Soil Fertility and Nutritive Value of Foods

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WE ARE gradually coming to believe that the soil, in terms of the food it grows, is a controlling factor in agricultural creation. The pattern of the soil fertility, according to the climatic forces determining it, has only recently been worked out. That this fertility pattern maps out the nutritional quality of feeds and foods is not yet widely recognized or appreciated. That it should be is not so expectable when we have been measuring our agricultural output in terms of only bulk and weight increase rather than in terms of nutrition, reproduction, and better survival of the species.

By subscribing to the production criteria of more tons and more bushels, we have watched the crops but have forgotten the soils that grow them. Accordingly, we have introduced new crops which pile up carbohydrates and caloric bulk readily instead of those which consume much of their own fuel foods in converting a part of them into proteins through help from the soil fertility. When the dwindling fertility makes protein-producing, mineral-providing crops "hard to grow," we fail to undergird them with soil treatment for their higher nutritional values in growing young animals. The soil fertility as help towards more protein within the body, as protection against microbial and other invasions, has not impressed itself. Instead we have taken to the therapeutic services of protective products generated by animals, and even microbes, in our bloodstream as disease fighters. The life of the soil is not attractive. The death of it is no recognized disaster. Hence, it may seem farfetched to any one but a student of both the soil and nutrition to relate the nutritive quality of feeds and foods to the soil.

The provision of proteins is our major food problem. Carbohydrates are easily grown. Any growing plant is synthesizing carbohydrates mainly from the elements of the weather by sunshine energy. For the output of these energy foods very little soil fertility is required in terms of either the number of chemical elements or the amounts of each. But, in order for the plant to convert its carbohydrates into proteins by its life processes and not by the sunshine power, calcium, nitrogen, phosphorus, and a long list, including the trace elements, are required. Plants and microbes —even those in the cow's gut—synthesize the amino acids that make up the proteins. Animals cannot fabricate these amino acids. They only collect them from the plants and assemble them into their proteins of milk, meat, eggs, and other body-building foods. Both plants and animals assemble their proteins to provide their reproductive functions since these are the only compounds through which the stream of life can flow.

It is in the protein synthesis and in the reproduction of life, that the control by the soil of the nutritive quality of food is pronounced. Our ignorance of this control is suggested when we classify as proteins anything that gives off nitrogen upon burning in sulfuric acid. By this we include nitrogenous compounds that are not proteins. Yet we recognize about two dozen different amino acids as components of the proteins. We know that life is impossible without providing the complete collection of at least eight of them. When even the trace elements, manganese and boron, applied to the soil at rates of but a few pounds per acre for alfalfa increase the concentration of these essential amino acids in this crop—especially those amino acids deficient in corn—there is evidence that the nutritive quality of this forage is connected with the fertility of the soil.

The assessment of the contributions by the soil through only the ash analyses of the crops, has left us ignorant of the numerous roles played in the plant's synthetic processes by the elements of soil origin. In believing that we need "minerals" according to such analyses of our bodies and our foods for their inorganic contents, we consider the soil as the supply of these and the plants as conveyors of them. We conclude therefrom that limestone fed to the cow in the mineral box is the equivalent in nutritional service to lime used as soil treatment coming through the plant.

Likewise have we been content to accept and use average figures for ash analyses. In the same year and in the same state, for example, the protein of wheat has varied from a low of 10 to a high of 18 percent of the grain. Ash elements may double or treble their concentration in the crop on one soil over that on another. Such variations go unappreciated if we are content to believe that "plants are good feed and good food if they make a big crop." Crops that are doing little more than to pile up carbohydrates, as was demonstrated with soybeans, make big yields of bulk. But when fertilized to produce proteins, the hay yields are smaller. To be content with the above simple faith is to be as agronomically gullible as the youngster content with the knowledge of reproduction that credits this process to the delivery services by the stork.

Our reluctance to credit the soil with some relation to the nutritive quality of our feeds and foods is well illustrated by the belief persistent during the last quarter of a century, namely, that the acidity of the soil is injurious and that the benefit from liming lies in its helps in fighting this acidity when, in truth, it lies in its nourishment of the plants with calcium and its activities in their synthesis of proteins and other food essentials. To say that we don't believe there is a relation between the nutritive values of feeds or foods and the fertility of the soil is a confession of ignorance of all that is to be known of this fact and is not a negation of it.

As yet we do not appreciate the pattern of soil fertility in the United States, that in pre-colonial days was allowing only wood crops, or forests, on the soils in the eastern half. It grew protein as meat in the bison on the buffalo grass in mid-continent, and in some scattered areas farther east like particular valleys of Pennsylvania or the present race horse area of Kentucky. It permitted corn in the forested New England when each hill was fertilized with a fish. Corn on the eastern prairies grew well without such stimulation.

We may well ask whether the soil in its fertility pattern is of no import relative to nutritive quality of what it produces (1) when we grow cattle and make beef protein more effectively today in the former bison area; (2) when that area is now growing the high protein wheat; (3) when we fatten cattle farther east on the more weathered soils and combine this speculative venture with pork production that puts emphasis on fat output by carbohydrates and the lessened hazard by marketing these smaller animals nearer their birthday; (4) when soil fertility exhaustion has pushed soft wheat westward; (5) when the protein in corn has dropped, because of soil exploitation, from an average figure of 9.5 to 8.5 percent; and (6) when the pattern of the caries of the teeth of the Navy inductees in 1942 reflects the climatic pattern of soil fertility. Such items related to the national pattern of soil fertility suggest that many of our agricultural successes (or escapes from disaster) have been good fortunes through chance location with respect to the fertility of the soil when we have too readily, perhaps, credited them to our embryo agricultural science.

When a crop begins to fail we search far and accept others if they make bulk where the predecessor didn't. We credit the newcomer with being "a hay crop but not a seed crop." If it cannot guarantee its own reproduction via seed, we call it feed for the cow. With the cow's failure to reproduce under such poor nutritional support we, apparently, economize on the bull's energy by resorting to repeated artificial inseminations. The grazing animals have been selecting areas according to better soils. They have been going through fences to the virgin right-of-way. They have been grazing the very edges of the highway shoulders next to the concrete to their own destruction on the Coastal Plains soils. All these are animal demonstrations that the nutritive quality of feeds is related to the soil that grows it. But to date, the animals rather than their masters, have appreciated this fact most.

Shall we keep our eyes closed to the soil's creative power via proteins, organo-inorganic compounds, and all the complexes of constructive and catalytic services in nutrition? When the health and functions of our plants, our animals and ourselves indicate the need, isn't it a call for agricultural research to gear production into delivery of nutritional values related to the fertility of the soil rather than only those premised on bulk and the ability to fill? By directing attention to the soil for its help in making better food, we may possibly realize the wisdom in the adage of long standing that tells us that "to be well fed is to be healthy" and that good nutrition must be built from the ground up.