Nutritional Gardening Department

The Natural Way to Grow Vegetables — Fruits — Flowers

HIDDEN IDEAS IN UNOPENED BOOKS

Soil Organic Matter Under Time and Treatment

by William A. Albrecht, B.A., B.S., M.S., Ph.D.

Prof. Emeritus of Soils, College of Agriculture, University of Missouri, Columbia, Mo.

Sanborn Field of the Missouri Agricultural Experiment Station provides an excellent opportunity to study the properties and performances of organic matter in the soil. The latter reports the microbial activities or "the life of the soil."

The field was laid out in 1888, at a time when barnyard manure was the major fertilizer. Pressing questions then were "How much manure shall we apply per acre? Where in the crop rotation should it be applied? What crops should make up the rotation in contrast to a crop grown continuously on the same land?" Many of the original plot treatments, aimed to answer those questions, are still being followed.

75th crop

Since the field is about to experience its 75th crop, or anniversary, it may be helpful to note the chemical changes in the organic matter of the different plots as indicators of the biological activities in the soils during the first two quarters of a century, and to learn how these suggest the expected "life" in the soil to testify at the end of the third quarter. These reports may increase our appreciation of the organic aspects of the soil, so seriously neglected in research and being so rapidly depleted. Since the soil organic matter is a major natural resource in determining the higher qualities as food- and feed-values which our soils produce, its continued depletion becomes most serious.

Since any living matter is distinguished by its chemical substance called "protein," and since this is characterized by the element nitrogen connected with carbon (both combustible), the chemical analyses of the soil by ignition served to measure these two life essentials in the soil at the end of the first 25 years. The data from such measures made on the soils of six of the plots on Sanborn Field, at two quarter-century periods, are reported in the accompanying table.

Only those soils under continuous cropping are cited, in order to eliminate irregularities due to changes in the crop during such a seemingly short period as a quarter of a century in the life-span of a "living" soil. Only two crops, and both of grass species, namely, wheat and timothy, are cited.

Types of treatment

The soil treatments used were commercial fertilizer salts and barnyard manure. The latter was applied at two different rates: six (short) tons and three tons per acre per annum. The wheat crop involved annual plowing and additional soil tillage. The timothy plots were plowed occasionally at intervals of about six years, but represent maintenance of a grass sod.

According to the data, these two different soil treatments emphasize clearly (1) the serious depletion of the soil organic matter under continuous wheat as a tilled crop; and (2) the opposite effect, or an increase in the soil organic matter by the untilled soil or sod-crop of the non-legume, timothy. The table divides itself naturally into two parts exhibiting these separate facts.

Two indices

The changes in the amount and kinds of organic matter are shown by varied values of both carbon and nitrogen, the two indices which must be considered in combination. If the soil organic matter increases, certainly the nitrogen as the index of living tissue must increase, if we view the "living" soils in terms of microbial performances or processes.

David Pascal. These very aptly give added emphasis to the straight-from-the-shoulder writing style that distinguishes Elmer Wheeler in all his books. With his barbed wit Elmer points out many authenticated truths on the matter of cholesterol, and the very important role the right kind of foods play in alleviating the cholesterol condition.

As with his previous book on reducing, Wheeler features a detachable "Cholesterol Counter Card" for easy reference when one is confronted with an array of high cholesterol foods while dining out, etc.

Cholesterol Charlie has provided an amusing yet instructive guide for people who want to reduce their intake of the saturated fats which produce cholesterol. There is a splendid appendix to the book that contains a very complete listing of the "on limits" and "off limits" foods showing those foods that are low in cholesterol and those that are too highly saturated. Also in this appendix there are many practical tips on how to "edit" your food and cheat on your diet honestly!

Wheeler puts in many a good word for so-called health foods, pointing out their advantages to "pep up" some of the blander non-fat-forming foods. He says: "Dietitians suggest flavoring foods with brewers' yeast and whole wheat germ, in addition to generous doses of vitamins, minerals and certain health food supplements."

Some may feel this man Wheeler is unorthodox in some of the things he advocates. However, by and large, he has turned out a book that is most readable and one which contains a great deal of common sense in the matter of reducing cholesterol if one finds himself confronted with the situation of too many saturated fats. We think you will approve. *The Fat Boy Goes Poly-Unsaturated*, which faces an unhappy condition of the blood with such good humor and good common sense. The subject of the book is splendidly presented and we recommend it to your earnest attention. ◆

Table I: Carbon and Nitrogen Contents (Also Carbon-Nitrogen Ratios) of Soils Under Continuous Cropping to Wheat and Timothy. Sanborn Field, Missouri Agri. Expt. Station

Plot Number	Cropping Periods	*Crop, Soil Treatment*	Carbon % [1]	Nitrogen %	Ratio C/N [2]
		Tilled Soil, Continuous Wheat.			
2	First 25 years	Wheat. com'l	1.13	0.107	10.5
	Second 25 years	Fertilizer	1.02	0.100	10.3
5	First 25 years	Wheat. 6 T Manure	1.52	1.40	10.8
	Second 25 years	3 T Manure [3]	1.27	1.19	10.6
20	First 25 years	Wheat. 6 T Manure	1.38	1.45	9.5
	Second 25 years	Am. Sulfate	1.07	0.081	13.2
30	First 25 years	Wheat 6 T Manure	1.61	1.71	9.4
	Second 25 years	Sodium Nitrate	1.30	0.094	13.8
		Sod Soil, Continuous Timothy			
23	First 25 years	Timothy, No.	1.32	1.41	9.4
	Second 25 years	Treatment [4]	1.45	1.35	10.7
22	First 25 years	Timothy 6 T	1.69	1.77	9.5
	Second 25 years	Manure	2.04	1.95	10.4

[1] Percent of dry Soil. [2] Ratio of carbon to nitrogen in the soil. [3] Tons per acre of barnyard manure. [4] Save periodic plowing of both plots after plot 23 became foul with weeds.

The carbon may increase merely as if it were a charcoal, or non-living matter. It may also decrease while the nitrogen is increasing due to different quality or chemical compositions of the organic matter, shown by increases or decreases in the carbon-nitrogen (C/N) ratio.

Decreases shown

Under the wheat crop, all soils showed decreases in nitrogen as the years went by. These declines were most rapid where commercial nitrogen alone (Plots 20 and 30—see accompanying table) and commercial mixed fertilizers (Plot 2) were used for 25 years in the former and for 50 years in the latter. Instead of building up the soil's nitrogen, these additions of it in salts lowered the soil's supply most decidedly. Simultaneously, the carbon loss was relatively much higher where nitrogenous salts were used singly (plots 20 and 30—see accompanying table) than where mixed fertilizers were applied (plot 2).

In contrast, the soil under timothy sod gained in carbon whether given manure or not. However, it lost nitrogen when nothing was returned, but gained in this element and in organic matter in general when barnyard manure was applied.

Ratios changed

That the nature of the soil organic matter was also changed is shown by the changes in its carbon-nitrogen ratios. Here again, the nitrogenous salt fertilizers disturbed this ratio most (wheat). The ratio was increased, not because the amount of carbon in the soil increased, but because the amount of nitrogen became decreased. Hence, there was less "living" organic matter. This substance may still have energy—or fuel-values but not much value for sustaining life.

Hidden in the data of soils "living" during the two quarter-centuries, and long before so much nitrogen was available in commercial fertilizers, are the cold facts telling us that single element additions of fertility are not maintaining our soils. Nitrogen, in particular, is even destructive of the virgin or reserve organic matter still remaining (or built up) in the soil. They tell us also that while chemical data give suggestions of slow changes, those under tillage of the soil announce forcefully that they seem *deadly sure.*

Significant question

"Shall we be able to recover if the soil organic matter goes much lower?" is a very significant question. It is even more so in view of the fact that nature arrived at her climax crops only by returning *all* of the organic matter grown in place. Time and future treatments of our soils will eventually give the answer. ◆