Avoid Trouble With Greens by Studying Fertilizer Needs*

By O. J. NOER

What kills clover is a frequent query. The question is asked by small courses in small communities rather than in metropolitan centers. Clover can be killed with ammonium sulfate, ferrous sulfate, sodium arsenite, and other chemicals. I always feel that chemical control is not the sole answer. The man who asks the question should not worry so much about getting some chemical panacea because clover control goes deeper than just finding a method to kill it. Sound maintenance practices are far better than a quick palliative.

The greens on a course in Mexico City were changed from Bermuda to bent and ended up with clover and weeds. When surfaces became unplayable they were re-sodded with bent turf from a turf nursery. That satisfied the members for several years or until clover and weeds predominated again. The club was doing three bad things. Greens were being starved because they were afraid to use fertilizer. They thought the peons would kill all the grass. Top-dressing was used very much as before on the Bermuda greens. It was not uncommon to apply three or four yards of top-dressing on a green that did not average over 4,000 square feet. The heavy top-dressing smothered the grass during the warmer seasons of the year. After the turf got thin the greens were overwatered continually in order to make them hold the ball. Instead of rebuilding, the club was induced to adopt a sensible maintenance program including the right kind of watering, the right top-dressing methods. Weeds and clover have disappeared and the greens are now satisfactory for play. It was not necessary to plow because basically the soil was all right, the surface drainage was satisfactory, and underdrainage was adequate.

Last week I saw some Bermuda grass in south Florida of one of the newer, finer strains of Bermuda. The grass on some of them was not as satisfactory as it should be. It was stubby and coarse, and a few seed heads were in evidence. I ventured the opinion that the nitrogen level was too low and that they might be overdosing phosphate and potash. They certainly were underfeeding with respect to nitrogen. It was the normal and natural thing for them to do in that area because they are always confronted with the possibility of a warm spell, which reactivates the Bermuda grass. When this happens the common, ordinary strains of Bermuda become very stemmy and the greens become bumpy as a result. As a consequence, it has been the practice in the past to withhold nitrogen to the point where it will keep the ryegrass growing and not unduly stimulate the Bermuda. On these newer greens of dense, fine-textured Bermuda grass feeding methods must be revised to produce greens which will be satisfactory for play.

Day before yesterday these views were vindicated at a golf course in Palm Beach. The Superintendent had a turf nursery of Gene Tift Bermuda which is a fine-textured strain. He was testing fertilizer rates and practices on that strain. I noticed that a certain strip showed no evidence of stemminess or throwing seed heads. I asked him what the difference was in the fertilizer practice on the different strips. Where the Bermuda was best for play, the grass was getting three times more nitrogen than on the plots where the grass tended to be stemmy.

Feeding Practices

I know that fertilizer practices have a bearing on the performance of the grass in many ways. This is true not only of southern grasses but also of bent grass in the North. For one thing, feeding practices affect the frequency and amount of disease. I believe it is well established now that dollar spot is accentuated by too low levels of nitrogen, just as well as by too much. The low levels are even worse than a bit too much nitrogen with respect to this disease. We see many instances of this fact. Dave Bell in Pittsburgh seldom has dollar spot. He may have some brown patch in the summer. It is not uncommon for him to use 200 and 300 pounds of fertilizer per green in the summertime. You will concede that is no small amount of fertilizer.

So far as brown patch is concerned, high levels of nitrogen, particularly if it tends to make the leaves soft and lush, accentuate this disease. So in many districts, especially in the belt from Philadelphia across to Kansas City, nitrogen levels must be high enough in the spring and fall to minimize dollar spot. Then they should be reduced for summer be-

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cause that is when brown patch is bad in this region. In a place like Milwaukee one need not worry too much about brown patch during the summer. It occurs, but repeated attacks are rare. The problem is one of keeping the nitrogen level at a point where dollar spot is not serious or troublesome.

Feeding practices affect the behavior and action of the grass. Mention was made of the effect of nitrogen on finer strain Bermuda in the South. The same thing is true in the North, especially with vegetatively planted types of bent. The relationship was striking on fertilizer plots at Brynwood. They were located on the practice green of Washington bent, which had been neglected. Verhaalen considered severe brushing on this green because the grass was so stubbly. After looking at the test strips he changed his mind. The effect of 1½ pounds actual nitrogen per 1,000 square feet was especially striking. The grass in the checks on each side was stringy and bad, but where the nitrogen level was adequate for that grass, it was leafy and there was no evidence of excessive stringiness from the standpoint of play. He used fertilizer on the green and forgot about brushing. It solved the problem.

Last June the turf on the fairways at Milwaukee Country Club started to become stringy and stemmy. The fairways are mostly creeping bent. After hearing about the experience on the practice greens at Brynwood, they applied 20 tons of fertilizer to the fairways, despite the fact that the turf had been fertilized generously the fall before. It certainly made a tremendous difference, so far as the character of the turf was concerned. The stemminess disappeared within several weeks. Whether bent is desirable or not is an academic question there. The members are satisfied and think they have the best golf course in the United States. That is the answer if you are the superintendent.

Density of Turf Affected

Density of turf is affected to some extent by fertilizer practices. Years ago Emil Picha, who is a very good greenkeeper in my opinion, told me that whenever the grass becomes too dense and heavy, he thins it out with ammonium sulfate. We have tried his prescription on a couple of greens in Milwaukee and got the same result. The one where ammonium sulfate has been the only source of nitrogen has thinner turf than the others.

In any sensible fertilizer program for greens, the fact that clippings are removed must be taken into account. In that respect the greenkeeper is like the farmer. He depletes the land by selling crops. Removal of clippings from greens accentuates the plant food losses, particularly with respect to phosphorous and potash. This does not occur on fairways. As the clippings undergo decay, the phosphorous and the potash are converted back into compounds which the soil will take up and release for the grass to utilize. Nitrogen is the principal loss there.

Analyze Clippings

For several years the clippings from two greens at Brynwood were weighed and recorded. Once a week a five-pound green weight sample of grass was collected from each green. The samples were taken to our laboratory, dried, and analyzed for nitrogen, phosphorous, potash, and some of the other elements. For all practical purposes the amount of clippings taken from the green of Washington strain bent was 100 pounds of dry grass per 1,000 square feet per season. Mowing starts in May and ends in late September or early October. These greens received approximately 1¼ pounds of nitrogen per 1,000 square feet per month. The amount of nitrogen reflects itself in the clippings more than any other element, both with respect to the amount of clippings taken and the content of nitrogen in the grass. If your growing season is seven or eight months instead of a little over five or six, then the amount of clippings taken off will be greater and the drain in plant food will be more.

The dry weight of clippings from the above greens contained almost 5 per cent of nitrogen, 1.75 per cent of P_2O_5 and the potash was about 3.75 per cent. In other words, each season Les Verhaalen takes off the equivalent of a 100-pound bag of fertilizer from each 1,000 square feet, and it would be a 5-2-4 in analysis. The big draft is on the nitrogen and potash.

During the past winter we checked some of the soil samples sent in from greens for testing. In ordinary practice when the amount of phosphorous by the Truog method is more than 800 pounds, a plus sign is used because figures beyond 300 pounds are meaningless. The method is not designed for amounts greater than 800 pounds. Most of the samples checked contained 2,000 to 3,000 pounds or more phosphorous per acre. In other words, many golf greens are becoming low grade phosphate mines. When the course is subdivided, the greens could be sold as sources of phosphate fertilizer. This suggestion is made to emphasize a point. Grass must be provided with enough phosphorous so it can make normal growth, and in doing so one must take into account the fact that some of the phosphorous may become fixed by the

soil in forms which the grass cannot utilize. Personally, I believe we overemphasize fixation so far as greens are concerned, especially when the greens contain a normal amount of organic matter. As the organic matter undergoes decay, it produces compounds which tend to activate and dissolve phosphorous even from difficultly soluble compounds such as iron and aluminum.

The Massachusetts Station demonstrated this fact very strikingly. They grew grass and other crops in jars with iron phosphate as the sole source of phosphorous. Where a little citric acid was added in the water, the plants made a normal growth. Where it was not used, the plants could not utilize the phosphorous from the iron phosphate. It is my conviction that some of the iron chlorosis, which is becoming more and more common, is being aggravated by the excessive use of phosphorous.

Reserve Phosphate in Greens

Authorities in the fertilizer industry believe superphosphate may become a critical material before the present emergency is over. Not because of a phosphate shortage, but due to the fact that sulfur is in short supply. Many greens contain enough reserve phosphate so grass will not suffer for several years. A couple of greens at Brynwood have not received phosphate for two years without any visible difference in the behavior of the grass. This is not an attempt to stop the use of phosphate. It is intended to emphasize the importance of an intelligent program. See that the grass gets what it needs with respect to phosphate and then stop worrying.

The basis of any fertilizer program is first to provide enough phosphate and potash, and then the problem is simply one of nitrogen.

We scare you by emphasizing that clover is increased by phosphate and potash. By way of emphasis, you are told that the pasture man who prizes clover uses plenty of lime, plenty of phosphate, and plenty of potash. That is true, but he does not apply nitrogen extensively because the legumes can use nitrogen from the air. They are independent of the soil supply. Give them the right kind of conditions to grow, namely, plenty of lime, plenty of phosphorous, plenty of potash and they will produce plenty of good protein feed. Grass must have phosphoric acid and potash, and lime is beneficial on acid soil. One need not worry too much even though phosphate and potash rates border on the luxury level, provided the nitrogen level is kept where it should be. In areas like Milwaukee with good conditions for growth during the summer, where more of the grasses are of the aggressive growing type of bent, such as Washington, Toronto, and so forth, it is not uncommon to use from 1¼ to 1½ pounds, and sometimes even more of actual nitrogen per 1,000 square

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USGA COMPETITIONS FOR 1952

Curtis Cup Match — to be played in British Isles; place and dates not fixed. Women's Amateur teams, British Isles vs. United States

(Dates entries close mean last dates for applications to **reach USGA office,** *except in the case of the Amateur Public Links Championship. For possible exceptions in dates of Sectional Qualifying Rounds, see entry forms.)*

Championship	Entries Close	Sectional Qualifying Rounds	Championship Dates	Venue
Open	May 19	June 2	June 12-13-14	Northwood Club, Dallas, Texas
Amateur Public Links	(X) May 29	(XX) June 15-21	Team: July 5 Indiv.: July 7-12	(not determined)
Junior Amateur	June 30	July 15	July 23-26	Yale G. C. New Haven, Conn.
Amateur	July 21	Aug. 5	Aug. 18-23	Seattle G. C. Seattle, Wash.
Girls' Junior	Aug. 4	None	Aug. 18-22	Monterey Peninsula C.C. Pebble Beach, Cal.
Women's Amateur	Aug. 7	None	Aug. 25-30	Waverly C.C. Portland, Ore.

(X) Entries close with Sectional Qualifying Chairmen.
(XX) Exact date in each section to be fixed by Sectional Chairmen.

young turf takes greater upkeep. A certain amount of costly experimentation may also be necessary to ascertain the correct number of men required, the hours for turning off the lights, the kind of evening (wet or very cold) when it is advisable not to turn on the lights at all, and the most effective means of publicity. As the first season advances it will undoubtedly be found that the course can be operated more and more efficiently.

Besides paying for itself, a short course is a useful adjunct to better eating places located on the outskirts of cities, and to driving ranges and resort hotels. Golf clubs and public courses might also consider installations of this type to attract night play and to secure additional revenue.

AVOID TROUBLE WITH GREENS

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feet, per month. Clover is not a problem in these greens even though the reaction is nearly pH 7.5.

Both phosphate and potash become fixed in the soil. Potash is taken up by the clay and the organic colloidal material. The phosphate is fixed as calcium phosphate if the soil is not too acid, otherwise probably in part as iron or aluminum phosphate. They are far less subject to leaching than the nitrogen. We talk a lot about leaching of potash. Personally, I do not think it a big factor, provided there is at least 15 per cent of colloidal material in the soil derived from silt, clay or organic matter. Because the soil colloids pick up and later release plant food elements, it would be unwise to grow grass in pure sand. However, there should be enough sand present to insure a well ventilated soil.

Some phosphoric acid and potash can be supplied each month or it can be applied in two applications once in the spring and once in the fall. All but two of the greens at Brynwood in Milwaukee receive 5 pounds of 20 per cent grade superphosphate and about the same amount of 60 per cent grade muriate of potash per 1,000 square feet at the start of the season and a like amount during September. So far, the grass is behaving normally and seems to be getting enough of both elements. Then nitrogen is supplied as needed during the season.

Soil Testing

A few remarks about soil and plant tissue testing: Soil testing has been in vogue for quite a few years. Many states have laboratories which are equipped to do testing for farmers. They test thousands of samples every year, advise the farmers and, I am sure, the farmer is benefited as a result. Soil testing never will reach the point where you can be told to put on 152 pounds of 20 per cent grade superphosphate and that the yield of wheat will be 28.5 bushels per acre. Soil tests provide an inventory of the plant food content of the soil. If properly done, they furnish valuable information so far as phosphorous

and potash are concerned, and about soil reaction. In other words, the best way to find out if lime is needed is to make a soil test. However, there are times when the soil may be above that figure and yet the grass responds to lime. The response will not be marked. It is quite safe to say that lime is needed whenever the soil is below pH 6.0 in reaction. Benefits will be obtained eventually even though the effects are not immediately noticeable. It is important to determine available calcium and magnesium. If calcium is extremely low, more lime is needed on an acid soil than when it is high. If the magnesium is very low, it is important to apply a dolomitic type limestone — one that contains 20 per cent or more of magnesium reported as the oxide. This information is usually printed on the bag and if not, can be obtained from the producer of the lime. By using a dolomite, any possibility of magnesium deficiencies as a plant food element are eliminated.

The soil test for phosphate, potash, calcium, and magnesium are no better than the samples submitted for testing. If they are improperly collected, the results are meaningless.

Nitrogen determinations on soil samples are meaningless for grass. When grass is in good growth it takes up the soil nitrates as fast as they are produced. A test would indicate an acute deficiency when none exists. Soil samples collected in spring or fall when grass is dormant will often show plenty of nitrogen after they are brought into a warm place. The combination of moisture and warm temperatures enable the soil organisms to produce nitrates. They accumulate because there is no grass or other living plants to utilize them. The test may show very high nitrates and be misleading.

Samples of Uniform Depth

In our soil testing we never got consistent results until we took samples to a uniform depth. Most state laboratories suggest taking the sample to the plow layer depth. The suggestion is perfectly right for farm crops. The agriculturist works the soil frequently. Therefore, the area from the top to the bottom of the plow layer is apt to be reasonably uniform with respect to plant food content. That is not true of grassland areas. The plant food content is seldom uniform with depth. So it is important to take samples to a uniform depth and never change. For example, we would suggest the use of phosphate because of a low soil test. Yet a new sample taken the next year would show less phosphorous than the year before. The first sample was a shallow one, and the second was taken to a depth of 6 to 8 inches. The

applied phosphate was fixed in the top inch. The extremely low phosphorous content in the lower layers obscured the larger amount in the top inch and made it impossible to spot the difference. That is why we insist that samples be taken to a uniform depth of 2 inches.

Then we collected samples from an area where superphosphate had been used at 1,000 pounds to the acre and from the adjoining unfertilized area. Separate samples were taken for each inch to a depth of 4 inches. The top inch on the unfertilized area contained 20 pounds of available phosphorous per acre. The range was 10 to 15 pounds in the other three. The average was about 15 pounds. Where superphosphate was applied, the top inch had 120 pounds of phosphorous per acre, the second inch contained 20 pounds, and the third and fourth were 10 to 15 pounds, making the average 40 pounds per acre, which is about half of what it should be. The average for the top 2 inches is 70 pounds, so by sampling to a 2-inch depth it is possible to tell something about past fertilizer practices.

In collecting soil samples we prefer a small sampler made from a discarded steel golft shaft. A mark is made 2 inches from the bottom. A little candy bag is used as a container for the sample and a pencil with a soft lead is used to write the name of the golf course and the number of the green, fairway, etc. on the outside. Each sample is a composite of 8 to 10 plugs. It provides enough soil to make all the tests and insures that the sample is representative. Too much soil only makes extra work for the man in the laboratory who prepares the sample for testing. Fairways samples should be taken to an exact depth of 2 inches also, and each sample should be a composite of 8 to 10 plugs at least.

Tissue testing is gaining favor. At the start we were unable to obtain consistent results. The newer tests for nitrogen and potash seem to be more reliable. The kit I have here was used on my last trip to Forida. At Ponte Vedra I tested the grass on the first tee where the grass was obviously in need of nitrogen. On another tee the grass was high in nitrogen, but it looked starved. I asked about the fertilization and was told the last tee had been fertilized two days before. Nitrogen had been taken up by the grass, but it was another several days before the effect on growth was visible.

Those of you who grow grass watch the amount of clippings and when they are

about ½ a basket per green, you know it is time to fertilize. If you are getting 3 or 4 baskets per green, you know the grass is doing pretty well. This is as good a test as any we have, but the tissue test may show a prospective drop in growth several days before it occurs.

In making the test we gather clippings with a knife. They are placed on a piece of filter paper and rolled up like a cigarette. Juice is squeezed into the paper with a pair of pliers. A white powder is used for the nitrogen test. It turns pink if nitrogen is present in the juice. When the grass gets enough nitrogen there is some present in the plant juice as nitrates. The same is true of phosphorous and potash. The tests show their presence or absence. The phosphorous and potash tests should be the most useful because it is impossible to judge need for them by growth behavior of the plant unless the deficiency is acute.

The phosphorous test is made by wetting the paper with ammonium molybdate solution and adding stannous chloride. Phosphorous produces a blue color. The intensity of color is roughly proportional to the amount of phosphorous. In making the potash test a drop of test solution is placed on the paper. Juice from grass clipings is squeezed into the spot. After 30 seconds the spot is drenched with dilute hydrochloric acid. If there is no potash in the tissue, the spot bleaches to a lemon yellow. If potash is present, a brick-red color develops. The red color means that the grass is obtaining ample potash.

TESTS SHOW CHEMICALS

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chemicals on various grasses used on putting greens.

On fallow areas where adjacent plant materials and grass are not factors which have to be considered, the above chemicals which gave from excellent to good control have outstanding possibilities as long term weed control treatments from only one application. In this respect the practical use of some of these materials may be limited by cost.

The control of weeds in sand traps will