Soil Teems With Life, So Culture Practices Are Complicated

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MOST of us who haven't studied the soil very carefully, look upon the soil as an inert, dead mixture of mineral materials and organic matter, with little thought that the soil is, after all, a living substance. A fertile soil is the most animated thing on earth, teeming with vitality. The amount of soil that you would hold on the end of a jack-knife, a gram, may contain 900 million soil organisms, divided into a large number of individual groups, each competing with the other.

So sensitive are these soil organisms that a change in the amount of water, the chemical treatment or the physical surroundings will completely disorganize the whole scheme. Press your foot firmly on wet ground, and you will cause a readjustment of the whole scheme.

You are dealing with a living thing, something really sensitive that must be handled with great care, because the development of the plant above the ground is dependent on the soil below the surface.

Now, here is what happens under a sod where you have roots constantly dying and new roots forming. There is a very large group of organisms responsible for breaking down the organic matter in the soil. For every unit of carbon that is utilized from the roots, there is a definite amount of nitrogen required. You have keen competition for the nitrogen available. As organic matter is broken down, the soil-making organisms utilize nitrogen at the expense of the plants. It is a competition between the roots of the plant and the soil organisms. You may have a deficiency of available nitrogen. That is why there is very little nitrogen loss from a permanent sod, while in the cultivated field you will have higher loss, because the nitrogen is quickly utilized by both the micro-organism and the plants. The ideal is to so make up the physical conditions of the soil that the roots of the plant can get their share. That is done by making conditions ideal for bacteria. These plants that have utilized these bacteria will die and the nitrogen will be liberated, so after all it is a matter of compensation or conservation.

The greenkeeper must grow his grass under the most adverse conditions possible. Excessive watering, walking on it, rolling it, compacting the soil—are entirely different from the conditions on a lawn or pasture. Even in a fairway, the most serious thing is the physical condition of the soil. You can correct the chemical condition, but it is a difficult task to change the physical condition of the soil.

I don't suppose any greenkeeper has nine or eighteen greens that behave the same; no two soils ever behave the same. So it becomes after all, an individual problem with each man. Know your soil—get acquainted with it. If you can find out why No. 7 is not as good as No. 6, and you can correct that, you have learned a lot.

One of the greenkeepers last night said, "I haven't told anybody this, but I am trying a little experiment. Over on the side of one fairway I cleaned off a little place, and I am trying out eight or ten different materials to see what happens. I am not saying anything until I see what happens." He has the right idea—he is close to his own soil.

A recommendation for one soil will not necessarily adapt itself to another soil. This has been brought out in my studies, through field experiment. I find, for instance, down in Washington, Pa., potash had very little effect on this soil, which extends probably a hundred miles northward. Super phosphate and lime are about all we seem to need for the usual crops; on the pastures, nitrogen, phosphorus and lime. Up in the glaciated sections of Northern Pennsylvania, potash was a limiting factor—you couldn't

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get returns from phosphorus until you applied potash. In another field experiment on very poor soil, everything we put on responded. The soil was so poor that even weeds wouldn't grow. So, there you have a picture of three soils. If I had started one experiment down here, and attempted to make recommendations for the northern farmers, I would have been entirely wrong.

The most distressing soil condition possible is one of extreme acidity. In the first place, although bent grasses will grow on a fairly acid soil, roots are restricted to half an inch; along comes a dry spell and grasses suffer. The ideal soil condition, if possible, is one which induces deep roots. The deeper roots descend, especially on fairways, the longer the grass will stand adverse conditions during summer months.

I have lately been studying to see if there is a relation between the activity of soil micro-organisms below the ground and the production of the plants above the ground. I found from studying the old plants, where I get maximum bacterial activity, I get the maximum crops. In extremely acid soil, the soil becomes infested with fungi and the bacteria disappears. These fungi cause trouble with most plant diseases; so, keeping soil too acid harbors trouble.

I think some have gone too far in keeping their soil acid. Putting on too much lime will, no doubt, induce certain weeds and clovers to come in. But to say what is the ideal pH reaction for growth of grasses is difficult. It varies with one soil or another. In a soil rich in organic matter, grass will grow at a much higher pH than another. In a soil poorly buffeted, a much lower acidity will cause serious trouble.

I want to impress upon you that every soil with which you deal is different, even your greens. You can't put down nine greens that are entirely the same to save your life; though you may fertilize them the same, there will be differences occur, which are due largely to exacting physical demands, such as when a ball hits the green it must stay there.

Where raw materials are used in composting, such as raw peat or hulls, it should be composted first, before it is put on the greens, especially peat. There are two reasons why I think that raw peat should be composted; first, to give it time to absorb all the water it is going to take; second, to prevent the bacteria from carrying out what I described above. If you apply heat to the compost, the easily decomposable material will break down any compost, so that when you apply it to your greens, you have a more permanent organic matter. That is what you are looking for on the greens—permanency.

Three or four weeks ago, in connection with our pasture studies, including bent grasses, the fescues, and especially Kentucky bluegrass, we used superphosphate and potash, and complete fertilizer. On the untreated soil, we got a good growth of bent grass and a fair growth of fescue. Bluegrass would not grow at all. Where we put on superphosphates, we had a slight growth of bent and fescue and an enormous growth of Kentucky bluegrass.

You often find bent grasses growing on poor land, but you never find Kentucky bluegrass on poor land. In other words, bent grasses have a stronger feeding power than Kentucky bluegrass, an ability to take phosphorus, for instance.

Now, to make a practical application: Where you want plenty of grass alone, your best chance is with low phosphorus application. With fescue, you might raise the ante a little bit, but where you want Kentucky bluegrass, you must put on a heavy application, because it hasn't the power of seeking out locked up plant food.

The ideal condition for a green is a slow, continuous growth through the season. I can see a very valuable field for the use of organic fertilizer. Fertilizer like sulphate of ammonia will give more immediate action than an organic; so, it seems to me, the practice to be followed is to mix a certain amount of sulphate of ammonia with organics. Thus you give the grass a quick start early in the spring, then permit the organics to carry on. In other words, you don't want high quick growth, you want steady growth. The slower your grass grows and still maintains proper conditions, the less liable is that grass to be susceptible to disease and to playing injury. The more quickly grass grows, the more artificial it becomes, and the more easily it becomes susceptible to disease.

Put on an enormous amount of soluble nitrogen and the grass will become tender. A cloudy moist day and it succumbs to brown patch. The more minerals this grass is permitted to take up in its growth, the more resistant it will be.