AUGUST, 1933
VOLUME VII—No. 8

Single Copies Twenty Cents
Six Months One Dollar
One Year Two Dollars

The NATIONAL GREENKEEPER *and* TURF CULTURE

(Registration of title applied for at U. S. Patent Office)

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Published monthly at 405 Caxton Building, Cleveland, Ohio.

Entered as second-class matter, Aug. 25, 1928, at the post office, Cleveland, Ohio, under act of March 3, 1879

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The Editor's Chair

ONE must think hard in these stormy times about the occupation in which we are engaged. Even so the future looks happy because one is quite willing to gamble in a game where all the cards are on the table. There never has been an era in the last two decades when brains meant so much to the business man. He must almost daily adjust himself to shifting conditions both in his living and his work. While it is a hardship, as one might say, yet it is a stimulant which will effectively take the cobwebs out of people's heads. And many need it.

* * *

WE ARE in a small business, relatively speaking, but the President of the United States has stated publicly that this is the "little fellows' " day in court and that the business administration in Washington will protect his interests no matter how small they may be. So we may wear our badge of honor with as much pride as the heads of the biggest trusts in this country. How the financial gods of industry have toppled from their pedestals will go down in history.

* * *

WHAT the manufacturers and dealers in the turf culture industry need is the courage to step out and advertise their products intelligently and honestly. The buying market is hungrily waiting for the appeal of those who have the products to keep their grounds in order. The owners of these grounds must backlog their investment against a cold and dreary winter.

I HOPE you will all read the articles in this issue by O. J. Noer on fairway fertilization, which applies as well to lawns and all turfed areas, and the one by James A. Smith on bacterial action as it affects plant growth. We are beginning to think under the ground which we should have done years ago but didn't. Both of these men have had a lifetime of experience and you can bet your last nickel on what they say.

* * *

THE national epidemic of dry weather has caused consternation among greenkeepers. Everyone seems to think our climate is changing. Perhaps without our knowing it, this northern hemisphere is sliding around the globe and some morning we may wake up in the Indian Ocean. Great day if Ghandi is there to greet us.

The fact is that when the end of the calendar year comes, the infallible United States government will publish figures showing that the average temperature and precipitation are the same as they have been for fifty years.

* * *

DON'T forget the new Dealer's Mart and those who advertise in it. The man who carries seeds, fertilizers, mowers and other turf maintenance equipment and is ready to sell and service your requirements on a local 'phone call, should be supported one hundred per cent.

Once *every week*

to prevent midsummer turf injury *by* BROWN PATCH

SEMESAN

25 lbs.	$46.25
100 lbs.	180.00
300 lbs.	525.00

NU-GREEN

25 lbs.	$30.00
100 lbs.	115.00
300 lbs.	330.00

August's heat and humidity always increase the danger of brown patch damage. But in most cases, this damage can be entirely prevented by treating greens regularly *every week* with Du Bay Semesan or Nu-Green.

Semesan, recommended where soil is normally fertile, has a remarkable 10-year record for the prevention and control of brown patch. Nu-Green (the only brown patch disinfectant licensed under U. S. Patent No. 1,787,581) has been used successfully for 6 years. Because it also stimulates grass growth, it is advised where soil fertility is lower. Order from your seedsman or golf supply house.

SEMESAN
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DU BAY

NU-GREEN
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FREE: New pamphlet—"Brown Patch Diseases; Their Prevention and Control." Describes principal grass diseases; tells when they occur and how to prevent them with Du Bay Fungicides. From your seedsman or supply house, or write Bayer - Semesan Co., Inc., Dept. 97-A, Du Pont Bldg., Wilmington, Del.

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The NATIONAL GREENKEEPER *and* TURF CULTURE

The only trade journal in the world devoted to the growing of fine turf grasses.

Fertilizer Facts for Fairway Improvement

By O. J. NOER

GOLF clubs cannot afford to neglect fairway turf. Players demand good lies and will not long support clubs which permit turf deterioration. It is also vastly more expensive to rejuvenate thin, weed-infested turf than to maintain good fairways. To meet reduced income, programs should be designed to produce desired results at reasonable cost.

During the past few years advances in fairway management have resulted in greatly improved turf. More general fertilization, sometimes supplemented with irrigation, have displaced the older, less certain methods of re-seeding alone, top-dressing with soil, and the use of bulky, weed-infested animal manures.

O. J. NOER
Whose nation-wide experience on turf maintenance has been keenly observant and whose advice is considered as final by those who know.

Re-seeding alone is an expensive procedure, and securing a satisfactory stand of grass is often a gamble, especially upon the heavier compact soils. Besides the actual seed cost, there is the expense of preparing a suitable seed bed. This necessitates thorough spiking or discing, an operation which can be performed on heavy soils only when soil moisture conditions are favorable. Occasionally seeding is followed by a light top-dressing to effectively cover the seed. When disc seeders are used, the seed is drilled in rows several inches apart. This necessitates cross seeding several times to obtain even reasonable coverage. Unless moisture conditions are favorable, the discs fail to penetrate the compact soil, and if cuppy depressions in the turf are numerous, the discs often ride over the soil areas devoid of grass.

Failure to obtain a desired stand of grass may result from any one of several causes. On loam and heavier soils the small, light seed is often washed from the bare areas into adjacent tufts of heavy grass by downpouring rain. This is likely to occur when soil moisture is low, because dry soils do not absorb water readily and consequently surface run-off is greater.

Poor stands of turf are often the result of soil deficiences in plant food. Under such conditions it is hardly reasonable to expect the struggling young seedling to compete with the existing grass on account of the limited supply of plant food. When seeding is necessary, adequate fertilization should obviously precede seeding. Where the grass is uniform but thin, feeding alone will produce desired turf. Only where the grass is unusually thin, and large bare spots are numerous should re-seeding accompany fertilization.

COMMON PRACTICE TO TOP-DRESS FAIRWAYS

AT ONE time it was common practice to top-dress fairways with soil. The limited benefits make it altogether too expensive practice. Top-dressing must be dismissed as a practical means of appreci-

ably increasing the soil supply of plant food. For this purpose fertilization is more effective and far less expensive. Essentially top-dressing can be justified only to level uneven surfaces or improve the water-holding capacity of sand soils. If uneven surfaces are due to tufted turf growth, topdressing is not the proper corrective treatment.

Systematic feeding will quickly encourage the existing grass to spread and thus obliterate the objectionable cuppy lies. On sand soils, an irrigation system may prove more effective and satisfactory than extensive topdressing. Their low waterholding capacity is not sufficiently increased to enable the grass to withstand even moderate mid-summer drought.

Confronted with the increased difficulty in obtaining adequate supplies of high quality manure, clubs reluctantly turned to supposedly more costly and less effective concentrated materials. The latter rapidly supplanted manure because of the startling results produced. Now they are preferred because of more rapid improvement in turf; they do not introduce objectionable weed and clover seed, nor do they leave any bulky debris following application to interfere with play. It is actually less expensive to use these superior manure substitutes because of the lower cost of applying the smaller quantities required.

ABOUT IRRIGATION SYSTEMS

SOME enthusiasts attempt turf improvement by installing elaborate irrigation systems. An adequate supply of water is advantageous because it eliminates moisture as a growth-retarding factor, but grasses also require essential plant food elements, and unless fertilization accompanies irrigation, disappointing results are inevitable.

In most cases water alone results in material increase in objectionable clover. This can be controlled by proper nitrogen feeding. Where the underlying soil is moderately fertile, clover infestation may not be immediately apparent, but will eventually result from the sole use of water.

The same nutrient requirements for essential plant food elements govern improvement of thin turf as are needed to maintain good fairways. The only difference is in the amount of fertilizer required and frequency of application. More general feeding at more frequent intervals is important when the grass is thin. This encourages it to spread and form desired coverage.

While yearly applications often suffice on dense sod, spring and fall fertilization is advised on poor turf and, where the grass is unusually poor, quicker improvement will result from an early spring application, a lighter application in May, followed by a fall application. The principles underlying fertilizer usage are comparatively simple. The program must be built around nitrogen feeding, for this is the growth-producing element, with phosphoric acid and potash playing minor roles.

NITROGEN IS THE DOMINANT NEED

NITROGEN is the dominant need on established turf to produce green color, encourage existing grass to spread and thus form dense turf. Furthermore, it is the element responsible for clover and weed control.

The generous use of nitrogen is warranted until turf of desired texture is produced, provided poa annua is not too prevalent in the fairways. Excessive use of water-soluble nitrogen fertilizers produces rapid lush growth following their application, but effects soon disappear because the immediately available nitrogen is either taken up and utilized to promote excessive leaf growth, or is leached from the soil. Organics tend to promote a more uniform and continuous growth, because the nitrogen is gradually converted into available forms by soil organisms.

The safest criteria for determining quantity of nitrogen needed are general turf vigor and kind of soil. Heavier rates are justified where turf is sparse with moss, clover, and weeds prevalent. Larger amounts are also needed on light-colored heavy soils and on sands.

DANGER OF BURNING IS ALWAYS PRESENT

THERE is always the danger of burning or injuring turf when soluble fertilizers are used. Heavy rates should be avoided and applications should not be made when the grass is wet or heavily laden with dew. During hot weather burning may occur even though the grass is dry; so if the weather suddenly turns hot, operations should be suspended until temperatures moderate. It is also well to attach a chain or mat device to the spreader so as to brush adhering fertilizer off the grass blades.

If organics are used as the sole source of nitrogen,

initial applications of 1000 to 2000 pounds per acre of a material containing six to eight per cent nitrogent are warranted. Succeeding spring and fall applications can be reduced to 800 to 1000 pounds per acre, and if May fertilization is included, 500 to 700 pounds is ample at that time.

When some water-soluble nitrogen is also desired to promote immediate growth, or as an additional aid in weed suppression, the indicated quantities of organic fertilizer can be reduced several hundred pounds and from 100 to 200 pounds per acre of sulphate of ammonia or ammonium phosphate substituted. Obviously, the ammonium phosphate should be used where tests indicate the need for phosphoric acid in addition to nitrogen.

Spring and fall are the logical seasons for applying nitrogenous fertilizers on established grass, especially if rainfall is the sole source of moisture. These are the seasons of greatest rainfall, and temperatures are more favorable for growth.

FALL FERTILIZING BEST IN SEPTEMBER AND OCTOBER

FALL applications are best made during September and October, and in the spring it is well to apply the fertilizer before active growth begins.

Marked response is rarely obtained on established turf from applications of phosphate fertilizers, probably because the soil supply of available phosphorus is constantly augmented by the decay of clippings. Fixation of added soluble phosphates in the soil very close to the surface may be an added reason.

There is reason to believe that in the north, fescue and bent succeed in soils too low in available phosphorus to support Kentucky blue grass, and in the south Bermuda appears to have a low phosphorus requirement. This means that on soils where phosphoric acid is needed, lower rates suffice for fescue, bent and Bermuda than are required for Kentucky blue grass.

Need for phosphate can be judged by using one of the soil phosphorus test kits now on the market, provided the turf has not been treated with lead arsenate. Samples for these tests are usually taken to a depth of four inches or more, but where phosphates have been used in the past, it is well to make supplementary determinations of surface samples, for applied phosphate is usually fixed in the surface inch of soil.

HOW PHOSPHATES SHOULD BE USED

SOIL texture, kind of grass, and amount of available soil phosphorus should determine rate at which phosphates are used. Less phosphate is needed on sandy soil than on heavy soil, and rates should be somewhat higher for Kentucky blue grass than for fescue and bent. Obviously, higher rates are warranted where the soil supply of available phosphorus is low. Based on these factors the accompanying table can be used as a rough guide for determining the approximate amount of phosphate to apply. The rates are based on 20-per cent grade of superphosphate. If other materials are substituted, they should supply the same amount of phosphoric acid.

Obviously, in each instance the heavier rates should be used where the available soil phosphorus approaches the lower limit, and the lesser rate where the available soil phosphorus approaches the upper limit indicated. Annual applications of phosphate are seldom needed. The rates suggested are sufficient for from two to four years.

Approximate Rates for Applying 20% Super Phosphate, for types of soil and grasses indicated, based on available soil phosphate by the Truog Method

		Pounds per Acre 20% Super Phos.	
Texture of Soil	*Pounds Avail. Phos. per Acre Truog Method*	*Kentucky Blue Grass*	*Fescue and Bent*
Sand and Sandy Loams	0-25	200-300	100-200
	25-50	100-200	0-100
	50-75	0-100	000
	75+	000	000
Loams, Silt Loams, Clay Loams and Clay	0-25	300-400	200-300
	25-50	200-300	100-200
	50-75	100-200	000
	75+	000	000

APPLICATION OF LIME

ON VERY acid soils where applications of lime are needed, the lime should be applied several months in advance of the phosphate, if possible. This tends to increase phosphate efficiency by reducing the possibility of its being converted into inavailable forms by the acid soil.

Potash may be regarded as being unessential where clippings are not removed, with the possible exception of fairways on sands, peats, and mucks. When used on these soils, rates should approximate 100 to 200 pounds of 50 per cent muriate or sulphate of potash.

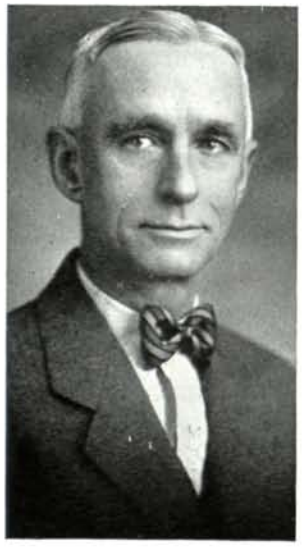
(Concluded on page 18)

Our Bacterial Laborers

Give them a proper home to live in and they will produce luxuriant grass and plants.

By JAMES A. SMITH

FOR years we have been given splendid articles on soils. We have learned that they must be physically fit, containing certain proportions of humus, gravel, coarse sand, fine sand, clay and silt and have been told how proper mixing of these materials have produced best results. If our proportions are correct, we get an easy passage of water into the soil, taking with it air to where it is needed with proper moisture retention after the excess of water has passed through.



JAMES A. SMITH

Who discusses soils from a geologic standpoint and unfolds the apparent mystery about them which never existed.

We know that our best clays originated in granite, that they contain large quantities of potash, usually from 38,000 to 40,000 pounds per acre, that our sources of nitrogen must be decayed organic matter or a commercial substitute, and that phosphorus is required and must be supplied commercially. These things we are well advised on, but there the story stops.

I have always thought that these articles, all of them founded on research and undoubtedly correct, lost their real point in failing to tell *why nature demands* these proper physical conditions if we are to have satisfactory plant life. I think the story from this point on is far more interesting and important than the bare facts of physical preparation. The story of the building of a manufacturing plant, the type of roof, the number of wheels used and the size of the whistle blown at noon, cannot be anything near as interesting as how the plant after construction, makes life possible for the Earth's millions.

WHY THE MYSTERY OF SOILS?

WHY this mystery of soils? Soil has comparatively little to do directly with fertility. It is more accurately merely a home in which certain digestive soil bacteria may work and live happily amid pleasant surroundings, having fresh air and water with which they may carry on their chemical operations from which we get fertility. Rather, let us take the spotlight of publicity and put it where it belongs, not on a healthy home which by all right these bacterial workers rightly deserve, but upon the workers themselves, probably one of the grandest creations given us.

We are constantly told why the body must be kept as nearly physically perfect as possible if we are to have assimilation and nutrition from necessary diet balances. How, in a body physically unfit, digestion is imperfect and nutrition from a diet balance is impossible? Physically, soil conditions must be maintained for practically the same reasons that we must keep the body fit. Malnutrition, faulty elimination and acidosis, are terms which may without effort be easily translated into soil disturbances.

The average person is too familiar with the appearance of earth to be interested in it. He would much prefer to dread it as a carrier of the deadly "lock jaw" microbe than to appreciate it for the 400 million harmless nitrobacteria which one teaspoonful of good earth might contain. Had this life in our soil been eliminated in the scheme of creation, there could have been no living thing on Earth. Left alone for millions of years, they were easily able to care for themselves. Not until man made his mad effort to achieve maximum production from the soil, taking all and leaving nothing in which these little workers could live and carry on their chemical work, did soil problems arise. Neither heat, cold, drouth nor water can entirely destroy these nitrifying bacteria. They may be temporarily effected with either, but with a correction of the condition, they immediately go back to work. Even on the Sahara, given water, we find them in some way, able

to make a home and waiting to produce the vegetation of the oasis. Their ability to produce fertility is only limited to the character of the home provided for them.

While the soil has a great variety of bacteria, many of which are of more or less value directly in our soil fertility scheme, there is but one group that we need be greatly interested in. They are a family living happily together, and, in a mysterious way, producing nothing in their laboratory but nitric acid. Their operations are almost identical with the commercial laboratory producing the same acid.

NITRIC ACID IS EXTREMELY VIOLENT

Nitric acid, as we all know, is extremely violent in its action upon all tissues, whether animal or vegetable. Applied to the skin, it immediately burns. Such an acid could not be taken up by the plant feeding. To make this possible, it must first unite with a base such as lime or magnesium in our soils which will neutralize the burning effect. This combination is a chemical one and by it is produced a nitrate. The Creator has in His wisdom made this nitrate easily dissolved in water so that it may be taken up as a feeding for plant life as the rootage absorbs moisture. This is in all probability the necessity for added lime to our soils.

In the production of nitric acid, the family work in three distinct groups. The first is interested only, in the change of organic matter into ammonia. As rapidly as ammonia is made, the second group take it up and change it into nitrous acid. The third group immediately make from the nitrous acid, nitric acid, which in chemical combination with lime or some other alkaline base, makes the completed product, a calcium or other nitrate, ready for the plant to absorb as a feeding. (If the nitric acid should now combine with the aluminum in our clays, it is temporarily lost.)

All fertilization used, if not already a nitrate, must be subject to the above operations. Ammonium sulphate would be saved the first step, being already an ammonium salt, but it would be necessary for it to be made into nitrous and nitric acid and combine with some alkaline base before it could become plant feeding. Cotton seed meal, soya bean meal, tankage or the materials used in complete fertilizers for nitrate production, must all go through this bacterial laboratory.

Since oxygen taken from the air in the soil, and added to the ammonia of the first step, makes the nitrous acid of the second, and the addition of more oxygen to the nitrous acid produces the nitric acid of the third step, the necessity of an abundance of air in the soil at all times is evident. Chemical action cannot take place except in the presence of moisture, and as air cannot penetrate the soil except as it is drawn down by water, so the necessity of the frequent passage of water into the soil and adequate drainage becomes evident. *For the possibility of these operations alone, we spend our money to obtain good physical conditions.*

The life and death of the millions of bacteria in our soil, with the acids formed, are largely responsible for the ultimate availability of the phosphorus and potash in our complete fertilizers. The definite action creating these availabilities is not known, but it has long been an established fact that only in soils, rich in these cultures, do we have results from the addition of any type of fertilization. Therefore it is interesting to see how easy it is to trace our soil troubles to imperfect care of our nitrobacteria.

POOR TURF IS TRACED TO SHALLOW ROOTAGE

Poor turf on lawn or green is most generally traceable to shallow rootage. This condition may have been aided by poor soil preparation or because an insufficient quantity of humus was added to make a bacterial home. Nitrobacteria will produce nitrates to almost any depth in the soil to which air and water have penetrated. To this depth, rootage will go for feedings. If our watering is shallow, bacteria will exist only near the surface and we will have but one or two inches of rootage. Feeding at this depth, the humus will early become exhausted, our active bacteria will be greatly reduced in numbers and the quantity of nitrates produced will be correspondingly small. We will immediately begin feedings to bring back the turf but we will not have a sufficient number of bacteria active, to operate the laboratory and we will be disappointed in the result.

If physical conditions had permitted, and sprinkling had been infrequent and deep, almost any reasonable depth of rootage might have been expected. The greater the depth of rootage exposed to the feedings made by the nitrobacteria, the stronger and more rapid the growth and the less liable to the

ravages of disease. Soil should never be watered until actually in need as it can then take water, and breath to the greatest possible depth.

Imperfect plant development north of buildings, is directly traceable to insufficient evaporation from the plants or soil due to lack of sunlight. Moisture is applied to the soil more rapidly than it can be taken away by drainage or evaporation. As a result, fresh air will rarely reach the home of our bacteria and nitrate production must stop for want of air with which to carry on chemical operations. Good drainage can be the only correction.

TREES AND SHRUBS SHOULD HAVE BACTERIAL HOME

New tree or shrubbery plantings should not be made without putting about the fine rootage a known, healthy bacterial home. (Not undecayed leaves or undecayed manure.) If planted in a pit to the usual depth of planting, the rootage will likely be established in subsoil having no humus so that nitrate production for the new tree will be impossible. The tree or shrub in its original habitat produced its own humus supply through rootage decay. In the replanting of trees and shrubs the soil should be replaced so as to allow the easy passage of air and water to the new developing rootage.

Poorly drained greens or lawn, whether the surface of subsurface drainage be imperfect, will hold free water sufficient to stop nitrate production. Surface drainage is usually ample except in constantly shaded areas.

Under-watering of turf is most common although over-watering is frequently the practice. A plug taken from the lawn or green will show whether your nitrobacteria have too much or too little water. Remember that water going up through the plant that does not carry feedings, will be of no lasting benefit. Unless your soil is making nitrates and other feedings, you may lose your turf.

Soft maples or other trees producing surface rootage keep the turf rootage area deficient in moisture, and absorb too great a part of all nitrates produced. Surface wetting under such trees encourages surface tree rootage. If these areas are not sprinkled, tree rootage will develop in the lower moist areas rather than at the surface which causes a better possibility of turf growth.

Remember, the success of your plantings, depends upon the welfare of your bacteria laborers, so be interested in their living conditions. Comfortable homes, ample food and a proper environment will allow them to make plantings a success. It would be well for them if they could occasionally send a delegation to you, complaining of the treatment they are receiving.

Turf Field Day at New Brunswick

By DR. HOWARD B. SPRAGUE

The annual Turf Field Day was held at the New Jersey Agricultural Experiment Station, New Brunswick, N. J., on June 19, 1933. The weather was favorable and a group of approximately 100 inspected the plots in the early afternoon. Each of the several hundred plots were fully labeled, providing visitors with an opportunity to draw their own conclusions regarding the effect of the various treatments. A discussion of the recent results was given on the turf plots by Dr. Howard B. Sprague during the course of the afternoon.

DR. HOWARD B. SPRAGUE

At 6:30 p. m. the group adjourned to the Elks' Club in New Brunswick for a dinner and evening program. Mr. Robert F. Arnott, Chairman of the Green Section of the New Jersey Golf Association and also of the Metropolitan Golf Association, was master of ceremonies. The first address of the evening was by Mr. L. P. Christenson, President of the New Jersey Golf Association, whose subject dealt with economy in golf management.

Other speakers of the evening included Dr. John Monteith, Jr., of the United States Golf Association Green Section, Dr. Edward E. Evaul of the New Jersey State Experiment Station, and Mr. Louis Weiland, representative of the New Jersey Greenkeepers' Association.

Dr. Howard B. Sprague, Agronomist, in charge of turf investigations at the New Jersey Agricultural Experiment Station, concluded the evening program with a discussion of the proper place of fairway watering in golf course management.