monia per thousand feet per month, and in ammonium phosphate .8 pound of ammonia and .8 pound of phosphoric acid. Even if half the water of such a solution is soon evaporated, taking into consideration the natural soil moisture and the frequent waterings given a green, it is not likely the soil solution will become concentrated above .5 per cent.

Samuel H. Purvis Pioneers With the Giant Spray Pump

Obviously it would be an expensive job to apply three to four hundred gallons of solution to each green weekly with a spray barrel and Samuel H. Purvis, superintendent of the Seaview Golf Club of Absecon, New Jersey, demonstrated to the writer how it could be done economically. Credit is due him for adopting the first giant size spray rig and applying ammonium sulphate and Semesan in solution by means of it. His machine is a Royal Leader made by the Field Force Pump Company of Elmira, N. Y. and it has given him splendid service. He can get around his course easily in two days and his greens are always in splendid condition. This is remarkable when one considers that the Seaview Club entertains over seven thousand visiting golfers per year and the course is given hard wear. Mr. Purvis never permits his greens to become undernourished and Brown Patch never damages his grass because he always sprays ahead of it.

Special Bean Sprayer of Wilmington Country Club

For the Wilmington Country Club was purchased a Bean Super-Giant Outfit No. 737 (Bean Spray Pump Company, Lansing, Mich.), converted to conform to the writer's specifications. The 400 gallon tank is divided into two tanks of 200 gallons each by means of a partition. Both tanks are agitated with a propeller stirring device. Each tank has a gauge glass mounted on the rear in a small closet and protected from breakage when not in use by a door. The gauge glasses are calibrated to ten gallons. Each tank can be cut off from the pump by means of a valve and the overflow when the pump is running idle is returned to the tank from which the pump is sucking by means of a quickly adjustable piece of hose. A box on top of the rig carries the chemicals which are weighed out on rainy days into cotton bags containing just four pounds each.

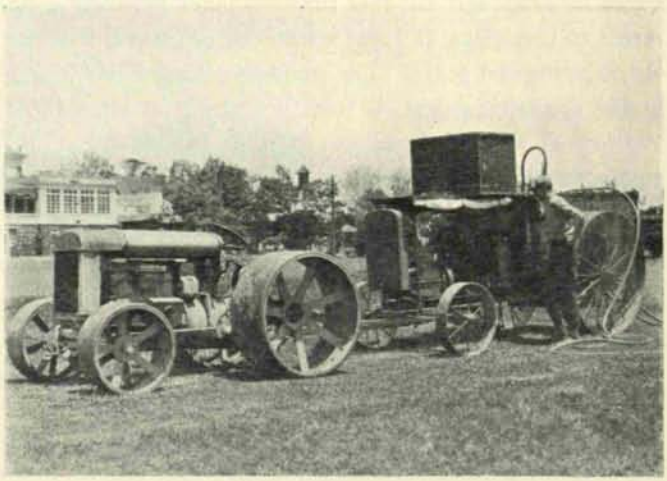
Special broad tired wheels were provided with the machine. The back wheels have ten inch tires and the front wheels six inch tires.

The pump will throw twenty gallons per minute at 300 pounds per square inch pressure on the Boyce spray guns. Two hose lines and two Boyce double bitted guns comprise the spraying equipment.

Spraying Procedure

The machine with one tank filled with solution is moved up to the water outlet near a green and a hose attached to this outlet is inserted through a hole in the top of the empty tank and the water turned on. Three men operate the outfit, a tractor man who looks after the machinery, reads the solution gauges and directs the gunners, and two Boyce gunners. The gunners assisted by the tractor man run out their hose lines and the tractor man turns the valves that allow the pump to throw the solution through the guns. The guns are throttled down until they throw a fine mist. The engine has been running idle for about five minutes. The tractor man now empties a bag of chemical in the tank being filled from the green outlet. The chemical is constantly stirred and dissolves within a minute. The gunners have now sprayed one tank but the other is full. Valves and the overflow line are reversed and the hose stream from the ground outlet turned into the recently emptied tank.

While watching his tank gauge the tractor man moves his gunners over the green and secures remarkably uniform distribution of the solution. The mist from the guns is so fine that they may be turned toward the turf without scoring it in the least and the wetting resembles that of dew.



Fordson tractor and Bean spray pump in use at Wilmington

The greens have been measured and a chart showing the number of gallons for each green hangs on the back of the rig. When the required volume of solution has been sprayed on a green the tractor man shuts off his spray rig engine, starts the tractor engine and off they go for the next green.

They accomplish the spraying of nine greens a day and occasionally give tees and tennis courts a dose.

Urea

At the Wilmington Country Club urea is mainly used with an occasional application of ammo-Phos. Urea has been selected because it is over twice as strong in ammonia as ammonium sulfate and by its use the soluble salt content of the turf may be kept at a minimum. It

gives a response in twenty-four hours after application unless the green is already in the prime of condition. While it is twice as costly per unit of ammonia as ammonium sulfate, nevertheless it is worth the difference. Last year when only top-dressings of a mushroom soil containing ammonium sulfate and top soil were applied to our greens they were in a miserable condition. This year even the "cranks" are congratulating the greenkeeper and the committee on the fine appearance and true playing surface of the greens. There is no room for doubt as to the improvement. The method is a splendid success. No burning is experienced unless a great quantity of solution is applied to one small spot. On hot days the rig is out only in the early morning and evening hours.

Brown-Patch

Brown-Patch is caused by a fungous plant, Rhizoctonia, and this plant is of just as definite a character as the grass itself only of a lower order. No amount of water or sand will kill this fungous plant and one must resort to chemicals of great selectivity to control it without injuring the grass. The greatest selectivity is found in the organic mercurial, Semesan, used by Dr. M. B. Waite and Mr. E. A. Siegler of the United States Department of Agriculture, in controlling Crown Gall which is sometimes called plant cancer. While speaking in glowing terms of Semesan they refer to the inorganic mercury compounds as follows:

> "Mercury compounds are among the most powerful of germicides; but the inorganic compounds, such as corrosive sublimate, are often very injurious to plant life, even in extremely dilute solutions."

Semesan is a necessity on the golf course and it can be most economically applied by means of the power spray rig. It can be used in the same solution with urea if desired.

Because the high pressure spray wets quickly and seeks out every exposed portion of the grass plant, frequently as little as twenty-five gallons of the standard solution (one pound in fifty gallons of water) will be sufficient for each 1,000 square feet of green. This is an additional reason why every golf course should be equipped with a large size power spray outfit.

Top Dressing

Only one top-dressing has been used so far this year on the course of the Wilmington Country Club. It was composed of equal parts Hyper-Humus and good top soil. Mushroom manure has been discarded entirely for greens since it has been found that most of it contains undestroyed weed seeds notably chickweed. It may interest some of the Pennsylvania and New York members to know of the changed composition of mushroom soil produced at Kennett Square, Pa., the largest center of the mushroom industry.

Prior to 1917, twelve parts of good horse manure were mixed with two parts by weight of top soil for composting. Composting was carried out in the boxes inside the mushroom house and the temperature of the fermentation was so high that practically all of the weed seeds were destroyed. After 1917, because it became known that mushroom growing was very profitable, many people hastened to erect houses and get into the business. Manure leaped in price and it became necessary to conserve it. Less and less manure was used in the compost until in 1924 it became standard practice to mix only seven parts of horse manure with two parts of earth in making the compost. Also good top soil became scarce and the growers substituted the clay soil from the farms adjacent to the mushroom houses. Therefore, at the present time only in the top boxes in the mushroom houses is the temperature of the fermentation of the compost sufficiently high to kill the germs of the weed seeds. Mushroom soil cannot be regarded as a fertilizing medium of any great value, only as a humus, since its present analysis is as follows:

Nitrogen as ammonia	.78%
Available Phosphoric Acid (P_2O_5)	.24%
Potash (K_2O)	.51%
Total	1.53%

The Future

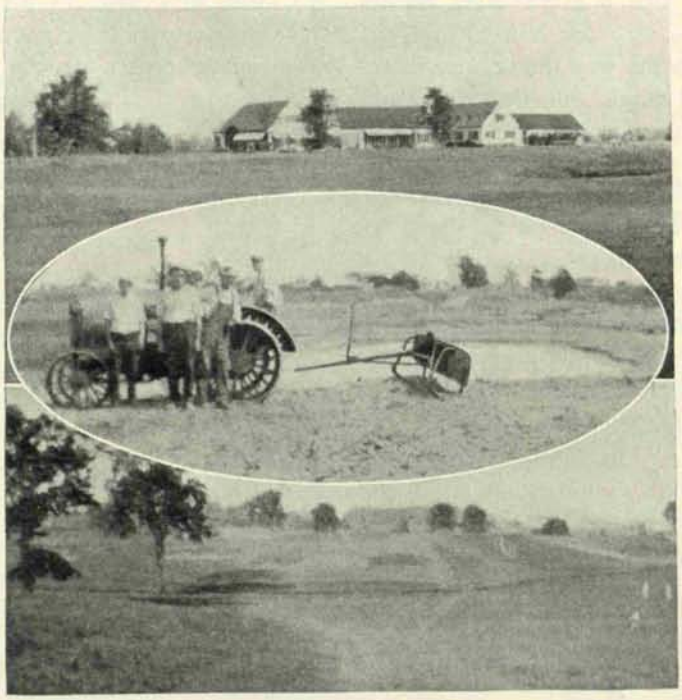
The art of maintaining turf progresses due to the free exchange of ideas between those who are engaged in a professional way in keeping our golf courses and the writer heartily welcomes the advent of THE NATIONAL GREENKEEPER. Since Samuel H. Purvis purchased the first large size spraying machine, there have been six or eight such machines sold in the Philadelphia Golf District and it seems probable that the solution method of applying soluble fertilizers will become standard practice in the course of the next few years.

Some top-dressing will always be needed especially on the creeping bent grass types, but it will be used for the purpose of adding humus and to cover roots rather than for fertilization. It must be realized that every chemical which is absorbed by the roots of the grass must first be in a soluble condition and this applies equally to all fertilizers whether they be of organic nature such as cottonseed meal, soy bean meal and poultry manure or salts such as ammonium sulfate and ammonium phosphate.

Saving Money on Reconstruction

By FORD GOODRICH, Vice President
National Association of Greenkeepers of America
Flint Country Club, Flint, Michigan.

A GOLF course is never finished. No matter how ideally planned or how perfectly builded it may be in the beginning, like the sands of the desert it is constantly being shifted. A new tee is built here, a bunker or two there, a fairway may be narrowed or made wider. These changes are being made every year but occasionally there comes the need of a more radical change such as a new green or two with of course new fairways, tees and bunkers.



Upper, number 18 with clubhouse in background; oval, grading around lake; lower, showing bunkers around number 2 green, Flint Country Club, Flint, Michigan

No doubt a large percentage of greenkeepers have been confronted with the problem of several changes to be made on the course with only a limited amount of funds for the work. This was our experience two years ago when the board of governors and Green committee decided it would be necessary for three holes to be changed.

Making Changes Along With Regular Work

After going over the project very thoroughly we made an estimate on the cost of building two new greens and three fairways. At their next meeting they decided they could not afford to make the change at one time. The Green committee and I made them a proposition of allowing us $1000.00 more a year on our budget and we would do what we could at odd times along with our other work until the changes were completed. This they consented to with the result that in two years' time we have nearly completed the changes which would originally have cost $8000.00 for only $2000.00 more than our annual allowance for the upkeep of the course.

Here is how we managed to do the work at this low cost. As the fairways which we had to build were across a swampy rough, the first work we did was to dig our ditches through this in the fall after the season's work was finished and labor was cheap. This was accomplished the first fall with the help of but three men.

In the spring we purchased a Schaefer Fresno which can be operated by the man on the tractor. With this outfit we did nearly all of the grading. We were very fortunate, however, in having a large hill beside the swamp where we were building our fairways so we had plenty of filling dirt handy.

Novel Way to Build Water Hazard

At the end of first year we had the greens finished and seeded to stolons and a fair start on the fairways, but a water-hazard was to be built where there was nothing but soft, mucky ground making dredging an almost impossibility under ordinary conditions. So in January when the ground was frozen solid we hired a steam shovel on which was attached a clam shell. With this we excavated a hole 200 feet long by 80 feet wide and 5 feet deep, and of an irregular shape. This pit quickly filled with water, for it was below the level of a large lake nearby, yet we had nothing but a mudhole which was anything but ornamental.

To overcome this we purchased enough second hand cypress lumber to lay a double floor on the ice which formed on the lake after it was filled with water, laying one floor lengthwise, and the other crosswise and nailing the two together. Around the edge we placed boards five feet long nailing one end to the platform and letting the other end stick up over the banks. Then we covered the platform with about 18 inches of gravel. When the ice thawed in the spring it all sank, making a nice gravel bottom for our lake.

After we had finished the grading around the lake and the ground had dried out during the summer so we could get in with trucks we hauled gravel and dumped it over the boards around the edges thus making a gravel bank all around the lake. We did not seed within 5 feet of the lake, leaving a gravel walk all around which makes a very pleasing appearance. The dirt from the lake helped out in filling and top-dressing our fair-

(*Continued on page* 33)

Should a Greenkeeper Play Golf?

Greenkeepers Are All of One Voice

I THINK it is important that a greenkeeper should play golf. It is the best way for him to find out the condition of his course in the way the regular members have of finding out. I think, too, that he should make his round early in the morning, and then play with the pro, or a member of the Green committee so if he wants to bring up anything pertaining to improvements to the course he can do so right on the spot. If some dub golfer says Number seven is awfully rough today you can come right back at him and say that you made a birdie there yourself, and can't see anything wrong with it. All greenkeepers should play golf. Why not have an Ohio greenkeepers' tournament?

LAWRENCE HUBER,
Elks Country Club,
Worthington, Ohio.

FIRST it enables the greenkeeper to become better acquainted with the playing condition of his course, and to see the course from the players' point of view.

Second, it enables him to become better acquainted with the club members.

Third, an occasional round of golf will renew his interest in his work.

CHESTER MENDENHALL,
Municipal Golf Course,
Wichita, Kansas.

POSITIVELY, and especially so if your "sweet sugar" plays golf, for then it will give you a line of chatter that's interesting to her and again you will acquire a line of talk that the average business man can understand. You will also become a master of subtraction, not to mention acquire the ability to pick out the truthful, plus the privilege of wearing knickers and looking like a colt even if you are over seventy.

A. E. LUNDSTROM,
Saint Charles Golf Club,
Saint Charles, Illinois.

IF a greenkeeper is just walking over the course looking for trouble he will not see half that he would if he is playing and his ball gets in places which should not be there. And again these places will be fresh on his mind and he will get busy and fill them up. That has been my experience and I say yes, with all of the boys that play golf.

B. G. SHELDIN,
Country Club,
Bratenahl, Ohio.

IF you have time to play golf play, by all means. Greenkeepers have not much time to play. Experienced greenkeepers can tell a good green or fairway by looking at it, they do not have to play it. I know greenkeepers who are good golf players, and not good greenkeepers.

JOHN PRESSLER,
Allegheny Country Club,
Sewickley, Penna.

IF a greenkeeper played golf he would take more interest in his work and know why certain holes are laid out for a "hook" shot, etc. Why traps are placed at certain places and the importance of keeping them in first class condition, also he might get into a foot print and know what it would cost him and could realize what it would mean in tournament play.

Playing around the course gives him a better insight of the work and discovers the faulty work of his men, if any should be on his payroll. In fact I think the only way for any greens superintendent is to make a general inspection of his course and he should play at least twice a week.

SAM LYLE,
North Hills Country Club,
Normandy, Missouri.

THE playing greenkeeper can see the course from the member's point of view, consequently he can grasp the necessity of alterations, and anticipate quite a lot of work that the non-player cannot see.

HUGH LUKE,
Garden City Golf Club,
Garden City, L. I., New York.

I DON'T play much golf myself. Don't have time. However, I play enough to know if a course is trapped properly, rough and other hazards as they should be. Rules, yardage, etc., these things a greenkeeper should know, especially if one has construction work on hand.

C. R. FRAZEE,
Hyperion Field & Motor Club,
Grimes, Iowa.

FROM the first tee to the eighteenth green is the most direct way to cover your course thoroughly. Eighteen holes of play will let you know the condition of your

(*Continued on page* 30)

The A B C of Turf Culture

Functions of Plant Elements and Characteristics of Various Groups of Fertilizer Materials

By O. J. NOER

THE rational use of fertilizers must be based upon a knowledge of the functions of the plant food elements—nitrogen, phosphoric acid and potash, and the effect of these on clover and weeds must be considered also. These secondary effects, due either to the plant food elements themselves or some other non-essential constituent of the raw fertilizer material deserves particular attention. Their injudicious use may require careful management and considerable time to overcome the bad effects produced.

Functions of Specific Plant Food Elements

Nitrogen is the most important plant food element in turf maintenance, and is most largely used by turf grasses. It is responsible for dark green color and active vegetative growth. Deficiencies of nitrogen are easily recognized. If the turf is thin, light green in color and not growing actively, the need for additional nitrogen is unmistakable, provided other conditions such as good drainage, proper physical soil conditions, favorable climate and sufficient moisture exist. Abundant clover on fairways points to a *limited nitrogen supply*. Clover is a legume and by virtue of the nitrogen fixing bacteria contained in the nodules or sacs present on the roots can utilize atmospheric nitrogen. Turf grasses cannot draw upon this inexhaustible supply of nitrogen, but must depend upon the soil to satisfy its demand. Consequently the clover satisfies its nitrogen needs, becomes more aggressive, and may predominate in the turf.

The large amounts of nitrogen removed from greens in clippings is rarely appreciated. Analyses made last year showed the nitrogen content of dry clippings vary from 1½ to 3 per cent. The higher nitrogen content was from turf fertilized with quick acting nitrogenous fertilizers, yet the average green receives more nitrogen than was applied to this turf. Three hundred pounds of clippings removed from a green contain about one hundred pounds of dry matter. If the nitrogen content is only two per cent, two pounds of nitrogen are removed. Since nitrogen constitutes one-fifth the weight of sulphate of ammonium this is equivalent to ten pounds sulphate of ammonium. If the nitrogen content is three per cent, three pounds of nitrogen, equivalent to fifteen pounds sulphate of ammonia are removed. These amounts are exclusive of any losses due to leaching in the drainage water. Is it any wonder that greens require constant applications of nitrogenous fertilizers?

O. J. Noer

Editor's Note: For the past four years Mr. Noer has investigated the value of various fertilizers in relation to golf turf at the Soils Department, University of Wisconsin, under a fellowship established by the City of Milwaukee.

Turf grasses require only limited amounts of phosphoric acid. It is an essential constituent of the living protein or protoplasm of the plant cell. Root development is stimulated by the presence of abundant phosphoric acid, so it is essential to provide this plant food element on new seedings to insure rapid root development and obtain a uniform stand of turf. Unlike nitrogen, the need for phosphoric acid is not easily recognized, but in established turf it is rarely necessary to provide very much phosphoric acid in fertilizers. On greens apparently the top-dressing mixture contains sufficient phosphoric acid to satisfy the demands of the turf.

In the presence of abundant phosphoric acid, particularly if the source is bone meal or acid phosphate, the growth of clover may be greatly encouraged. The extensive use of fertilizers high in phosphoric acid are unnecessary on established turf and may defeat any program designed to rid the turf of clover.

Potash is essential to the formation of a class of substances called carbohydrates. There are three groups as regular constituents of plants namely, starch, sugar and cellulose. Sugars are built in the green leaves under the influence of active rays of the sun from simple substances. The sugars are one of the raw materials from which other complex organic compounds are built in the plant. Cellulose is the material which makes up the cell walls and hence gives form to the plant. The wood of trees and shrubs is almost entirely cellulose.

Clovers require abundant potash. Hence repeated applications of potash may result in increasing the amount of clover in turf. Most soils are supplied with sufficient potash to maintain normal growth of turf grasses, and it is doubtful if benefits from its use will be obtained except possibly on light sandy soils, peats and mucks. Because of the danger of encouraging

clover, potash fertilizers should be used sparingly and only when soil conditions indicate its possible need.

Sources of Plant Food

There are a variety of plant food materials which can be used as fertilizers. Some contain only one plant food element, while others may supply two or more. Their value and efficiency depend upon the amount, kind and availability of the plant food they contain. The choice is also affected by local soil conditions. On sandy soils some materials are rapidly lost in the drainage waters, others are slower acting and provide for longer feeding.

When mixed fertilizers are purchased the plant food constituents of necessity cost more than where the various raw materials are procured. The manufacturer must be reimbursed, for the cost of mixing. The value of mixed fertilizers depends primarily upon the percentage of plant food content. These are expressed in figures which represent the percentage composition of nitrogen, phosphoric acid and potash, and are expressed in that order. Thus a 6-3-2 contains six per cent nitrogen, three per cent phosphoric acid and two per cent potash. Nitrogen is usually reported both as nitrogen and its equivalent in terms of ammonia. Thus sulphate of ammonia contains approximately twenty per cent nitrogen or twenty-five per cent ammonia. These can be converted into one another by using the factors .82 or 1.215. To convert nitrogen into ammonia multiply the percentage of nitrogen by 1.215 and if expressed as ammonia multiply by .82 to obtain the percentage of nitrogen.

Ordinarily best results on established turf will be obtained by selecting mixtures of higher nitrogen content and lower phosphoric acid and potash content such as 6-3-2, 12-6-4 etc. On new fairway seeding a larger proportion of phosphoric acid usually produces better results.

There are three different classes of nitrogen containing materials depending upon the kind of nitrogen they contain, namely, organic, ammonia and nitrate nitrogen. Eventually any form of nitrogen is converted to nitrate nitrogen when applied to the soil. The mechanism of this process was explained in a previous article.

Nitrogen is the only one of the three plant food elements subject to loss. Any nitrogen existing as nitrates in the soil or converted to this form by soil processes dissolves in the soil water and is not retained by any soil constituent. Consequently it is lost in the drainage water unless taken up by the plant. Nitrogen is the most expensive plant food element so the danger of loss must be constantly considered, especially since it is the most critical element in turf culture.

The general characteristic of the different classes of nitrogenous materials deserves special consideration.

Organic Nitrogen

Materials containing organic nitrogen are derived from animal or plant residues. Some of the common materials are the various manures either fresh or dried, bone meal, cottonseed meal, soy bean meal, dried blood, tankage, fish scrap, Milorganite, etc. They vary in their nitrogen content and in the rate at which the nitrogen becomes available to the plant.

Most of the nitrogen contained in these materials is not soluble in water, and all of it must be converted into other forms before the plant can use it. When added to the soil the bacteria decompose the organic matter and liberate nitrogen in the form of ammonia. This is subsequently converted to nitrate nitrogen by a specific group of soil bacteria. The rate at which decay takes place determines how rapid results will be obtained from their use.

The advantage of organic fertilizers accrue from the fact that decay takes place over a considerable period and thus a uniform and continuous supply of available nitrogen is assured. Such a supply is essential if uniform and continuous growth of turf is to be obtained.

There is less danger of burning or injuring turf with organic forms of nitrogen than any other. The different materials differ in this respect. If decay takes place rapidly the danger increases. Dried blood in particular is apt to burn because decay is very rapid.

The effect of organic materials on soil reaction depends upon the individual material, particularly the amount of lime or other basic material which they contain. Thus bone meal due to the large amount of lime it contains decreases the acidity of the soil. Analyses of manure show that it contains about four per cent lime, so a ton contains about eighty pounds which is equivalent to about one hundred fifty pounds lime carbonate, (ground lime stone). Dried blood on the other hand contains very little lime and since the nitrogen is converted to nitric acid its use will eventually increase acidity.

Ammonia Nitrogen

The two principal sources of ammonia nitrogen are ammonium sulphate and ammo-phos. The nitrogen in both these materials exists as ammonia. Both are water soluble and quick acting. They must be used with caution on turf because of the danger of burning or scorching the grass.

When applied to the soil the ammonia is taken up and held by the clay particles. This tends to hold the nitrogen temporarily in the shallow surface layer where maximum root development occurs and may explain why ammonium sulphate sometimes serves as a more effective source of nitrogen than nitrate of soda even when applied to give equal amounts of nitrogen. The nitrate nitrogen is not held and may move down into the lower soil layer below the root zone.

Even though ammonia nitrogen is applied to the soil it is converted into nitrate nitrogen by soil bacteria, just

(*Continued on page 29*)

Clippings and Burlap Bags

By ALEX MCWHINNIE, Greenkeeper
Brown's Lake Golf Club, Burlington, Wisconsin

"WELL, we have to dump the clippings somewhere when we mow the greens." This was the reply of a workman when he was asked what the bare spots a yard or so in diameter were, beside each green.

Clippings from putting greens, if dumped from day to day on the same place will surely leave a bare spot, that gets larger and more unsightly as the season advances. Visitors who come to play your greens, and friends of club members who are invited out to see them, will walk over them, get down and feel them with their hands, tell you they are just like rugs, remark on the absence of weeds, and are astonished at the beauty of them. A clean, well kept putting green, surely is a thing of beauty. Why have the bare patch or the pile of clippings near it?

I have eighteen creeping bent greens that are cut and watered daily by six men who take the same three greens each. Each man when he leaves the implement shed in the morning takes with him three burlap bags (fertilizer bags) ripped up the seam. He spreads a bag beside each green and dumps his clippings on it. As soon as the greens are cut the tractor is taken around. The man takes the four corners of each bag, picks up bag and clippings and throws them on the dump body. You can imagine how quickly and easily they are removed.

Making Use of Clippings on Poor Fairways

Just now our fairways are what is familiarly called "burned up." We have only had one good rainfall in five weeks. On the hilly places and mounds the gravel is pretty close to the surface. Every day the clippings from the greens are taken, mixed with top soil, and the hilly places and mounds top-dressed with the mixture.

Our number 16 fairway (a par 4) almost all adjoins a swamp and was very poor. Thin and mossy. Daily for three weeks we top-dressed part of it with the clippings and top soil. This fairway in a month's time has improved wonderfully, and is getting better daily. I find that by using the burlap bags, the time taken to remove the clippings, mix them with soil, and top-dress with them is very little more than picking them up with a shovel or fork, and dumping them in a heap somewhere. The bare patches and clipping piles at each green have disappeared, and the improvement resulting from top dressing is very gratifying. In fact

(*Continued on page* 33)

Upper left number 3, where sixty trees were removed to give light and air; upper right, shows sand trap on top of dump pit; lower left, fairway showing dark area covered with one day's clippings and top dressing; lower right shows bank filled in with concrete blocks and scrap iron, one half terraced and sod laid. Oval, Alex McWhinnie, greenkeeper, Brown's Lake Golf Club, Burlington, Wisconsin

John McNamara

Brown-Patch In Western Pennsylvania

By JOHN McNAMARA, First Vice President
National Association of Greenkeepers of America
Pittsburgh Field Club
Pittsburgh, Pa.

BROWN-PATCH has been so much discussed in the past few months, that I think a few more lines on this subject may not be out of order.

From my observations, this disease makes its appearance in the Pittsburgh district any time from the first week in June until the first week in September, according to weather conditions. In 1925 we had our bad spell of brown-patch about the 8th of July, and in 1926 the month of July and the early part of August was cool and clear. We were all elated, thinking that we had escaped this evil for at least that season, but lo and behold, on August 17th the weather changed and the Pittsburgh district experienced the worst attack of brown-patch in its history. I do not think it missed any golf courses in Western Pennsylvania. This year things went along very well until August 1st and after two or three days and nights of rain, we had another pretty bad spell.

Chemical Control and Weather Conditions

Most of our greenkeepers have been using chemicals of some sort to try and head it off. At a meeting held in Pittsburgh last winter, an officer of a golf club made the assertion that there was absolutely no excuse for brown-patch now as there are so many preventives on the market. I often wonder if we are not wasting a lot of time and money by using these so-called preventives as when we have a rainy spell of several days or nights with the humidity pretty high, I have not found a chemical which can stop this disease until the weather changes. I do not believe in any chemicals where they recommend washing in with water after they are applied, as in my opinion, by doing this you wash the chemical into the ground, and it is not the roots the fungus attacks, but the grass blades. By applying chemicals to the blades of the grass the best results are obtained. If after an application, a heavy rain should come, I figure that the work was done without any results. The mixture I use is composed of one pound to fifty gallons of water to every 1,000 square feet. This in itself never burns the grass. In order to keep the application on the grass, we do not use grass catchers until after a rain or the green has been watered.

The Expense of Fighting Fungus Diseases

Some of the chemical dealers recommend an application about every two weeks. It has been my experience that in "fungus weather" even once a week will not prevent it. I have known of cases where chemicals used on an eighteen hole golf course cost from ten to fifteen hundred dollars for the season. I have begun to wonder if the average eighteen-hole golf course really wishes to spend this large sum of money for just the looks of the greens. Brown-patch does not hinder the putting surface to any great extent and in due course the grass will resume its natural color, whether the chemicals are used or not.

Algae Worse Than Brown-Patch

Another fungus which attacks the grass at this time of the year is a bit different and much worse than brown-patch when it appears, as it kills the roots as well as the leaves of the grass. You will notice sometime in looking a green over carefully, the grass getting thin in several places, during damp weather. If you examine it you find there a black wet or damp scum killing or eating away the crowns of the grass. A bad attack of this fungus and the greens do not come back. Whenever I find that a green is in that condition, the best results are obtained by using a perforator over the parts affected. This breaks the solid scum and we then cover these parts with fine sand thereby letting the air in to the roots or crowns and the grass starts to improve.

Snow-mold Only Temporary Disease

Still another variety of fungus is snow-mold which appears on some greens in winter with the snow. This has never done much harm in this section. It shows up for a while when the snow is melting off the greens in the early spring. This fungus thins the grass in patches but soon covers up with the advance of spring.

Scientists employed by the government and also by manufacturers of chemicals are doing an earnest and invaluable service for greenkeepers in their research work. However, the "perfect cure" for brown-patch and other fungus diseases has not, in my opinion, yet been evolved.

Florida Greenkeeping

By LYMAN CARRIER

Lyman Carrier

Editor's Note:—Mr. Carrier was for many years connected with the U. S. Department of Agriculture, as agronomist in pasture and forage crop investigations. His work with the U. S. G. A. Green Section established the value of vegetative creeping bent for putting greens.

MOST Florida golf courses appear neglected in summer. Golf there has in the past been considered a winter pastime. The courses have been built largely to meet the demand of the northern tourists who sojourn there for a few winter months. When the tourist season is over in the spring maintenance operations are cut to a minimum or cease altogether. The finer grasses languish and die out. Crab grass, Bermuda and a few weeds make a struggle for existence. In the fall there are hurried preparations to put the course again in condition for play. The greens are cut and raked and reseeded to redtop, rye grass or something similar. Greenkeeping under such conditions lacks something which the northern greenkeeper enjoys—there is not the satisfaction of creating a permanently beautiful scene.

There are lots of people who live in Florida the whole year and the play on some of the public golf courses where an attempt has been made to keep up playable conditions prove that the game is as popular there in summer as it is in the North. Some greenkeepers in Florida, however, seem to have the idea that the period of summer neglect is a necessary feature of golf course maintenance.

Black Muck for Top Dressing

Ray Tower of the Forest Hills Golf Course, an excellent course located near Tampa, does not subscribe to this theory. When I visited his layout late in June he had the best summer turf on his putting greens I ever saw in Florida. He was giving them the same care as is customary to give greens during the season of heaviest play. The Forest Hills Course was designed and built under the direction of J. Franklin Meehan, the well known golf architect and landscape artist of Philadelphia. Construction was started in January, 1926 and the course was ready for play the following October. The soil at Forest Hills is sand the same as is the case on nearly all of the Florida courses. During the construction the putting greens were given a covering of five inches of black muck from the bed of an old pond. Mr. Tower considers this top soil of muck over the sand as highly important in the matter of production of all-the-year-round turf in Florida. It keeps the loose sand from shifting, holds moisture, and as it is composed mostly of organic matter it furnishes more plant food to the grass than will the natural soil of the region.

Planting Bermuda by New Method

The greens were planted with Bermuda grass by the vegetative method. It is customary in the South to plant the Bermuda stolons in shallow trenches. It has been

Number 1 green at the Forest Hills Club, Tampa, Florida

done that way for years and many think it is the only way it can be done successfully. Tower had had experience with vegetative planting and could see no reason why the stolons could not be cut into short pieces and planted broadcast the same as is done with creeping bent. He finally persuaded those in charge to let him put in a green by his method. The result was a decided saving in labor and the ground was completely covered with turf in a much shorter length of time.

bone meal, and potash, leaving ammonium sulphate and ammonium phosphate as the only common commercial goods that are safe to use.

Bermuda Needs Plenty of Fertilizer

With Bermuda grass this restriction does not apply. There is no danger of promoting the growth of clover in Florida by the use of an alkaline fertilizer and all that Bermuda asks for is a square meal and is not overly particular about what it is fed. A good fertilizer for

A view of Number 18 at Forest Hills

Ray Tower is a firm believer in the liberal use of fertilizers under Florida conditions and it is difficult to see how good turf can be produced otherwise on thin sandy land. The Florida greenkeepers have much more freedom in the choice of fertilizing materials than have those in the North.

In the North where the bent grasses predominate for putting green purposes it has been proved to be advisable to keep the soil in an acid condition. To do this only such fertilizers should be used as do not leave an alkaline residue in the soil. This necessitates cutting out such common materials as nitrate of soda, acid phosphate, turf should carry a high percentage of nitrogen, about half as much phosphoric acid as nitrogen and a small amount of potash.

Experiments with Poa bulbosa, the new winter bluegrass for the Southland, at Forest Hills gave very promising results. Although not planted until January it made sufficient growth so it was cut three times before it died down with the beginning of summer. If this is a sample of what is to be expected from this interesting little grass it may be suitable for use on the Bermuda greens instead of the redtop or rye grass to give the green turf during the winter.