acid increased in some cases to 28 and 30 per cent. The steamed bone-meal is more readily available, on account of the absence of fat, which retards decay, and is the form to be preferred by green-keepers. Bone-black (or animal charcoal), which is made by heating bones until all volatile matter is driven off, is used to clarify sugar. After it has served its purpose in refining sugar, it is sold for fertilizer. Bone-black, together with the impurities it has absorbed, will contain from 32 to 36 per cent of phosphoric acid. The absence of sulfate of lime in bone-meal makes it one of the most desirable forms of phosphate for putting-greens.

Basic slag.—In the smelting of ores which contain phosphorus, a high grade of fertilizer is obtained in the slag. This is known as basic slag, also as Thomas phosphate. Good slag should have 18 per cent phosphoric acid. It carries, however, a large amount of lime in the carbonate form. This promotes the growth of clovers, dandelions, crab-grass and other noxious weeds. The use of basic slag should be avoided by the green-keeper.

Potash

The term potash when used in connection with fertilizers means the oxide of potassium in the proportion of two parts potassium to one of oxygen. Potassium plays a very peculiar role in plant growth. It appears to be more of an aid to growth than an intimate constituent of plant tissue itself. In a crop like wheat there is more potassium present when the crop is just heading out than when it is mature, indicating that part of the potassium had served its purpose and was discarded. Most soils carry sufficient potash for growing grass. But to be sure that there is enough present it is advisable to give a light application at least once a year. Potash does not leach out of the soil, so it may be applied at any time without danger of losing it. The experiments which have been conducted with potash on grass indicate that heavy applications promote the growth of clovers, which are not desirable. On the other hand, withholding completely all potash gives the grass a stunted appearance, showing that it is suffering from malnutrition.

In fertilizer analyses, potassium is usually given in per cent of potash. If the analysis is given for potassium, one should know that 39 pounds of potassium equals 47 pounds of potash. The chemical symbol for potassium is K, and for potash K_2O.

There were two forms of potash on the market prior to the war, each of which contained approximately the equivalent of 50 per cent of oxide of potassium; these were the muriate and sulfate, obtained from large deposits in Europe. The muriate of potash (or chloride of potassium, as known by chemists) was usually cheaper and fully as efficient as the sulfate for increasing plant growth. The potash industry was badly demoralized by the war and has not as yet returned to normal. It is now possible, however, to get muriate of potash and that is the form which is best to use on fine grass. This is a high-grade material and is frequently applied in too large amounts. One hundred pounds of muriate of potassium carries as much potash as a ton of mixed fertilizer analyzing 2½ per cent of this ingredient. *Do not use too much potash.*

Mixed Fertilizers

A mixed fertilizer, as the name implies, consists of two or more materials mixed together, and usually carry nitrogen, phosphorus, and potash in various proportions. Sometimes one of these three elements may be

lacking. The fertilizer manufacturers always claim that the different ingredients in their goods are complete and properly balanced for the particular use desired, etc. There is something in the matter of balancing a fertilizer where large amounts are applied to special crops, such as potatoes and tobacco; but the green-keeper is not concerned in this subject, and the matter of whether the fertilizer is balanced or not, in the light of present knowledge, need not be considered in turf work.

What the green-keeper is vitally concerned about is whether the plant food in the fertilizer is readily available or not. The fertilizer companies are compelled by law in most states to give the percentage composition of their fertilizers, showing how much of nitrogen, how much phosphoric acid, and how much potash they contain. In some states the kind of material used in the mixture must also be given. Two fertilizers may have exactly the same composition and yet differ widely in their value. Leather waste, hoofs, horns, and hair carry a high percentage of nitrogen, yet unless treated to render them soluble are nearly worthless for fertilizer because they are so slow in decaying. It should be remembered that plants absorb all of their food which they get from the soil in liquid form. Until a fertilizer goes into solution it can not benefit a growing plant. Some materials which are insoluble decay quickly and form soluble compounds when exposed in the soil.

Many of the large fertilizer companies have practically discarded the use of brand-names and designate their fertilizers by their composition, as 3-8-3 or 3-6-8 goods. These numbers mean the parts in a hundred by weight of the three substances, nitrogen, phosphoric acid and potash, and in this order. In some localities it is customary to give the phosphoric acid first, as 8-3-3, or 6-3-8. If this order is used it can usually be readily detected, as potash is always given last place in the series and the phosphoric acid is almost always a much larger number than that for nitrogen.

A ton of 3-8-3 goods carries 60 pounds of nitrogen, 160 pounds of phosphoric acid, and 60 pounds of potash. If this fertilizer is composed of the standard materials (nitrate of soda, acid phosphate, and muriate of potash) the amounts of these to the ton would be as follows:

Nitrate of soda with 16% N	$= 60 \div 16 \times 100 =$	375 lbs.
Acid-phosphate with 16% P_2O_5	$= 160 \div 16 \times 100 =$	1,000 "
Muriate of potash with 50% K_2O	$= 60 \div 50 \times 100 =$	120 "
Total		1,495 "

There are many other fertilizing materials from which this grade of fertilizer might be made, but in buying a ton of 3-8-3 goods one gets 1,495 pounds of fertilizing materials and 505 pounds of filler. This explains why sand-banks are at a premium when located near a fertilizer factory. It also explains why it is better and cheaper to buy unmixed goods, know what you are buying, and save freight and hauling on this filler. The consensus of opinion of green-keepers in late years has been to steer shy of Bunkum's Grass Special of unknown composition and buy standard unmixed goods of known purity. There is no more need to be swindled in buying nitrate of soda or ammonium sulfate than there is in buying granulated sugar or table salt.

Buy by Composition

The analysis of any fertilizing material should be ascertained and the price compared with the prices of similar grades before purchasing.

While the chemical analysis is far from being a perfect guide, it is the only means available for telling anything whatever about the value of a fertilizer before using it, and it is by far better to buy by analysis than by trade-name.

Some companies still try to befog the issue by including so many different things in the statement of composition that their fertilizer analysis looks like the advertisement of a mineral spring. They still like to drag in by the hair of the head high-sounding terms, as "bone phosphate of lime," although the phosphorous in the fertilizer may all be derived from southern phosphate-rock. The inference is plain; bone-meal has long been favorably known as a fertilizer.

Rate of Application

The following recommendations for fertiliziing putting-greens are given for those who have not had much experience in the matter of the use of these materials. It is not claimed to be a perfect combination for all soils, but it is safe and sane. The proportions should be changed when experiments indicate such change is desirable.

For a complete fertilizer to be used once a year, preferably in the spring (or the phosphate and potash may be applied in the fall and the nitrate withheld until spring), the following is suggested:

Ammonium sulfate	250 pounds
Bone-meal	500 "
Muriate of potash	100 "

This mixture should be applied at a rate not to exceed 20 pounds to 1,000 square feet of surface. During the summer two or three applications of ammonium sulfate may be made at the rate of not to exceed 6 pounds to 1,000 square feet. If desired, nitrate of soda may be substituted for ammonium sulfate by using the same quantities.

Burning from Fertilizers

Everyone who has done much fertilizing of grass with high-grade fertilizers is familiar with the burning effects which are produced when too much is applied or when the fertilizer is in large lumps.

Such materials as nitrate of soda, ammonium sulfate, calcium cyanamid, and other highly soluble materials, should never be applied at a heavier rate than one ounce to ten square feet, or six pounds to 1,000 square feet of surface. Such materials cause a concentration of dissolved material in the soil water and give a greater density than the sap within the plant. As a result the juices are drawn out of the plant instead of more moisture entering, as is necessary to keep the grass alive.

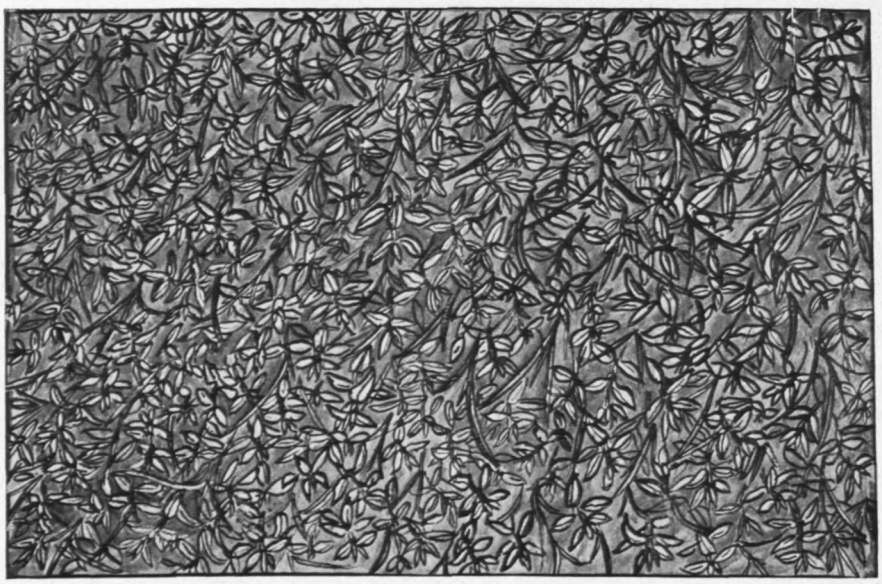
The same effect can be produced with liquid manure if it is in too strong a solution. The remedy is to dilute with water. We have several reports of burning of grass from the use of cotton-seed meal in too liberal quantities. While the writer has never been able to produce this effect even with very heavy applications, he does not doubt the accuracy of these reports. When conditions are right for the rapid fermentation and decay of the meal, burning will undoubtedly take place if too much is used. But two ounces to ten square feet or 12 pounds to 1,000 square feet will probably never cause any trouble. In applying any of these fertilizers, it is advisable to work them down to the soil with a broom, and, if possible, follow immediately with a good watering.

A Troublesome Chickweed

(Stellaria graminea L)

C. V. PIPER

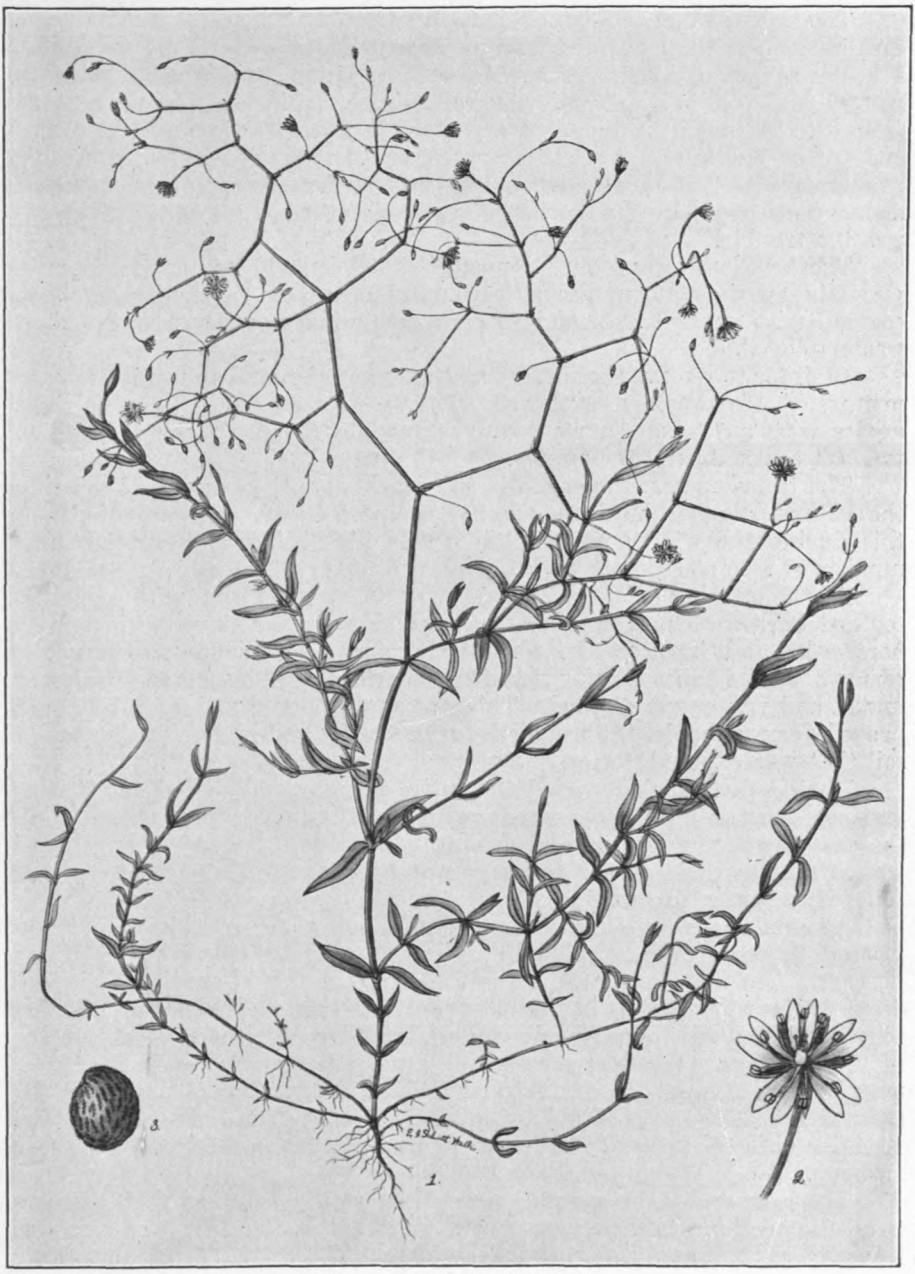
The chickweed shown in the illustration is a European species long since introduced into the United States and now more or less plentiful across the continent. In England it is known as *lesser stitchwort* or *lesser starwort,* but in this country has received no popular name. Under



A piece of turf of Stellaria graminea from a putting-green, about natural size

favorable conditions it may grow 2 feet high, in dense tangled masses of fine stems. It is a perennial and proves to be a difficult weed to handle in putting greens. On the Pacific Coast particularly it often makes up much of the turf both on putting greens and in lawns. It makes turf of fair quality but certainly not as good as creeping bent, and besides mars the uniformity of the grass. It is one of the weeds that should be combatted as soon as it appears by using a radical method, namely, cutting out completely the area infested and replacing with good turf. If not checked it will spread increasingly year by year.

From New Brunswick to California and from British Columbia to Florida, golf clubs are coming into the Green Section. Then beyond our shores we have members of the Section in Bermuda and Hawaii. It is quite probable that before long the Section will include the Country Clubs of Guatemala, Timbuctoo, Nijni Novgorod, and Lhasa.



STELLARIA GRAMINEA L.

(1) A portion of a plant showing its characteristic habit; (2) a single flower enlarged; (3) a seed much enlarged

Efficiency in Golf Course Construction

C. Ashley Hardy

The fairways at Eastward Ho, the new course at Chatham, Cape Cod, presented the combined difficulties of a thick growth of pitch-pine, a heavy carpet of bunch-grasses beneath, and numerous glacial boulders from 2 to 6 feet in diameter. The soil is a sandy loam. The pines were from 3 to 10 inches in diameter, and were pulled with double steel blocks and horses, one hitch taking three to five at a time in sequence. A week's preliminary test of this method and a 20-horsepower tractor of standard make resulted quickly in the latter being discarded; time out for repairs was the trouble.

The boulders were "mud capped." Sufficient 50 per cent dynamite was laid on the flat surface of each, and detonated, after having been covered with enough wet mud to offer preliminary resistance. No drill was employed.

In order to remove the surface mat of vegetation and to use it as green manure, the fairways were plowed. They were then diseed twice at right angles with a 12-inch cutaway disc-harrow, to break up the sod, which was left to rot during the winter.

The teams and men engaged in this work were then turned to grading the greens, digging bunkers, making compost heaps, and were busy at this during the winter months, the whole idea being to keep the same number of men steadily at work during the construction period.

At the opening of spring the fairways were gone over with a spring-toothed harrow to pull out the roots, which were raked up with a farm horse-rake and burned. In places where grading made necessary the removal of the top soil, raw fish from the fish traps nearby was plowed under, and winter rye planted. This was again plowed under in July, and proved very valuable, the fish-oil acting as a fine soil-binder on the sandy soil that was exposed.

During the growing period the entire fairway was diseed as often as was necessary to keep down weeds, with the additional effect of softening the contours of the ground and firming it for a seed bed. The only hand work that was done on the fairways was by a gang of stone-pickers that followed a screen of dump-carts.

As soon as the contours of the ground assumed their final shape, finely ground limestone was applied by a lime-spreader at the rate of 2 tons per acre. So insufficient are Cape Cod soils in this element that it was deemed wise to employ it in limited quantities—not to produce an alkaline reaction, which red fescue does not need, but to reduce the general poverty of the fairways. To assist in securing a good catch of grass in a district where heavy downpours are frequent, sheep manure was spread by the same means at the rate of 1½ tons per acre. Only one lime-spreader was used for both operations, and it spread its contents at the rate of an acre an hour.

The lime and sheep manure were harrowed in together with a spike-toothed smoothing harrow, going both ways across the field, and this was followed by a heavy iron two-horse roller. The teeth of the smoothing harrow were set forward only enough to raise the harrow frame off the ground, and it was sent after the roller. By this method the surface, now

thoroughly compacted, was not disturbed, but only roughened to hold the seed when sown.

Seeding was done at the rate of 12 bushels per acre on fairways and tees, and 20 on the greens.* All were seeded by the same method, a one-horse lime-sower hauled by two men, adjusted on a measured acre to a delivery of 6 bushels of seed per acre where fairways were concerned, and 5 for greens. By cross-sowing on the former the requisite quantity was evenly distributed without the nuisance of weighing or measuring in the field, and by doube cross-sowing the greens were accurately covered in an average of less than one-half an hour each. On the fairways, where fewer turns had to be taken, the average rate of seeding was two hours to the acre, this including time consumed in filling the machine.

No wind we encountered was too severe to hinder the action of this machine, although at times there was half a gale blowing. The delivery spouts were within two inches of the ground, and when the seed fell in the light furrows left by the smoothing harrow, it stayed there, and did not blow.

The harrow with teeth set back was now employed to distribute the seed so sown as well as to cover it, and was sent across twice at right angles. Cross-rolling with the two-horse iron roller followed to firm down the ground, and the job was done. The seed most deeply covered, sometimes to depths of an inch, was the first to germinate. No sign of the striations that might be expected from this method of seeding are to be seen, and the horse-drawn smoothing-harrow seems to have done adequately, and cheaply the work of rakes. Needless to say, the putting-greens were hand-raked and hand-rolled with the utmost care.

It will be observed that, except for the picking up of stones, the fair ways were not touched by hand-labor. Three varieties of ordinary farm-harrows prepared the seed bed and did the light grading, but no rakers were employed. The only sign of farm methods having been employed are footmarks of horses, which the first rain will obliterate in this sandy soil, and there is nothing to indicate that the surface will not be first rate in a few weeks, given rain, which is badly needed.

On this eighteen-hole course of 6,350 yards, ten fairways were plowed and seeded, and trees removed from 17½ acres thereof. The total labor cost, including horse and farm machinery hire, has been less than $40,000 to date, with greens, tees, and fairways finished. A not inconsiderable item of this total is the 10,000 two-horse loads of green compost moved twice, and the heavy grading necessary on some greens as well as fair-ways, for which the Cape Cod "sand plow" proved a highly efficient instrument.

An interesting sidelight on the exactness of the seeding method em-ployed, is the fact that after estimates were made and the seeding machine set, but one three-bushel bag of red fescue, our chief ingredient, remained in the barn after all greens, tees, and fairways were seeded.

The caddy-master of one of our leading golf clubs recently remarked, "I wonder if business men would not be more considerate if thier own boys were caddies."

* The rate of seeding used was very heavy, at least four times as much as was really necessary on the fairways. Money spent in very heavy seeding could better be invested in fertilizer.—*Editor.*

The Japanese Beetle in Relation to Golf Grounds

B. R. LEACH, UNITED STATES DEPARTMENT OF AGRICULTURE

The Japanese beetle now infests an area in the states of New Jersey and Pennsylvania within which are located several golf courses. Naturally the question arises as to just how much of a nuisance this insect will become from the standpoint of golf-ground upkeep. This question can not be definitely answered at the present time, although observations made at our laboratory during the last two years tend to give some indication of what may be expected.

The Japanese beetle has a one-year life cycle. The beetles emerge in late June and July. During their existence they feed on the foliage of various shade trees, shrubbery, weeds, field crops, etc., in addition to laying their eggs in grass lands. The eggs hatch into the grubs, which remain in the soil until the following June. While the beetle itself may cause more or less annoyance to golf grounds, by feeding on shade trees or shrubbery, it is only of secondary importance in this connection as compared with the grub.

A detailed study of the habits of the Japanese beetle grub has been made by Mr. L. B. Smith, of our laboratory; and regardless of previously published reports to the contrary, it is entirely evident that the Japanese beetle grub is a root feeder; and that under certain conditions it will injure and even kill grass.

The grubs of the Japanese beetle are now present in the turf of several golf courses in the infested area. The insects are distributed generally over the course, but are especially prevalent in the turf of the greens, as many as eight grubs having been found in a piece of sod as large as one's hand. These greens have been injured by the grubs, the killing of grass being especially noticeable on the higher portions of the green, such as the sloping edges. It is these sloping portions of the green which dry out most quickly after being watered, a condition which does not give the grass roots (injured by the feeding of the grubs) a chance to send out new roots rapidly enough to maintain growth, the death of the grass being the ultimate result.

The level portions of the green, when watered properly, are usually sufficiently moist so that the grass can make an optimum root growth and thereby maintain itself fairly well in spite of the continuous feeding upon the grass roots by the grubs. Even under these conditions it is fairly obvious that the grub of the Japanese beetle is another obstacle in the way of maintaining the proper sort of turf on golf greens.

Experimental work designed to evolve a method of destroying the grub in turf has been conducted at our Japanese beetle laboratory at Riverton, N. J., and a fair degree of success has been obtained from the use of sodium cyanide in solution. However, experiments conducted this fall on golf greens indicate that the material is too injurious to have much application in the problem of controlling the grub in greens unless the green is to be reseeded after the treatment. Experiment involving other materials in solution were conducted at the same time, and while prediction of success is premature at this time, it is fairly evident that a treatment can be found which will control the grub without at the same time ruining the turf.

The problem is fundamental in nature, and a basic study of it should properly be undertaken from both the biological and chemical control aspects, such a study to occupy a period of several years. The results would have an important application in the control of not only the Japanese beetle, but other soil insects infesting golf courses.

Dear Bill Letter VI

Richland Center, N. Y., October 14, 1921.

DEAR BILL:

About this time of year every green committee is getting down to the dregs of appropriations; club treasurers are figuring what the deficits will be; and everyone's nerves are on edge. I suppose you are just like the rest—tired of the job; and you are wondering whyinell you accepted it; and you are firmly resolved that this year is the last.

You are looking back over the year and recalling to mind all the plans you made so carefully, all the problems you and your green-keeper studied out, and all the work you both did, and you are asking yourself, Who, if anyone, in the club appreciated it? Do any of them have any conception of the detail and variety of the work required to keep them happy and maintain the course as it should be?

You count the kickers one by one and consign them to the particular variety of eternal punishment your fancy conceives to be most suitable—none excruciatingly painful enough to suit you. And an eternity of punishment for this, that, or the other kicker strikes you as being just a short forenoon of what you'd like to give them.

I can read your mind, Bill, and I can see your right hand raised so that you can tell the world that the oath you are taking—"Never again"—is too solemn to be forgotten; and you hope awful—I might say horrendous—casualties will fall upon you if you ever do it again.

You can count on the fingers of one hand the club members who have come up to you during the year to say that the work was being well done, or that they were pleased.

Tell me this, when you figure it out: Why are the officers and committeemen of any club imbeciles, and why are the conscientious objectors so omniscient? How can an objector decide offhand just exactly what should have been done, though some poor fool of a committeeman was obliged to rack his stupid brain for days only to do the wrong thing?

Sometimes I wonder how it is that I make a living for one wife and a couple of kids—I appear to be so dull in comparison with the objectors.

There's some pleasure in serving others if there's any appreciation of the effort, even if it must be conceded that greater intelligence would have been applied had some one else undertaken the task.

But I have a remedy to propose. We read advertisements that a certain week is prune week or some other week, and large gatherings of people are often asked to devote a moment or two to silent reflection upon this or that. I'm going to ask the Green Committee of the U. S. Golf Association to announce that at 12 o'clock, noon, Naval Observatory time, on Saturday, October 29, A. D. 1921, all green-keepers and green-committeemen in the United States shall stop wherever they happen to be, face south, and shout in unison, though widely separated, something that the scientists in the Department of Agriculture will guarantee to place as a curse on the kickers for at least seven generations; I shall insist that it must be something awful and shivery; I'd not only curdle their blood, but turn it into cheese. Per-

haps the Green Committee, with the official sanction of the U. S. Golf Association, could devise a sort of a black spot which, when put on a kicker, would let him know that he was done for. You remember your *Treasure Island,* and how Captain Bill Bones shivered in fear that someone would clap the black spot on him, and the death he died when Old Pew did it? That's the kind of stuff I want, only worse.

If I knew I should suffer until Gabriel blows, I could not think a kind or loving thought of a single one of these kickers. There's murder in my heart, Bill. There ought to be an "open season," if only a day, during which committeemen could maim, mutilate, or murder kickers. I'd at least have sort of a callithumpian day, on which committeemen, all over, could gather and, with absolute immunity, call the kickers by their right names.

I trust my present mood will not turn you sour on the world; but the kickers have me winging. I'd be willing to stick another year and stand it all over again if someone would explain why the vocal organs of the kickers have such wonderful development and why, through deep breathing, or what, they can keep in action all the time. Tell me that, Bill, and I'll stay on the job another year and feed you advice.

Yours, CHAUNCEY.

P. S.—Are there any clubs in your vicinity which do not belong to the Green Section of the U. S. Golf Association? *Get them in.* C.

A NEW METHOD OF APPLYING CORROSIVE SUBLIMATE IN DESTROYING EARTHWORMS

E. J. MARSHALL

The destruction of worms by the use of corrosive sublimate (bichloride of mercury) is regarded by some as tedious and expensive, because of the time required to distribute the solution by means of sprinkling-cans. At the Flossmoor Country Club, Flossmoor, Illinois, Mr. Harry Collis, the professional at the club, overcomes this objection by putting a few boards on a green, on which he places a barrel, which is then filled with water, to which the corrosive sublimate, in powdered form, is added; the barrel is then tipped over and its contents spilled so as to flood a section of the green. Men aid in the even distribution by spreading the water with the backs of rakes, which they use also for gathering up the worms. This operation is repeated as often as necessary to cover the green. If powdered corrosive sublimate is used in this manner the proper amount would be 1 ounce to the barrel. It would be well to have two barrels at the edge of a green, out of which men could dip the solution with buckets and throw or pour it on the green; while one barrel is being emptied the other could be filled.

Corrosive sublimate is soluble in water only in minute quantity. This can be overcome by making first a stock solution, as follows:

8 ounces corrosive sublimate.
8 ounces ammonium chloride.
1 gallon water.

One pint of this stock solution will contain the one ounce of corrosive sublimate to add to each barrel of water.

Corrosive sublimate can, however, be applied easily and effectively in dry form. [See page 81 (May number) of this volume.]

Questions and Answers

All questions sent to the Green Committee will be answered as promptly as possible in a letter to the writer. 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.

1. *We have a very good stand of grass on all of our greens, but it is largely Poa annua, and now that it is possible to get some bent seed I thought that by sowing some of it in the spring and fall we could gradually get bent greens. Do you know whether this method has been tried out and what the results have been? I have been led to believe that the nature of the bent was to crowd out the other varieties of grass. We use "——— humus," as our green-keeper thinks it very desirable to top-dress with this humus mixed with sand. Is there the same danger of burning the greens when using bone-meal, dried blood, fish-scrap, or tankage, as there is when using chemical fertilizers? What is your opinion of using lime or greens? T. G. S., New Jersey.*

If your greens are largely *Poa annua,* by all means put bent seed in them. More or less of it will catch, particularly the velvet bent and the creeping bent, and in time you can get a bent green. The bents will certainly compete with *Poa annua.* Where a green is practically pure bent already we have the gravest doubts that putting in more seed does any good; but it certainly does no harm. With a thin stand of pure bent the turf can be thickened by proper treatment, including fertilizers, which as a rule is very much more satisfactory than putting in seed. Most golf courses put some seed on their putting-greens every fall, even if they have practically perfect turf. This is done more or less on the theory that it will do no harm and will please the members. Where a green is practically perfect we can see no possible advantage in putting in more bent seed. Your case, however, is somewhat different and we would by all means suggest that you put in the bent seed. In reference to "——— humus" or any other humus, our objection to them is that they are expensive out of all proportion to their merits. As a result of experiments we have reached the conclusion that a ton of well-rotted barnyard manure is worth at least five tons of humus, and usually the manure can be purchased very much cheaper than the humus. Besides, some commercial humuses are very toxic, so toxic indeed that grass seedlings will not grow in them. We have never seen any burning of grass from the use of bone-meal, dried blood, fish-scrap, or tankage. You will, however, secure burning from the use of cottonseed meal or other seed meals unless they are mixed with considerable soil. We do not advocate the use of lime on greens at all. The bents and the fescues thrive perfectly in acid soils; and besides, the use of lime encourages weeds. Lime also speeds up nitrification of the humus in the ground, which, it is true, furnishes more nitrogen for the plants, but on a golf course it is cheaper and better to apply your nitrogen as such. You don't want to burn the humus out of your greens, as you want the resiliency it gives.

2. *We are sending you for purity and germination test six packets of turf grass seed samples representing a set of two lots of three kinds from two different firms—namely, a mixture of one-half redtop and one-half*

fescue, a mixture of one-half redtop and one-half Kentucky bluegrass, and a specimen of Italian rye-grass, which we propose to use on our golf course this fall. H. E. B., Florida.

May we express the opinion that you are making a mistake to seed any other grass for your winter greens than redtop alone or Italian rye-grass alone? We prefer the redtop, as the turf is somewhat finer, but it does not grow quite so rapidly as the Italian rye-grass. There is no possible advantage in the mixtures which you have sent us. We are sure you will get very much better results by seeding redtop alone or Italian rye-grass alone, and besides save a good deal of money, as the seeds of these two grasses are cheap. It might be of interest to you to plant one green to redtop and another to Italian rye and compare the results, or to plant one-half to redtop and one-half to Italian rye, so you will have the two grasses side by side; but most of the southern clubs have been using redtop.

We are having the samples you send examined for purity and trueness to name and will report results. The germination tests usually require some time and you can usually save time by planting a little of the seed in a bed a foot or two square. There is rarely any question about the germination of redtop, Kentucky bluegrass, and Italian rye-grass, but New Zealand fescue varies greatly in germination.

3. *We are informed by a club in California that they have had great success with New Zealand fescue seed. Would you advise planting it in August so that our greens would be green all winter? Our average frost date is November 12, and after that date the Bermuda grass gets brown and all growing stops until next spring. C. B. B., Texas.*

We are very dubious about the chances of New Zealand or Chewings' fescue for putting-greens in Texas. We would suggest first of all that about the first of October you plant an experimental putting-green, which can be any size from 10 feet square up. Keep this under putting-green conditions for a year. That will give you definite information as to whether or not it is going to succeed under your conditions—a matter which we gravely doubt. Conditions in California, with its dry climate, are radically different from those in Texas. On account of the high price of Chewings' fescue seed and its slow growth, it is not at all the grass for you to plant on your Bermuda greens to keep them green throughout the winter. The grass for you to use for that purpose is redtop, the seed of which is cheap and of high quality, and seedling redtop makes really good putting-greens. It will disappear the following spring after hot weather comes and the Bermuda starts growing. As your average frost date is November 12, we would advise that you seed the redtop between October 1 and October 15, seeding it heavily, at least 5 pounds to 1,000 square feet, using recleaned redtop seed.

4. *We would appreciate full information and suggestions as to the best grasses to meet our requirements in southern Florida on rolling, high, cut-over pine lands, not flat-woods. V. W. H., Florida.*

For your fairways you have two choices—carpet grass on the lower, moister lands, and Bermuda grass on the higher, drier lands. At the Belleair course, near Tampa, when visited several years ago, the fairways were then largely carpet grass, although they had been planted to Bermuda. Wherever the soil conditions are suitable for carpet grass we would advise using that, otherwise Bermuda. As a hit-or-miss proposition you could seed all the fairways to a mixture of Bermuda and carpet. Your putting-greens we assume will be Bermuda grass. If these are seeded about

three weeks before frost, or let us say, in your latitude, as soon as the weather is fairly cool, about the end of October, with Italian rye-grass or with redtop, you will have nice green putting-greens all winter. Formerly Italian rye was mainly used, but now all the better clubs are using redtop, which we regard as distinctly superior. The redtop or the Italian rye makes a putting-green during the winter and disappears as the Bermuda begins to grow with the recurrence of warm weather in spring.

5. *I would like to have your opinion as to the best methods of getting rid of crab-grass. Would you recommend cutting it out early in the season or raking down later? Also, what fertilizer would you recommend for use on a green which has been troubled previous seasons with crab-grass? E. H. B., Massachusetts.*

We regret to say that we have found no easy method of eradicating crab-grass from turf. In fact, about the only method that has proved successful is hand-weeding, and where this method is followed and the greens are protected from overwash from the rough and fairway, the crab-grass problem usually lessens in importance from year to year. We have tried a great many experiments with the hope of finding some treatment that would obviate the necessity of so much hand-work, but our results so far have been almost entirely negative. Reaction of crab-grass to fertilizer is such that there appears to be no fertilizer that will give the desirable turf grasses material advantage over crab-grass. There is an advantage, however, in fertilizing the greens properly. The advantage lies in the fact that if this is done it is possible to keep the desirable turf grasses in vigorous condition, and by a few years' careful pulling out of crab-grass very little of it appears in the greens thereafter, provided, of course, good treatment is given the greens.

6. *We are going to seed our Bermuda greens this winter to redtop. As the greens are used until well on into the season, would it be absolutely necessary to plow up the Bermuda to get good results or would a good, heavy top-dressing answer the purpose as well and give a good stand during the winter months? The soil here is light and sandy, deficient in humus and does not retain moisture very long; so we thought that unless the top-dressing was incorporated thoroughly in the soil by means of plowing and harrowing it would dry out too readily. F. M., Florida.*

In your locality the best date to seed your Bermuda greens to redtop would probably be October 15 or perhaps a little later; at any rate it should be about three weeks prior to the first frost that you get. We would not advise spading up the Bermuda, although this can be done if you so desire. It is sufficient to skin the green—that is, cut off the Bermuda as closely as possible, then seed heavily to redtop (the seed is cheap), cover with a light top-dressing of good soil, and roll. By heavy seeding we mean 5 pounds to 1,000 square feet. Bear in mind that all through the winter you will be putting on what is practically seedling redtop, and therefore the number of young plants should be sufficiently large to make a complete turf. In case you decide to spade up the greens so as to have a stimulating effect on the Bermuda for next yeyar, we would advise that you fine the soil sufficiently well before you plant the redtop seed, and in this case it will not be necessary to top-dress. We might advise in this connection, however, that if you can manage to get a soil containing considerable clay about the consistency of a rich clay loam and use it as a top-dressing you will get very much better Bermuda turf than it is possible to get with a sandy soil.

MEDITATIONS OF A PERIPATETIC GOLFER

A man without any especial reputation can utter what he pleases without much concern. Therefore these mutterings.

How much better that green would show up if there were tongues of white sand on the slope of the bunker mounds. Photographs with and without the sand tongues emphasize the difference.

A patch of lawn pennywort on a green—really a beautiful thing. If the green-keeper doesn't get busy and eradicate it he is headed for pennywort greens.

"Fairway" is a good word and now much used. But there is no sanction for it in the Official Rules.

A putting green is the area within 20 yards of the hole—often including rough and bunkers. There is no name for the actual putting surface. Why not call it putting sward or putting carpet,

"This is the best two-shot hole on the course, because the green is harder to get to than any other." Architects, take notice. Excellence and difficulty are one and the same thing when applied to golf holes. Make the greens blind, put them on saddle-back ridges, dig up the fairways into continuous bunkers; thus will you intensify difficulties, and in like proportion excellence. After all, why not play golf without clearing the land at all, so as to have plenty of difficulties?

Four attractive shelters on the course. When a thunder storm comes up they are very popular and much appreciated.

Easy, attractive, permanent seats at each tee iustead of rude benches. Let the tired golfer be comfortable while he learns patience waiting for the slow foursome ahead.

Dozens of indigo buntings and golffinches on a putting green, with a brilliant scarlet tanager in their midst, make even a golfer pause to admire. Yet some golfers assert that even the twittering of a bird will spoil a tee-shot.

Will wonders never stop ceasing? A modern golf club where most of the money was not put in the house.

Some grass devotees are becoming such "nuts" that we urge them not to go into the woods alone for fear the squirrels will eat them.

Ninety-seven and eight-tenths per cent of all approach shots ,including putts, are short, according to a statistical fiend. If a player will remember this he can improve his game.

Isn't it curious to see how many a player is not careful enough with his third putt?

"I should dearly love to see a finished golf course," said a green-keeper to me recently. As long as there is progress in the game, his longings will be in vain.