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Good health seems to be the one thing all of us desire most. That conclusion follows from the simple observation that when we meet our universal salutation or greeting, is the inquiry, "How do you do?" This expresses our concern first about our health. Perhaps that results from the fact that good health is yet not clearly defined; that the only health we know is, perhaps, a poor one; and that we are all hopefully anticipating the discovery of one that is better, at least in some measure.

Attention has long been going to the lack of health. Professions profiting by that kind of human misery—and the fear of more of it—have built lucrative employment for many. This view of the problem in the negative aspect has too long disregarded the time-worn adage which tells us in the positive that "To be well-fed is to be healthy." Our failure to know how to feed ourselves well—and also our animals—has denied us and them better healths. Perhaps we have been over-fed. Thereby "one third of what we eat supports our bodies, and two thirds of it our doctors." Conversely, perhaps we have been under-fed, when we are told that vitamins are something that will kill us if we don't eat them. More significantly, however, for your consideration under the title listed herewith, is the concept that to be well fed and healthy is a matter of having us consider our foods carefully, not only as to kind or name, but more specifically in their relation to the complete soil fertility by which they, or their contents, were grown. Late research is pointing to the significance of the soil in nutrition.

This is the approach to health from its positive aspect. It is the belief that we need to consider good health as a by-product of good eating under the guidance of knowledge of the physiology of the plants, animals, and humans concerned. It is not a case of calling in pathology, and surgical mechanics, to get names and attempts to explain—or relieve and remove—where physiology is unknown. Instead it is an attempt to undergird the physiology of good health and not a fight with disease.

Foods and Feeds May Fill, But Not Necessarily Nourish

In connection with the production of milk and meat by our farm animals, the economics of the procedure have too often had first consideration. Feeding trials, reported in the many printed volumes, are given to one objective, viz., making cheap gains or cheap gallons. When fats, as fuel foods, either on the carcass or in the pail, are the major objective, it is not unexpected that calories as measures of heat should have long been the major criterion of

nutritional effort. Naturally for a fuel objective, fuel foods, that is, the carbohydrates, would take major concern. Consequently, the carbohydrates have been at the head of the foods list. In that thought pattern the building of the body was taken for granted and only fuel for it was sought. Proteins have been second on the list. Minerals have had attention as the *inorganic* elements. This kept them as a part of the ash rather than of the *organic* compounds which contained them or the synthesis of which they prompted. Proteins and the mineral elements have not been commonly considered together in their close association. The proteins have been considered only as "crude" proteins. They have been classified as those compounds containing nitrogen in total to the extent of about 16 percent. It is in this lack of complete understanding of the protein compounds, of their functions in our bodies, and of the services by the inorganic elements connected with them that much of the irregularity in being well fed arises. Under no fuller knowledge than this, feeding becomes mainly a matter filling with food in general, rather than a matter of nutrition with specificity of function and purpose, of what is consumed.

When animal gains, consisting mainly of more fat and possibly of more water, represent possible sale at higher price—and then usually of a castrated male—we are apt to lose sight of the health involved. Does a fattened, show animal suggest buoyant health? Doesn't it suggest the very absence of it? Feeding operations on such a score and purpose ought not be classified as animal production. Rather, they seem to be a case of mere speculation in a culinary excuse for buying low and selling high. Health would scarcely be an expected associate when the feeding performance suggests its necessity to limit the life span of the animal to that of baby beef and of the barrows in the ton-litters, before the animals breakdown in health disaster under such treatment. One must naturally raise the question whether animal feeding under no more critical criterion than that provided by an ordinary scale is apt to bring good health, or whether it must be bad health. Feeding to encourage the building of muscle, to guarantee fecund reproduction and to protect from the invasion of the microbes calls for a more searching criterion. It calls also for foods and feeds that are more than mere bulk for filling purposes. It demands the appreciation of some physiology, and some comprehension of body functions. It transcends the matters of economics resting on no more than simple arithmetic.

Declining Fertility Goes Unrecognized When Quantity Rather Than Quality Rules

That the supplies of essential nutrient elements in the soil supporting all life have been declining has not yet been widely comprehended. The dwindling supply of creative power has encouraged us to search for crop substitutes as soon as a tried and true crop indicated its decrease in yield of bulk or bushels per acre. Rather

than rebuild the fertility of the soil to nourish the tried crop, we have searched the corners of the world for another crop to take its place. By this procedure we have introduced more and more of the crops that are making mainly vegetative bulk and are producing less of real nourishment for animals. They have been said to be "hay crops but not seed crops." While juggling the new crops into the farming scheme the nutritional quality as protein, the inorganic essentials, the vitamins, and other necessary compounds of high value as feed for good health, have been juggled out. Carbohydrates, composed mainly of air, water, and sunshine, are amply produced for fattening services, but proteins are becoming scarcer in the feeds to bring about increasing troubles in the health and reproduction of the animals consuming them. Crops that create the proteins are considered "hard to grow." The cost of the extra fertility for the soil to nourish them so they can create the needed helps for better nutrition is sidestepped. A big crop yield but less of protein in it is thereby produced. While failing to see the declining fertility of the soil responsible for less milk, less meat, and poorer reproduction, we are calling for more artificial insemination and other procedures looking more toward improved breeding than toward improved feeding as the possible help.

While one generation of us is a sufficient time period to exhaust the fertility of a farm, it is, in most cases, not long enough to convince the owner of a farm of what has happened. Having never figured the cost of maintaining the fertility of the soil, he is not apt to appreciate the great fact that agricultural products have always been priced under the assumption that what the soil contributed is not a part of the cost of their production.

Depreciation of the soil is not recognized in terms of the income tax question. Only the buildings and the fences are considered as depreciable. Our ignorance of the soil fertility as a mineral delivery source still leaves this basic substance as of no value and of no cost in agricultural production in the minds of those directing internal revenue procedures. Yet oil wells, coal mines, quarries, and similar resources may be depreciated as much as 15-25 percent per year. Minerals are not minerals for all that, apparently, unless the political aspect of lobby pressure rather than common sense so classifies them. Can there be any other result from exploited soils, abandoned farms, and poor quality in our foods than the invitation to bad health in our animals and ourselves when all the qualities determined by fertile soils are so completely forgotten?

Animal Instincts Go Unheeded. The Plow Precedes the Cow

One needs only to look at the beef map or the pork map of the United States to see that the beef cow has gone west to the soils which the buffalo mapped out for his choice in making bone and brawn, but not necessarily in making fat. Beef cows range, and choose their grazing from soils that make the high protein wheat and the nutritious grass. The beef cattle *grow out West. We fatten*

them *in the East*. The buffalo that chose that same soil area called for no imported protein supplements, no veterinarian, and no midwifery helps during parturation. He did not populate our East where the dairy cow in close company with the congested human population is expected to serve as foster mother for that crowd.

The buffalo went ahead of the plow to choose the soil under the feed, rather than worry over the particular plant species, or the pedigree of some supposedly choice variety of recently imported forage. The poor dairy cow has no chance to exercise her unique instincts for selecting the forage of higher nutritional values according to the better soils growing it. It was the plow that took her where she is. The fences confine her and so do the stanchions and the feed mixtures until she is little more than a machine for consumption of certain allotted daily amounts of feed according to calculated compulsory delivery of gallons of liquid and pounds of fat. The protein content of the milk, of major value after the reproductive process that gives occasion for it, has been almost completely disregarded and aborted in considering the real values of milk. Seasonal variations in the quantity and the quality of the milk proteins draw little, if any concern. This creative service the cow intends for her calf has not been guarded for the corresponding high value to the cow's foster children.

Isn't this protein problem possibly a part of the picture when the cow breaks through the fence, or when she searches out certain plants in the pasture and eats them shorter while she lets others grow taller? Are not her instincts given to guiding her to produce proteins too and not just fats? When once we think more about milk proteins for healthy boys and girls, as well as calves, rather than just bottles of milk and pounds of fat for sale, we shall be compelled to think of the complete soil fertility required under the cow in making the former rather than just rainfall and sunshine above her giving us the latter. Apparently only some necessity compelling us to think, some threat of disaster, or some disaster itself, will make us appreciate our natural resource, the soil, which we have too long taken for granted.

Soil Fertility Pattern Under Patterns of Animal Distribution Suggests Better Health via More and Better Proteins

With milk proteins, meat proteins, and vegetable proteins now coming into national concern because some few folks are reminding us that our natural resources producing them are dwindling, we may well center our thinking on just this one food requirement, namely our national needs for proteins and the provision of them. When these requisites in our foods are not created, but are assembled, by our animals only as the plants which they eat have synthesized them from the elements of soil fertility, we may well see that the fertility supplies in the soil mark our possible protein supplies of our country.

A look at the soil fertility map of the United States according to the climatic forces that give increasing soil construction on coming out of our arid West to the Midcontinent, and then increasing soil destruction in terms of protein potential on going from there to the East and the Southeast, helps us realize that our soil resources are already so low as to make the shortage of proteins our major national problem. While there are cries for, and hopes in, a grass agriculture which is being propagandized so glibly for cover of the soil against its loss by erosion, a few folks are reminding us that one does not get a grass agriculture by mail order and spread it over the farm. It must be grown on the soil it covers. Even then, it must be more than cover. It must be nutrition for our animals to pay its own costs. For that contribution, it must be a balanced ration for them. It can be that only as the soil fertility is a properly balanced nutrition for the grass, a creation of complete proteins rather than merely bales of bulk.

The rainfall in totals per year, balanced against evaporation in the West and against leaching in the East, gives soils in the West that are under-developed and soils in the East that are over-developed for protein production. In the West, there is excess of the alkalis and alkaline earths, or an excess of soil neutrality in terms of simple chemistry. In reality, it is a deficiency both in soil acidity and in soil fertility in terms of plant and animal physiology. In the East there is an excess of soil acidity in terms of simple chemistry, but a deficiency of soil fertility in terms of those physiologies.

The crop pattern superimposed on that of soil fertility tells us that the Creator himself was making only wood on the eastern half of the United States. Even for no more than the growth of the starchy grain of corn, the American Indian in New England was compelled to fertilize the corn plant with some fish protein, as the Pilgrim fathers observed but failed to appreciate fully. Grass, and not forests, prevailed under the Creator's agricultural management in the Midcontinent and the West where the Buffalo roamed. High-protein, or "hard," horny, wheat grew recently on those former "grassy" plains. Credit for the high protein in wheat is still given to the pedigree or to the particular wheat variety, because we have not looked deeply enough into plant physiology to see the soil fertility responsible for it. Now that most of the Kansas soils have given us bumper wheat crops to exhaust the fertility, especially the nitrogen, to the point of making "soft" or low-protein grain, we are gradually coming to see that the fertility of the soil was in control of the protein that made quality for nutrition more than quantity for sale. Now that the fertility is gone, we really appreciate what we once had.

Unfortunately it is on to just such soils where denser human populations are now expecting to bring the dairy cow and a diversified agriculture. Where intense crop specialization prevails, it is usually the limiting fertility that brings on such prevalence.

From those areas of single crop agriculture there are commonly numerous life lines reaching out to other areas of higher fertility levels, especially to those producing proteins. From the Midcontinent, its soil fertility for protein production, and its livestock markets, numerous life lines run in all directions. From the area of crop specialization known for its cotton farming in the South, one can see the life lines reaching to the Midcontinent when the menus of the hotels down there announce K. C. Steaks, and point back to the beef center of the United States that was once much farther East.

As we mined our virgin soil fertility, we moved on West. The beef cow with her limited output of milk went ahead of the plow. The dairy cow, which is managed under more mechanical operations of herself and her larger milk output, is trailing along behind the plow. Instead of her instincts guiding us to better soils as she assays them for protein production and delivery of high nutrition, or as she would outline for us the soil fertility pattern for that high food value, we have put the plow and other machinery ahead to enslave her physiologically while the significance of that soil fertility pattern in terms of proper soil management for protein production for her and for ourselves has not yet been appreciated.

Gadgets Measured Increasing Soil Acidity But Missed Its Reciprocal, The Declining Soil Fertility

Legume plants have long been the cow's choice among forages. Most students of animal nutrition and health have been ready to believe that the higher concentrations of proteins and inorganic elements in these nitrogen-fixing feeds have been responsible. These crops have always been the feed desired by both the cow and her owner. But with the cow on the highly weathered soils, from which virgin forests were cleared, we discovered that the better legume crops failed to grow there except as the soil fertility was given uplift. With the advent of laboratory gadgets measuring the degree of acidity of the soil, it was soon observed that the increasing degree of soil acidity in Nature was associated with more trouble in growing these highly desired forages. Consequently the erroneous conclusion was drawn that acidity of the soil is bad, since it seemingly prohibits many protein-producing crops from growing.

Had we studied the physiology of the plant with emphasis on its biochemistry in place of learning no more soil chemistry than that required to send us out to propagandize laboratory gadgets, we could have seen that soil acidity is not a detriment but an asset. It is the soil acidity that is regularly making mineral nutrients in the rock and soil available to plants. When it accumulates in the soil naturally to a high degree, the resulting injury to our crops is not occurring because the acidity has come into the soil. This results because many of the fertility elements replaced by the advent of that much hydrogen, a non-nutrient, have gone out to leave this infertility take their place.

Instead of seeing lime on the soil beneficial because it provided the nutrient calcium, we saw its benefit in the carbonate it provided to neutralize the acidity, or the hydrogen. Simple gadgets measuring acidity should have been supplemented by means of measuring the plant's better physiology making more and better proteins rather than just more yields.

Now that we have made so many soils about neutral by stocking them heavily with calcium while attempting to drive out all the hydrogen, we find that those soils highly loaded with calcium are no more productive than those loaded to corresponding degree with hydrogen as acidity. What is needed to grow nutritious forage is the balance of all the nutrient elements in the soil rather than only to replace the acidity. Getting rid of the acidity by liming with a carbonate or an alkali is not the equivalent of providing the plant a balanced diet within the soil. Feeding the crop via the soil, not fighting soil acidity, is what is demanded. A little science came in to lead astray the art of agriculture that had long been using lime to grow better feeds but not to wage a fight on soil acidity.

Limited Knowledge Is Apt to Propagandize Itself Too Soon

While fighting soil acidity, during the last two decades, unfortunately there was a delay of just that many years in the progress toward better nutrition for better plant and animal health. Fertilizing the soil went into vogue by no more knowledge than that required for one to get bigger crop yields and bigger monetary gains by this practice. The fundamentals of that procedure for better nutrition of all life are not common knowledge. Nitrogen, phosphorus, and potassium became standard fertilizers on their score of bigger yields. Even calcium going on as lime did not—and does not yet in the minds of some—classify as a fertilizer. Sulfur, applied to the soil unwittingly in superphosphate and ammonium sulfate, has not been credited for its values in plant nutrition and better animal nourishment. Nitrogen was not used until recently, because nitrogen fixation by legumes was a hope even if not necessarily a realization. Copper, manganese, zinc, molybdenum, and other trace elements are not yet considered by many minds that are closed to the possible services of these in plant and animal nutrition.

With increased yields of vegetative mass as the major criterion by which to judge the services from soil treatments using fertilizers, much that results therefrom in the physiology of plants, animals, and man is not commonly observed. We therefore have not seen the decrease in plant disease, the less insect attacks, the better seeds for reproduction, the better health of animals, their more fecund reproduction and many higher nutritional values in plant and animal products used as food, all resulting as we discover the nutrient deficiencies in the soil, and adapt the methods of modifying them for better plant and animal health.

Inorganic Criteria Are Insufficient. Quality Criteria Point To Organic Differences For Better Health On Better Soils

To date it has been impossible to explain the many plant and animal improvements from soil treatments merely (a) by bigger yields for more consumption, (b) by a higher concentration of ash or the mineral elements in the feeds, or (c) by changes recognizable after the plant has been ashed for chemical study. From recent experimental evidence, there comes the suggestion that the better soils make more and better proteins. Accordingly, then, we may well look to the more nearly complete array of the required amino acids of protein as possibly the nutritional improvement in forages and feeds from fertilized soils. Is it possible that the instinct of the animals is directing them to recognize these better proteins when they break from the fertility exhausted soils of our fields out to graze the grass on the still fertile soil of the highway and railroad right-of-way? Is the imbalance of too much nitrogen, or crude protein, of the grass growing on the urine-soaked spot just as quickly recognized? Cannot the wild animals and the unhampered domestic animals judge the quality of their feeds in terms of health and reproduction more effectively for their survival than we can? Do they not carry their search for quality of feed as far as they can, namely to the fertility of the soil growing it?

Proteins for Better Nutrition and Better Protection Against Disease

It is only when our soils are better in terms of all the essential elements, that they can grow the *complete* proteins. Just when are proteins complete? That is still an unanswered question. They should be complete as regards all the eight or ten different amino acids recognized as required for survival. Some recent research especially with the trace elements, points out that soil treatments may improve the nutritional values of grains and forages by increasing the concentration of some of the amino acids commonly deficient, like tryptophane, and methionine. The use of these trace elements on the soil growing alfalfa and corn, points out by microbial assay that better soils increase the output of these essential amino acids. Rabbits feeding on the corn, balanced with amino acid supplements, suggest that trace elements function apparently through the modification of the amino acid values commonly more deficient in the feeds grown on less fertile soils.

Magnesium and sulfur, not classed as trace elements, come in for similar effects. Magnesium, applied to correct the soil's shortage improved the tryptophane content of forages. Sulfur, applied even in the elemental form, increased the amount of methionine. When these amino acids are produced to higher concentrations in the feed, may we not expect those better proteins in the animal and human bodies by which there is protection against invasion by the microbes? When the common cold and tuberculosis are invasions via the mucous membrane; when both are considered as breakdown of our defense; and when tuberculosis is "cured" by a high pro-

tein diet, is it too much of a stretch of the imagination to theorize that mastitis and brucellosis, may also be microbial invasions through the mucous membrane? Shall we not test that postulate by treating the soil with all possible fertilizers to include the trace elements, and studying the physiology, blood properties, and all other animal manifestations in order to learn whether animal health is not related to the soil fertility?

Studies so far with animals suggest the truth of the old adage and we can say that some dairy cows must be better fed via the soil if they are to reproduce better, to give more milk, and to be healthy with respect to some diseases the cows now have and for which—because of transmissibility to humans—the cows are about to be innocently slaughtered. Surely such a negative approach, by which the cow species would become extinct, ought to be replaced by a positive one looking to better proteins via more fertile soils and better protection against diseases for the animals to keep them living and healthy. Proteins complete for this kind of protection may be a new degree of completeness not yet regularly associated with this organic food substance, much less with the fertility of the soil creating it.

The proteins are slowly being appreciated in terms of the struggles required for their synthesis and their assemblage. Plants are literally struggling for their proteins. They make carbohydrates readily, but fail often in finding in the soil the fertility helps for converting those into complete proteins, and much seed to multiply their species. Animals struggle for their proteins too. They can easily put on fat, but for the proteins needed in their reproduction they go long distances, search over myriads of kinds of vegetation, and are active from dawn to sunset on many of our less fertile soils. But when on good feed on better soils, they fill quickly and soon lie down, in what we call contentment but which is maximum of body physiology in action. Man, too, struggles for his proteins. Unfortunately, he fails to see it as a struggle premised on a similar one by his animal; that premised on the struggle by the plant; and that, in turn, limited because of the insufficient fertility in the soil.

When our best proteins, like those in milk, eggs and lean meat, must be assembled and brought to us through that long creative line connecting back to the soil, surely we shall finally see that the shortage of proteins, which has much to do with our failure to keep well fed and healthy, is not one of economic quarrels between groups of us, but a declining soil fertility underneath all of us and all lower life forms below us. Soil conservation is not a fad of the 15 per cent of our population classed as farmers. It is a necessity to a far greater degree for the 85 percent of us classified as urban and too far removed from the place where the proteins can be created by our own management. When we still have two acres per person in the United States and one acre does well to make only 250 pounds of live beef per year, we may see no reason yet for concern

about dwindling soil fertility and our shaky foundation of protein creation. But when we drop to the world level, by taking on world feedership under guise of world leadership, and cut ourselves back to one acre per person, we cannot have our milk and meat proteins provided for us so generously. Then we may be content to call for our daily food allotment of little more than a bowl of rice. Must it take the experience of that situation for us to realize that healthy nations are protein eaters because they have ample acreage, conserve their soils and keep them fertile?

Health In The Positive Via Nutrition, Not In The Negative Via Drugs

Food has long been taken two or three times daily as a pleasant experience looking towards satiation, rather than as a carefully studied effort leading to good nutrition with good health a resulting by-product. Health has become less and less a positive matter resulting from ample quality of food to keep us buoyantly active. It has become more and more a worry about finding drugs under professional guidance to relieve us from the misery of pain and to help us escape the chagrin of insufficient health even to work enough to care for ourselves. We are gradually coming to realize that bad nutrition and poor health can result from deficiencies in quality, or from the hidden hungers, even where ample bulk may be regularly ingested.

Then too, while there are growing numbers of deficiencies expectable with soil exhaustion, the introduction and use of drugs and poisons extensively aggravates the situation still more. Administration of drugs for one service does not prohibit many unknown side reactions by which the ultimate price of the relief may be costlier than the original pain. One does not remove the cause of the headache by taking aspirin. One only blots out the recognition of it, which relief is paid for in eliminating the aspirin. The advent of sulfa drugs was heralded as a great value in the fight on microbes. But, some of the side reactions of them included inroads on blood corpuscle creation with resulting anemias making the price too big to be paid in many instances for the service they give. Now that we have used DDT to exterminate insects, and hormone sprays to eliminate weeds, the fact is slowly dawning on us that promiscuous scattering of the deadly chemical carbon-ring-structures may be building up consequences of bad health not fully explained by calling them virus X or some other unknown. Such a negative approach toward a better health by working from the worst health, the morgue and grave backward has farther to go to arrive at good health than the effort to reach it by cooperating with the Creator starting at the soil and all that is required from that point of take-off in the assembly procedure.

Surely science and scientists given supposedly to sound reasoning cannot long disregard the great facts of the relation of the soil to good reproduction of any life form when food, in the last analysis,

draws its basic essentials from the soil. Can we continue to match one segment of our society against another and survive by one consuming the other? Isn't it about time to realize that the warring human is only a hungry animal, all the more animal and less human with more hunger? When the curve of mounting populations and the curve of dwindling creative capacity—confused with dwindling acreage—are now crossing each other, isn't it about time to face the problem and consider means of holding down the sick and hungry crowd to numbers in relation to the soil rather than permitting one horde to murder another in ignorance of what the great food facts, provoking those quarrels or wars, really are?

Soils are the basic resource not only for feeding cows, but also for feeding humans as well. Perhaps there are still enough humans in close contact with the soil, and perhaps there are still enough thinking folks at some distance from the soil, to carry the responsibility of leading us to undertake the conservation of it and to manage its food potentials wisely. If so, then our population may be balanced against its chance for all to be well fed and thereby healthy. We cannot long survive under growing technologies of exploitation and destruction of both our soils and ourselves without the realization that there is a most significant relation between the fertility stores in our soils and the health and survival of our animals and of us humans.

