

Chapter 5

The Importance of pH

THE symbol pH has acquired a mysterious connotation out of proportion to the facts. Admittedly, the pH theory is not the easiest thing in the world to understand. Many of its controversial aspects were only settled within comparatively recent times. However, this does not prevent us from putting the theory to work to grow better grass. Just as we do not have to know kinetics to drive a nail, or thermodynamics to read a thermometer, so we can juggle the acidity and alkalinity of our soil without a clear comprehension of the pH or hydrogen-ion theory.

The first fact to understand is that pH affects fertility, but does not itself feed plants. Many gardeners dump lime on the lawn to raise the pH (or sulfur to lower it) and think that in doing so they are also supplying nutrition. Actually, the amount of lime needed to feed grass is only a fraction of the amount we might have to use to change a pH reading one full point. And in applying too much lime, we might be worsening the food supply by making the soil so alkaline that an element like iron becomes unavailable.

Think of the pH scale as a thermometer: instead of measuring heat it measures the acidity or alkalinity of the soil. The scale runs from 0 to 14, with the acid and alkali factors just balancing out at 7.0, which is considered to be neutral. Just as 32 degrees marks the point at which water changes character, so 7.0 indicates where the acid-alkaline factors change. A reading above 7.0 indicates alkalinity, or a "sweet" soil, as our grandfathers called it. Everything below that point is acid or "sour."

THE IDEAL RANGE

Since all the grasses commonly used for lawn purposes do best at a pH range of 5.9 to 6.9, this is the only section of the scale

important to us at this time. True, we used to think of bent grasses as preferring acid soils, but we now realize that while they tolerate more acidity than other grasses, they really do not prefer this condition. The bluegrasses will, of course, tolerate much higher readings than a pH of 6.9. In fact, they will grow well in limestone soils as high as 7.4 or 7.5. As readings go above this point, however, the grass is lighter in color. This is due to the fact that iron is being suppressed—"locked up"—in an insoluble form which grass roots cannot utilize.

The reason so many grasses thrive at the 5.9 to 6.9 range will be easier to appreciate if we briefly consider the chemistry of soils. Plants need an amazingly wide range of elements for nutrition, some fifteen or sixteen in all. *In the 5.9 to 6.9 range, all of the elements that plants need for growth are in active, available form.*

FERTILIZER CONVERSION

Nitrogen in ammonium form, for example, is readily converted into the more desirable nitrate form in this pH range. The effect here is indirect (the bacteria can work better in this range) but the end result is the same. In alkaline soils, potash tends to become less and less efficient until at a pH of 8 it is completely locked up. The calcium in lime (we are considering it here as a nutrient, not as a regulator of pH) is only one-third as available at pH 5 as it is at 7.

Phosphates are the worst performers because they "lock up at both ends," either in a too-acid or a too-alkaline soil. Magnesium behaves much like lime. Manganese, iron, copper, and other metallic minor elements become insoluble and cannot be absorbed by roots at a pH of 7 or above.

In very acid soils, and also in those that are very alkaline, the element aluminum (which has no nutritional value) becomes so active that it poisons plants. Much of the toxic effect of western alkali soils is aluminum toxicity.

Thus we see the importance of pH. By keeping soils at the right point, between 5.9 and 6.9, we assure maximum use of all the fertilizers we supply. This does *not* mean that simply by dumping

lime to make a soil more alkaline, or sulfur to make it more acid, we are adding fertility. We may get a temporary effect from such treatment because the locked-up nutrients are released in soluble form, enabling the plants to absorb them. This not only adds no fertility, but exhausts some of the reserves already there.

Lime is often said to “release and make it available to plants”. This is true only if (1) the pH is wrong (too low) for good bacterial action; (2) the fertility other than organic is there but is locked up by a too-acid soil; (3) there is organic matter for bacteria to work on; (4) the soil contains some free nitrogen to feed the bacteria while they work to release locked-up protein.

So we can see that liming to release plant food is a rather “iffy” matter and that we cannot state without reservation that it will work.

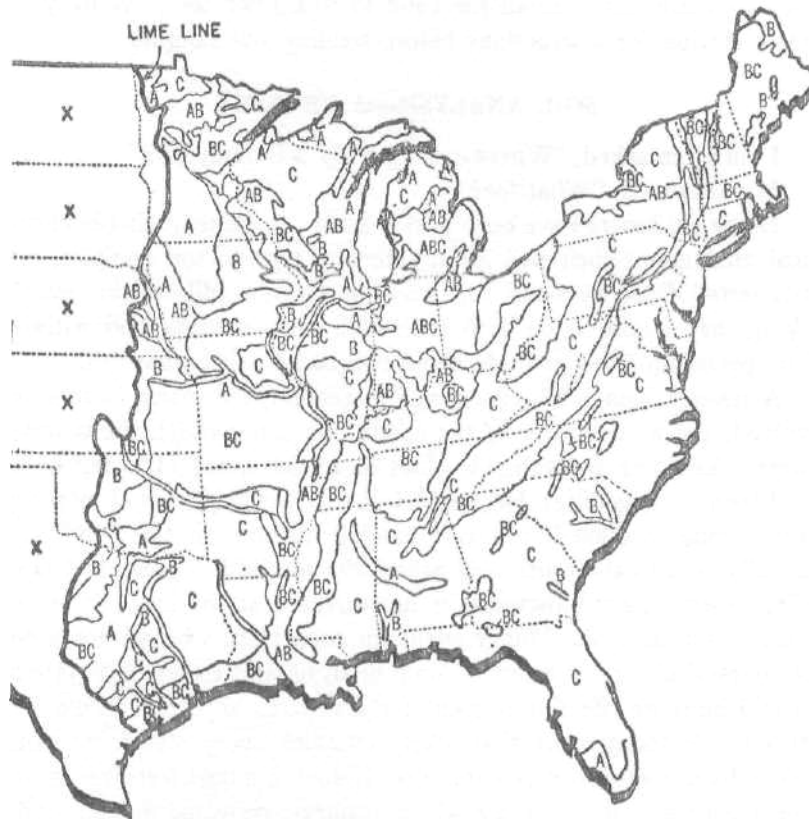
WHAT IT MEANS

What does all this mean to you, the lawn-maker? First, and most important, you should keep the soil at the right pH. In the East, where soils have been tilled for generations, and where rainfall is heavy enough to wash out lime from tilled gardens and fields, low pH is the rule. Even when the underlying rock is limestone, this element is usually lacking in topsoil in older regions.

The “lime line” of the United States, east of which shortages of this element can be suspected, runs roughly through the middle of Texas and north to the Canadian border between Minnesota and North Dakota (see map). Anywhere east of this line, the lawn-maker should check up on the pH of this soil as a matter of routine. West of this line, soil testing is equally important, but for the opposite reason. Here, the addition of sulfur or other acid-forming chemicals may be necessary to bring down the pH and overcome the effects of excess alkalinity.

This can be determined very easily with the soil-test kits sold in most seed stores or garden centers for a dollar or so. Be sure to get the kind that shows the actual pH reading, not the kind that gives a code letter applicable only to some patented product. This type of kit is often sold or given away by the manufacturer of a proprietary chemical, but the reading means nothing to you since you

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East of the "lime line" soils are generally arid and lime is often needed. X—soils rich in lime; A—fairly rich in lime, but some surfaces may be acid; B—acid soils but lime is available to deep-rooting plants; C—acid, poor in lime; A.B—soils mixed high and medium lime; BC—mixed medium and low lime; A.B.C—mixed high, medium and low lime. *V. S. Department of Agriculture.*

get only the relative position, not a figure that can be translated into the use of other chemicals.

Litmus paper, the nineteenth-century test, is practically worthless. It should never be used where better materials are available. The ideal method of checking is on an electric bridge pH tester. This would be rather expensive for the amateur, but most county agents and county farm advisors have one.

Often pH tests can be had at state agricultural experiment sta-

tions, usually for a small fee (50 cent to \$1.00 per test). Write your state station for instructions before sending soil samples.

SOIL ANALYSIS—A PROTEST

I am often asked, "Where can I get my soil analyzed?"

My answer is, "What for?"

Home gardeners have been misled as to the value of simple chemical analysis of their soil. (I'm referring now to soil analysis, not pH tests.) Gardeners feel that such an analysis will indicate everything they ought to do with their soil, automatically and without interpretation. This attitude is not shared by soil authorities.

A trained man, with experience in reading the many factors involved, and a knowledge of the conditions under which the samples were taken, can get valuable clues as to the needs of a particular soil from test readings. He would feel that his professional integrity were being assailed if someone handed him one of the "toy" kits usually sold to amateurs, and asked him to check a given soil sample. However, my indictment is not directed at the kits but at the *idea* of soil analysis. Money spent for such tests, whether for a do-it-yourself kit or for a professional analysis at a recognized station, would be more effective if spent for fertilizer. Any good mixed fertilizer sold today more than likely contains every non-nitrogenous plant food grasses can possibly use. If such a mixed fertilizer is applied once a year, the grass will not starve, provided enough additional nitrogen is used to meet the requirements of superior growth. Money spent for a soil analysis might well pay for part of that nitrogen.

CHIPS OFF THE CHAPTER

1. You need not understand all the chemical workings of soil in order to understand—and supply—what it needs. A soil's acidity or alkalinity—its pH—largely determines its amount of *usable* fertility. If the pH is too high or too low, various fertilizer elements are "locked up" in a form that grass plants cannot absorb.
2. Use common sense in changing the pH level. Simple pH testing kits can be helpful.
3. A complete soil analysis is a waste of time and money for most lawn-makers.