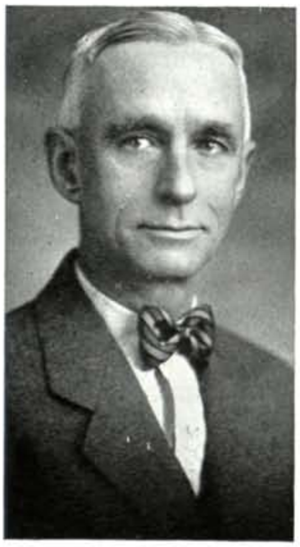
Our Bacterial Laborers

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.

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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.