Now is the Time

WHILE the production of manufactured articles has been seriously curtailed, the production of constructive thought has not been affected by the present business depression.

Men have time in these days to read and they should read about things in which they are financially interested. Expenditures which formerly were passed over lightly are now carefully scrutinized.

Turf culture, it is true, is not a tremendously big business but it runs into quite a lot of money when you consider all the golf courses, private estates, athletic fields, school and college grounds, cemeteries, parks, aviation fields, etc. Therefore, isn't intensive study of turf culture worthwhile?

The NATIONAL GREENKEEPER—the only turf culture magazine in the world—tells you how to grow fine grass economically and successfully. It is not big, burdensome or involved. It has America's most noted turf experts on its editorial staff and no words are wasted in telling how and why.

May we ask you to secure a subscription for The NATIONAL GREENKEEPER—first, because we are proud of it, and—second, because we think your friends will like it.

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DECEMBER, 1932 VOLUME VI-NO. 12

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The NATIONAL GREENKEEPER

(Registered U. S. Patent Office)

Single Copies Twenty-Five Cents. Yearly Subscription Three Dollars.

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Official Organ of the National Association of Greenkeepers of America

Published monthly at 405 Caxton Building, Cleveland, Ohio.

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December, 1932

AN EDITORIAL

By L. J. FESER, Chairman of the Committee on the National Greenkeeper

 $\mathcal{E}_{\text{VERY}}$ gainfully occupied person is a salesman. Some sell objects that are produced and that are transportable. The balance sell their services. The selling of articles of trade is a difficult matter at the present time, but the selling of services is even more difficult.

Every salesman is also a purchaser. He purchases services as well as articles of trade. As a purchaser he has a keen eye on values. He will pay a premium for exceptional value even during this period of low valuations. As a salesman he demands all that he can get for his articles and services; as a purchaser he demands exceptional quality and quantity for his money.

Greenkeepers sell a service. It is a deep and widespreading service. His purchasers are men and women who buy health, pleasure and recreation wrapped up in a bundle labeled "GOLF." Many other men and women contribute the quantity and quality of the contents of the bundle, but the greenkeeper contributes the professional skill that makes the quality what it is.

The purchasers of the greenkeeper's services are organized; they purchase through a Green committee generally, though in many instances the purchase is made through a club manager or owner of a daily fee course. For our discussion we must consider the committee of primary importance. Unfortunately, committees change from time to time. New customer representatives face the greenkeeper and regardless of the type of service previously rendered, the new committee is prone to investigate the value of the service received.

Many new committees fail to analyze the service rendered by the greenkeeper. His position is of little importance in the minds of the uninitiated committeemen. Many of these committeemen feel that it is economy to supplant the greenkeeper and carry on with some other type of management. Unless the greenkeeper is lacking in professional skill or honesty, the club represented by such committeemen is heading into trouble.

The facts as stated are nothing new or extraordinary. Every thinking greenkeeper or Green committeeman has followed the same line of thought and arrived at the same conclusion: trouble ahead for the unwary. That is the reason why so many of our brother greenkeepers hold their jobs year after year, regardless of committee changes. There is always, however, the danger of short-sighted individuals becoming committeemen.

Let us assume that 60% of our golfing customers in private clubs are possible future committeemen. The greenkeeper who has made every professional endeavor to present a maximum of service to his purchasers should sell himself to this 60% of his customers. If the men who make up this percentage realize the amount of technical skill and executive ability required of a greenkeeper, they will not be prone to underrate his profession.

Every effort should be made to acquaint the golfing public with the importance of the greenkeeping profession. There are numerous ways that this can be done, but the most effective way is through organized effort. Our National Association of Greenkeepers of America is the proper organization to make the effort. The NATIONAL GREEN-KEEPER is the medium through which we can express ourselves so that the golfing public may see and hear.

Let every greenkeeper place the N. A. G. A. in ranking importance to his job. Strive to increase our membership. Strive to make our official organ bigger and better. Strive to place that organ in the hands of our customers, so that they may learn the value of what they are receiving. DECEMBER 1932 Volume VI Number XII

The NATIONAL GREENKEEPER

Official Organ of The National Association of Greenkeepers of America

Soils

Their compound parts—how formed and kind best suited for golf turf By JOHN ANDERSON, Greenkeeper Crestmont Golf Club, West Orange, N. J.

Soll is formed from various kinds of rocks and their residues, after long periods of time—decaying and forming unconsolidated material such as sands, gravel, clays, and minerals released by weathering, exposure to rain storms and surface water, wind, and ice storms. The classes or series of soils are determined by the mode of formation.

The color of the soil is influenced by the topography of the land. On hills or highlands the color will be lighter than in valleys or lowlands, due to washings off the high parts and disposals in the valleys. On the parts where drainage is excessive the color and texture will be different than on parts where the drainage is poor; this also determines the soil class or texture.

Lightness or heaviness of the soil is dependent on the size of the particles which a soil contains. The particles, fine gravel, coarse sand, sand, fine sand, very fine sand, loamy coarse sand, loamy sand, loamy fine sand, loamy very fine sand, coarse sandy loam, sandy loam, fine sandy loam, very fine sandy loam, loam, silt loam, sandy clay loam, silty clay loam, clay loam, sandy clay, silty clay, clay.

On virgin soil, or land that has not been cultivated, the top layer or top three to six inches is called the top soil. This is where all plants take root and grow. This top layer composed of organic mat-



ter is in more or less advanced stages of decomposition. The organic matter is derived from dead plants and decomposed vegetation, dead leaves, animal manures, roots, etc.

Organic matter is of great importance in soils. It brings about very desirable physical conditions, making light or sandy soils more water-retaining, and heavy clay soils more porous and adaptable to plant growth. This organic matter is often referred to as humus. Thus a soil which has a top layer of five or six inches in which a great deal of decomposition has taken place for a number of years, is very desirable for plant growth.

GOLF COURSES RARELY HAVE GOOD SOILS

GOLF courses rarely have soils which are best adapted to the growth of turf grasses. Other factors generally have a greater bearing when the land is selected for a golf course, than whether the soil is suitable. Thus, although the soil is the very foundation for the growth of fine turf grasses, it is very often left to the greenkeeper to make this suitability of soils and very often after the course is made he has to try to improve soil conditions especially on the greens.

Soils best suited for turf grasses are of a sandy loam, that is, they contain both large and small

(Concluded on page 18)



Soil Nutrients and Soil Acidity

By PROFESSOR M. H. CUBBON

Massachusetts State College, Amherst, Mass.

 $\mathcal{P}_{\text{LANTS}}$ take up from the water in the soil all the nutrients they use, except carbon and oxygen which come from the air. Eight elements thus come from the soil. If any of these ten elements is missing plant growth will not be normal. Some elements seem to be more important than others, judging by the effect on the plant.

The eight elements coming from the soil are: nitrogen, phosphorus, potassium, calcium, magnesium, sulphur, iron, and hydrogen. In order to grow plants successfully, therefore, the supply of these eight elements must be kept adequate. Hydrogen is so common in water that it is never lacking in soil. Iron is another element about which we need not worry, except when there is too much iron present as in certain acid soils.

Sulphur is present in sufficient quantities except in the drier regions of the country. Superphosphate carries enough sulphur to meet any shortage. Magnesium has come in for much discussion and experimental work very recently. A shortage usually exists in acid soils. If pulverized limestone is used as a source of lime the chances are that the material will carry all the magnesium needed.

In the average soil then, nitrogen, phosphorus, potassium, and calcium (lime) are most often absent or not available. Nitrogen is limited in amount, since it is directly proportional to the amount of organic matter. Phosphorus is also limited in amount, and is not soluble in acid soils. Potassium is not plentiful in sandy soils, but clay soils contain large amounts. A neutral clay usually has but little soluble potassium, however. Calcium washes out of the soil so easily that there is usually a shortage of that element.

Nitrogen, phosphorus, potassium, and calcium have the following effects of plant growth:

NITROGEN—Dark green leaves, rapid growth of a succulent nature.

PHOSPHORUS-Lighter green leaves, sturdy

growth, serves as a balancer for nitrogen by preventing too rapid growth, very favorable to root development.

POTASSIUM—Serves as a tonic to plants, strengthens the general make-up of the plant, and has been said to help the plant keep a stiff upper lip.

CALCIUM—Plants without calcium are very short and underdeveloped. Helps the plant to absorb potassium, phosphorus, and nitrogen.

SOIL ACIDITY

ACID soils are the rule instead of the exception in all regions of the country where rainfall amounts to more than 20 inches per year. Even where the soil has come from limestone the surface soil is usually acid and benefits from additions of lime. The reason for this situation is found in the fact that water dissolves out the basic material more rapidly than it does the acid material making up soils.

Soil that has been exposed to rain for thousands of years has lost nearly all the soluble or fairly soluble materials, and all that is left is made up of insoluble or inert substances. Many of the acid soils do not grow satisfactory crops without the addition of some basic material like limestone. Indeed, lime has come to mean a fundamental for soil treatment to allow practically any crop to grow normally. Any case of poor crop growth is usually laid to acid soil. Since many times the failure is due to other things than mere acidity, it is necessary to examine into all the other conditions in an acid soil. Acidity may be important (harmful) in soils for the following reasons:

- 1. Reduces the growth of clover*.
- 2. Makes nitrogen slowly available.
- 3. Makes potassium soluble.
- 4. Makes phosphorus unavailable.
- 5. Prevents the proper absorption of plant food by plants.
- 6. Soluble iron and aluminum appear in acid soils as toxic agents, causing weak plants.

*Not as much as desirable.

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- An acid soil is the most favorable medium for molds and fungi to develop in. Fungi are the organisms which cause most of the plant diseases.
- 8. Acidity may or may not keep out weeds.
- 9. Absence of calcium prevents length growth of stems.
- 10. Causes manganese to be soluble (usually beneficial).
- 11. May keep earthworms out.

ACIDITY AND THE GROWTH OF CLOVER IT IS common knowledge that potassium (potash in everyday usage) is largely responsible for the growth and encouragement of clover in greens. Four per cent potash is considered a maximum in fertilizer mixtures for greens, and some mixtures carry only a trace or none at all.

Too little attention has been given by those in charge of greens to the amounts of available potash in the soil. (There is no quick, easy test for available potash.) The old story of plenty of sulphate of ammonia appeared to satisfy nearly everybody. But in numerous cases the continued use of sulphate of ammonia has failed and is failing to prevent the growth of clover. There is no question of the acidity developed by sulphate of ammonia. Why, then, does clover continue to grow under acid soil conditions?

The answer appears to be that potash is much more soluble in acid than in neutral soils. Tests made in various states on the effects of acid-producing nitrogen fertilizers on solubility of potash all showed that the more acid the soil becomes the more soluble the potash. Soluble potash is usually available, and therefore clover gets the tonic it needs.

Loam or clay soils, and heavy soils in general, contain large amounts of total potash. Attempting to keep out clover from such soils with sulphate of ammonia, is like trying to put out a fire with gasolene. Perhaps when you are trying to get rid of clover by using sulphate of ammonia you are actually. giving the clover more encouragement than the grass.

ACIDITY MAKES NITROGEN SLOWLY SOLUBLE

T HE bacteria that change nitrogen from ammonia to nitrite and nitrate work best in soil that is nearly neutral. When soil acidity is strong the work of these bacteria practically stops. So when you add sulphate of ammonia to an acid soil and fail to get the results expected, perhaps the acidity is so great as to prevent the growth of essential bacteria. A pH value of 5 or less is very apt to cause a serious shortage of nitrate nitrogen. It is a condition which should be carefully checked and observed.

ACIDITY AND SOLUBLE POTASH

EXPERIMENTS have shown that more potash is soluble in acid soils than in neutral soils. This is a perfectly natural consequence. Remember that potassium is a base, and that acids unite with bases very easily. If no acids were present the potash would be much less soluble. Most plants are able to get potash rather freely from a neutral soil because of the help calcium gives in the absorption of potash.

ACIDITY AND SOLUBLE PHOSPHORUS \mathcal{P} HOSPHORUS behaves directly opposite to potassium. It is an acid-forming substance, therefore is not made soluble by acids in the soil. Bases are required to make phosphorus soluble and available. Attempts to make soil strongly acid must therefore be undesirable because of the phosphorus behavior.

ACIDITY AND ABSORPTION OF PLANT FOOD

THE element calcium does much to help plants take up other elements. For instance, potassium is taken into the plant only with difficulty when no calcium is present. Just how much it helps the other elements, directly at least, has not been fully worked out. Indirectly it is most important. Calcium is absolutely necessary for the change from ammonia to nitrate nitrogen, and for making phosphorus soluble.

Soil acidity has come to mean practically a lack of calcium, because of the pronounced effects of calcium on various elements. In other words, none of the effects of an acid soil are noticed when the element calcium is added to the soil. We call potassium a tonic to plants, but it can only be a tonic when it is within the plant, and there is little hope of it being taken up by the plant in usable quantities when no calcium is present in soil.

ACIDITY AND GROWTH OF ORGANISMS

T HE small organisms in the soil are very important. They take care of rough organic matter and reduce it to a condition in which it can be at least partly used by plants. Most of the organisms belong to the plant kingdom. There are a few small animals in soil, but we may practically forget them in this discussion. They are active only in soils that are too wet for good crop production. Water-logged soils, ones that are unsanitary and unhealthy, are favorable to the growth and activity of small animals called protozoa. Much discussion and many experiments have failed to give us a sound conclusion regarding the work of these organisms. They have no economic value which anyone has discovered in soils properly handled.

The organisms which belong to the plant kingdom are divided into two general groups, bacteria and fungi. Fungi (molds) are less desirable than bacteria because so many of them are the causes of diseases which weaken both tops and roots of plants. Many of the fungi work on organic matter and break it up. In that respect they are as valuable as bacteria.

Fungi, and especially the less desirable sorts, are more abundant in acid and wet soils than in other soils. In wet soils fungi are probably the main cause of unsanitary conditions that develop in such soils, because the products they form are poisonous to plants.

Brown patch is caused by a fungus. Therefore, the more acid the greens become, the more susceptible the grass is to attacks of brown patch, and the more vigorous the brown patch itself.

Bacteria do best in slightly acid to basic soils. Any condition which makes the soil approximately neutral in reaction is a great aid to the growth of bacteria. Nearly all of the desirable sorts of bacteria are killed if a soil remains acid for any length of time.

ACIDITY AND WEEDS

MANY experiments have shown that weeds are fewer in number on acid than on neutral or basic soils. Unfortunately, the reverse of this has often proved to be the case. That does not help the people who want to sell fertilizer.

Why does the difference exist? One guess is as good as another. Here are two possible answers to account for more weeds on neutral soil: First growing conditions are so much better under neutral than under acid soil conditions that weeds can crowd out the grass. Certain types of weeds require more phosphorus than others, or than grass. These weeds will therefore do best on neutral soil. Second—and probably more important, the bent grasses grow enough better on acid soil to make a solid turf in which there is no room for weeds.

ABSENCE OF CALCIUM PREVENTS LENGTH GROWTH WHERE calcium is a limiting factor, plants are

very stunted in appearance and character. A grass plant will never grow tall in the absence of calcium. But nobody wants the grass on a green to grow tall. That is beautiful theory, yet how does it work?

Short grass plants provide a less desirable putting surface than do longer plants, cut to the same height, of course. In short grass all the plant characters are present just as much as in tall grass. The two most important of these characters are the nodes (joints) and internodes (stem between the joints). When calcium is limited the internodes simply forget to lengthen. But the nodes are there just the same and a squatty plant is the result. The grass blades from such plants tend to grow more horizontally than straight up. In other words there is nothing to make the grass stand up as it should.

ACIDITY AND MANGANESE SOLUBILITY

MANGANESE is one of the recent additions to the list of necessary plant nutrient elements. It was overlooked for a long time because extremely small amounts are sufficient to produce normal growth. Acid soils have enough soluble manganese for good plant growth, hence the average greenkeeper need have no fear of a shortage.

When soils are neutral, or are limed until they are nearly neutral, especially sandy soils, there is often difficulty from a lack of manganese. Manganese simply becomes insoluble in neutral soils. This is one case where acid soils have a distinct advantage.

ACIDITY AND CONTROL OF EARTHWORMS

A FEW years ago most people thought that earthworms did not work in acid soils. One or two experiments showed this to be the case in soils used for general farming purposes. Experience with acid soil in greens has been far from similar. Here are soils plenty acid and becoming more so every year, yet worms are much too plentiful and active.

There must be a reason. In fact, there are at least two reasons why worms are so active in acid greens. First—the soil in greens is kept (usually) moist enough to be a real treat to worms. Second—there is plenty of food for them to work on in greens, much composted material and organic matter on which they especially thrive. What a contrast with the acid soil used for general crops. Such soils are often too poor to grow any organic matter, hence there is nothing for the worms to live on. No organic matter is added, either, in many cases.

HOW TO CORRECT SOIL ACIDITY

 $\mathcal{P}_{\text{RACTICALLY}}$ all the troubles for which acid soils are responsible, either directly or indirectly, are eliminated when lime (calcium) is added to the soil. For that reason lime has come to be the only material used to make soils neutral. Of all materials which might be used as neutralizers, lime is cheapest and best in all respects.

Lime is sold or offered for sale in three forms. The natural limestone is quarried and pulverized to a fine powder. This is the material most people mean when they say lime. One hundred pounds of limestone will neutralize the acidity from one hundred thirty-two pounds of sulphate of ammonia. It will neither burn the grass nor the skin of persons handling it, and is the most desirable form of lime to use on grass.

The limestone may be burned without grinding to form lump or builders' lime. This material is highly caustic and will burn grass severely when applied during the growing season. Burned lime is more concentrated than pulverized limestone because the burning process drives off some of the unnecessary substances that simply dilute the calcium. Fifty-six pounds of pure burned lime will neutralize one hundred thirty-two pounds of sulphate of ammonia.

Besides being caustic, burned lime takes on water and in so doing may produce considerable heat. It is therefore dangerous to store burned lime inside a building where there is any chance of water leaking in and reaching the lime.

When burned lime is treated with water (slaked) it becomes fine in texture and is known as hydrated lime. Seventy-four pounds of hydrated lime will neutralize one hundred thirty-two pounds of sulphate of ammonia. It is thus about half way between burned lime and pulverized limestone in efficiency. Hydrated lime is caustic to grass and disagreeable to handle, although safe to store. In the table at the top of next column is a comparison of three common liming materials.

Agricultural lime means more commonly a mixture of hydrated lime and pulverized limestone, used for general application to soil on which plants are to be grown.

A good application of limestone is about 50 pounds per thousand square feet. Such an application should take care of all acidity from sulphate of ammonia for three to five seasons. Smaller amounts

Common name	Other names by which it is known	Pounds needed to neutralize 100 lbs. sulphate of ammonia	Desirability for use on grass
BURNED LIME	Builders', lump, stone, quick, or caustic lime.	42 pounds .	Burns grass. Dangerous to store. Too lumpy to apply directly. More effective per lb. than any other.
Hydrated Lime	White lime.	56 pounds	Burns grass. Fine and easy to apply. More effective per lb. than Limestone. Safe to store. Burns hands somewhat.
GROUND OR PULVERIZED LIMESTONE	Lime. Agricultural lime	76 pounds	Does not burn grass or skin. Safely stored at any time. Heavy to handle, and goes only half as far per lb, as burned lime.

may, of course, be added, say every year. Fifty pounds of limestone are equal to thirty-seven pounds of hydrated lime and to twenty-eight pounds of burned lime. Limestone costs from \$5 to \$9 per ton. A pound of actual calcium costs about the same in limestone and in burned lime. The cost per pound of calcium in hydrated lime is considerably higher than in the other forms. When lime is purchased in carload lots considerable saving is made if the shipping and delivery points are on the same railroad.

Burned and hydrated limes can be used perfectly well when grass is dormant. This means late fall or early spring application. In normal conditions at least 40 pounds limestone per thousand square feet should be used every five years, unless calciumcarrying nitrogen fertilizers are used.

One of the peculiar things about lime is that it neutralizes only that layer of soil with which it comes in contact. Lime put on the surface of soil neutralizes only the top layer in spite of the fact that drainage water washes lime through the lower soil layers. A very small amount of the lime in drainage water is taken up by the lower soil layers, so small it can scarcely be measured.

This fact makes it possible to add lime to greens without having much influence on the clover growing there. The lime remains in the top layer where most of the grass roots are and does not get to the clover roots that are some distance down. Continued lime applications would be necessary to encourage growth of clover roots near the surface.

(Concluded on page 18)

The National Greenkeeper

December, 1932



Now Is the Opportune Time

A forecast of the 7th Annual Greenkeepers' Golf Show to be held in Chicago the first week in February. Below is a chart of the exhibition spaces.

> By FRED A. BURKHARDT Chairman Show Committee, National Association of Greenkeepers of America



WHETHER an optimist or pessimist concerning the business trend, it is unlikely that any manufacturer will want to miss this golden opportunity of making personal contact with the buying public and acquaint them with the merits of their individual product.

Greenkeepers from all parts of the United States and Canada, Superintendents of Parks, Estates and Cemeteries, will all attend the Convention of the National Association of Greenkeepers of America, at the Hotel Sherman, Chicago, January 31, February 1, 2, 3. Manufacturers, here is your ideal chance to contact the largest buying prospects in your industry at a very low cost to you.

The diagram at the left shows the arrangement and prices of display space in the large exhibit hall of the hotel. The present layout of space has been so planned that all delegates will pass through the exhibit hall in order to reach the convention meeting room.

Many of the well-known manufacturers have already secured considerable space and we are receiving additional reservations every day. If you are after more business, secure an exhibit space for the Chicago show.

For further details—write to F. A. Burkhardt, Chairman of the Show Committee, 405 Caxton Building, Cleveland, Ohio.

Ouimet to Write

Francis Ouimet, one of America's most famous golfers, who has held both the Open and Amateur Championships of the United States, will write an article for the January number of the NATIONAL GREENKEEPER. He will cover the question of golf course conditions from the standpoint of the expert golfer and discuss what constitutes good fairways and greens.